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TECHNICAL REPORT

Redesign of the National Hospital Discharge Survey

Conceptual Framework and Feasibility Study Final Report

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Prepared for the Centers for Disease Control and Prevention, National Center for Health Statistics

RAND HEALTH

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Preface

The National Hospital Discharge Survey (NHDS) has since its inception been a principal source of information on inpatient utilization in short-stay nonfederal hospitals in the United States. Although the NHDS has functioned well for more than 40 years, it is based on concepts of the health care delivery system and hospital and patient universe of previous decades. For the NHDS to remain relevant, it must reflect the types of care and services now offered in American hospitals. RAND Health was therefore asked to assist in the first phase of the redesign effort by developing an approach for redesigning the survey and identifying, through a feasibility study, specific data elements to be included and field procedures to be used in that survey. This report documents the findings from this study.

A companion volume to this report reproduces the contents of the field manual that the RAND team used in conducting the feasibility study:

Hospital Field Manual for the National Hospital Discharge Survey Redesign Pilot Study: November 2006 (TR-475/1-HLTH, March 2007), Lee Hilborne, Robin Meili, Sandra Berry, Marc Elliott, Anne (Belle) Griffin, Kristin Leuschner, Yimin Lou, Chau Pham, Denise Quigley, and Carol Roth. A number of forms were revised as a result of this study (Appendix A):

- Revised Facility Induction Form
- Revised Facility Questionnaire
- Revised Patient Abstract
- Revised Patient Abstract Form Instructions

This study was prepared for the National Center for Health Statistics, Centers for Disease Control and Prevention. It should be of interest to policymakers, health policy experts, regulators, researchers, providers, and commercial institutions.

This study was conducted in RAND Health, a division of the RAND Corporation. A profile of RAND Health, abstracts of its publications, and ordering information can be found at www.rand.org/health.

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Summary

The National Center for Health Statistics (NCHS) is responsible for developing and maintaining a portfolio of nationally representative surveys, referred to collectively as the National Health Care Surveys (NHCS), that is designed to measure utilization of the health care delivery system and is used for a variety of public- and private-sector purposes. A key component in the portfolio of surveys is the National Hospital Discharge Survey (NHDS). Since its inception in 1965, the NHDS has been a principal source of information on inpatient utilization in short-stay nonfederal hospitals in the United States.

Although the NHDS has served the country well, it was formulated in the context of the health care delivery system and hospital and patient universe of previous decades. NCHS therefore undertook an evaluation to determine the role that a redesigned NHDS might play in informing current and future policy and research issues. RAND Health, a division of the RAND Corporation, was selected to assist in developing an approach, including statistical considerations, for the redesign and to identify and test specific data elements to be included in the future survey.

Conceptual Framework for the Redesign

NCHS wanted to have a broad understanding of what a redesigned survey might achieve. The initial question posed to motivate development of a conceptual framework for the redesign was: "In the context of a survey designed to measure inpatient care, what data are currently lacking or limited in their availability that are needed to answer important policy and research questions for the next 10 to 20 years?"

To respond to this question, RAND sought to identify critical health policy research issues that will need to be addressed in the next two decades, and to identify redesign options that add unique value, rather than duplicate information being collected by other surveys or databases. To explore these areas, RAND drew on several sources, including a discussion group of RAND health policy experts; interviews with representatives of government agencies, policy experts, researchers, providers, and other users of data; and a workgroup of nationally recognized health policy experts. RAND also undertook a review of existing surveys to identify gaps that might be filled by a redesigned NHDS.

Key Policy Issues

Results of discussions with stakeholder groups provided insight into the types of important policy issues and related research questions that researchers and policymakers would like to be able to address through a redesigned NHDS. Stakeholders were strongly interested in obtaining more-detailed data on hospital patients than is currently available, including clinical data to facilitate risk adjustment and quality assessment; cost and resource-use data to support increased financial transparency; and patient demographic data to better understand barriers to access.

Stakeholders also expressed a strong interest in being able to understand care at a much greater level of geographic and hospital specificity than is currently available through the NHDS or other surveys, and they also commonly cited the desire to study care longitudinally and the ability to link the NHDS to other datasets (e.g., to the National Death Index, Medicare Provider Analysis and Review [MEDPAR file]).

Input from RAND researchers and other health policy experts was used to develop a list of 13 key policy issues, which were later discussed and validated by the Workgroup as being important for health and health care policy research. The Workgroup also ranked the issues and identified five that should be given the highest priority in the survey redesign. Table S.1 shows the five high-priority issues, together with an illustrative research question for each issue.

Table S.1
High-Priority Policy Issues and Illustrative Research Questions

Policy Issue	Illustrative Research Question
Cost of care and resource use	How much improvement in health is obtained for each dollar spent?
Quality of care and patient safety	What is the quality of care for people across various care settings?
Care delivered throughout the hospital	How consistent are admission and discharge diagnoses?
Continuity of care and transitions	How do patients access the health system over time?
Disparities and access	Are there differences in hospital utilization by different socioeconomic characteristics?

Although the Workgroup felt these five policy issues should be given priority for the redesign, they also agreed with the importance of the full list of policy issues and indicated that a redesigned survey might also provide value in other areas as well. The other issues are:

- Standards against which performance can be measured (benchmarking)
- Use and value of technology and innovation
- Role and value of electronic health records
- Mix and use of labor
- Care migration away from inpatient settings
- Public health and surveillance
- Focused studies
- Impact of globalization.

Limitations of Existing Surveys

To understand how the NHDS might be redesigned to address the high-priority and other issues identified by the stakeholders, RAND evaluated the current NHDS and other existing surveys to assess the extent to which they could be used to answer the research questions cited by stakeholders, particularly at the level of detail required. This review indicated that a significant opportunity exists for the NHDS to offer data at a more granular level—in greater depth—providing better national assessments of hospital-based care.

The review found that data gaps exist in many areas that are critical to addressing the high-priority policy issues cited by the stakeholders. For example, existing surveys do not provide adequate information about costs (e.g., data on actual payment or case-level profit or loss experienced by America's hospitals), medications, patient status (e.g., clinical information, such as vital signs, laboratory and other diagnostic test results, functional status), and outcomes. Nor do most existing surveys offer linkages between maternal and child records, or identifiers to link databases, including patient-, provider-, or facility-specific identifiers, and patient socioeconomic status.

Redesign Options

An understanding of the key policy issues and the limitations of existing surveys to address these issues led to the development of a set of non-mutually exclusive options for redesigning the NHDS. The redesign options illustrate different ways in which the NHDS might address some of the key policy issues. These options were reviewed by the Workgroup, which identified eight high-priority options that were most relevant for the survey redesign.

It should be noted that the option given highest priority by the Workgroup was the possibility of redesigning the NHDS in a way that would allow for better data coordination throughout the Department of Health and Human Services (DHHS) and in particular would allow for better alignment of inpatient data-collection efforts between Healthcare Cost and Utilization Project (HCUP) and the NHDS. Such an alignment could mean that the NHDS would supplement HCUP in the states where there is no State Inpatient Database (SID). However, further consideration of this option was beyond the scope of this project, so this option was not used to guide variable selection.

Eight high-priority options were used to guide the selection of specific variables to be included in the redesigned survey:

- **Increase hospital resource-use information.** Understanding the costs and general resource use associated with delivering care in the inpatient setting can provide information to assist in allocating resources more efficiently and effectively. The NHDS might continue to collect billed charges while adding data on expected and actual reimbursement. Other data of interest include information on resources used in the care of the patient throughout hospitalization, including detail on the number of days the patient spent at various levels of care (e.g., intensive care unit [ICU], observation prior to hospitalization, or general medical/surgical); the

drugs and supplies used; and the types of technology used to care for a patient (e.g., monitored bed, ventilators, endoscopy services).

- **Increase clinical depth.** This option adds clinical variables to facilitate a better understanding of hospital care. Clinical detail is essential for assessing the quality and appropriateness of health care, yet no existing publicly available survey collects in-depth information on clinical services provided to hospitalized patients.

- **Obtain outcome data.** Collection of outcomes of care was highly rated by the Workgroup. The information collected through the NHDS might be expanded to link hospital-related care to specific health-related outcomes. The complexity of this option depends on the outcomes selected for consideration, but in all cases a meaningful assessment of outcomes of care would need to extend beyond the hospital providing care.

- **Increase patient demographic information.** This option would permit a more accurate analysis of socioeconomic status and access to care. In addition to the demographic, administrative, and medical information currently collected, either patient interviews or patient written surveys would be required to collect data on the socioeconomic characteristics of each person sampled through the survey. Variables solicited might include address, Census tract, race, ethnicity, income, wealth, education, occupation, neighborhood socioeconomic characteristics, and past socioeconomic experiences.[1]

- **Track disease-specific care.** There is great interest among researchers in collecting more-detailed information for specific conditions or situations. NCHS could use the trust that has been built with survey hospitals over the past 40 years to collect in-depth clinical (e.g., cancer care, cardiac surgery, diabetes) or operational (e.g., workload, waste) information. The specific issues could be identified either by NCHS or in response to queries or requests from governmental or nongovernmental clients.

- **Incorporate inpatient and short-stay admissions.** Treatment that was traditionally provided for many conditions in the inpatient setting is now provided as outpatient care. This option would address this change in hospital utilization by including some of the spectrum of services that were previously considered to be inpatient admissions. Obtaining information on patients with such conditions should be relatively straightforward, because the encounters will be part of the hospital's billing system. Outpatient care that has moved to non-hospital settings, e.g., physicians' offices and ambulatory centers, is tracked in other NCHS surveys.

- **Incorporate patient-care encounters throughout the hospital.** The NHDS could be expanded to capture data relevant to the entire spectrum of services that are provided in U.S. hospitals, including ambulatory

[1] Socioeconomic experiences are the characteristics that surround a person's life experience, including economic status, discrimination, and optimism about life prospects and opportunities.

surgery, emergency care, hospital outpatient services, rehabilitation, observation, acute inpatient, and hospital-based skilled nursing facilities.

- **Obtain data on pre- and post-hospital care.** The NHDS might also seek to collect information on the care provided to hospitalized patients in the peri-hospital period (e.g., for the 72 hours immediately before admission and 72 hours following discharge). Such information might include ambulatory, emergency, institutional, and home care.

Selection of Variables for Testing in the Feasibility Study

In selecting variables for testing, RAND sought to identify those data elements that could help address the high-priority policy issues identified by the Workgroup, and, to a lesser extent, other important issues cited by our stakeholders. Variables included those abstracted from patient records (Patient Abstract) and information about the facility in which the care was performed (Facility Questionnaire). The selection of variables was also informed by general cost considerations, such as the time required for abstraction or availability of the data element from hospital systems and records; and by Workgroup priorities for the redesign options. Thousands, and perhaps even millions, of questions might be asked about a given practice or condition. The goal was to create a sufficiently robust general-purpose survey that addresses many of the high-priority policy issues while incorporating sufficient depth and flexibility through the use of modules that will be capable of providing data to answer specific questions of interest.

Given the expressed desire by NCHS to retain the ability to trend and track hospital data that have been collected and analyzed over the past 40 years, RAND recommended that variables included in the current NHDS be maintained as part of the redesign. The RAND team also identified many new variables, including some that we considered likely to be easy to obtain, and others that we considered likely to be more difficult to collect, but worthwhile to test, since they mapped to high-priority research domains. A list of key variables selected for inclusion in the feasibility study is shown in Table S.2.

Some variables were deemed to be beyond the scope of the current redesign, either because they would be extremely difficult to collect or because current systems do not reliably collect them. In the Patient Abstract, these include variables related to longitudinal patient care (encounters in other facilities), actual cost of services, and nonphysician professional services (e.g., nursing hours, other allied health hours, consultations). In the Facility Questionnaire, they include volume and capacity by clinical service.

Table S.2
Variables Included in the Feasibility Study, by Variable Category

Patient Abstract	
Variables in Current NHDS	**Variables in Proposed Redesign**
AHA hospital identifier	AHA hospital identifier
Birth date (or age)	Birth date (or age)
Sex	Sex
Marital status	Marital status
Race and ethnicity	Race and ethnicity
	Patient name
	Patient medical record number
	Encounter, billing, or visit number
	Medicare HIC number
	English proficiency
	Occupation
	Education
	Mother's medical record # (newborns)
Zip code	Zip code
	Patient address
Expected source of payment	Expected source of payment
	Payment type (e.g., indemnity, HMO)
	National provider identifier
	ICD-9-CM Diagnosis code
ICD-9-CM Diagnosis codes (Principal/Other)	ICD-9-CM Diagnosis codes (Principal/Other)
ICD-9-CM Procedure codes (Principal/Other)	ICD-9-CM Procedure codes (Principal/Other)
Admission type (elective, emergent, newborn)	Admission type (elective, emergent, newborn)
	Living situation on admission
	Diagnoses present on admission
	Height and weight
	Drug allergies
	Location and dates of initial care (e.g., acute, ICU, observation)
	Vital signs
	Pain assessment
	ASA classification (surgical patients)
	Tobacco use
Date of admission and discharge	Date of admission and discharge
	Date(s) in ED care
Patient location preceding admission	Patient location preceding admission
Discharge disposition and location (partial)	Discharge disposition and location (detailed)
	Palliative care
	Observation/acute (for initial observation patients)
	Vital signs before discharge
Discharge disposition = expired	Discharge disposition = expired

Facility Questionnaire	
Variables in Current NHDS	**Variables in Proposed Redesign**
AHA hospital identifier	AHA hospital identifier
Hospital name, address, phone, fax	Hospital name, address, phone, fax
	Hospital key contact
	Days open during reporting period
Staffed beds by hospital unit	Staffed beds by hospital unit (detailed)
	Licensed observation unit beds
	Licensed other outpatient beds
	Total Emergency Dept. (ED) beds/bays
	ED beds/bays (adult, pediatric, psych)
	Number operating rooms
	Level of care provided by
Trauma level of ED	Trauma level of ED
Total discharges	Total discharges
	Total admissions
Number of live births	Number live births
Average length of stay	Average length of stay
Total surgeries – and by inpatient and outpatient	Total surgeries – and by inpatient and outpatient
Total outpatient visits	Total outpatient visits
Total ED visits	Total ED visits
	No. admitted from ED to hospital, transferred, seen & discharged
	Total observation stays (and Medicare only)
	Total outpatient stays
Accreditation and certification – Joint Commission, CMS	Accreditation and certification – Joint Commission, CMS
	Ownership type
	Subsidiary of larger company
	Affiliated with organized physician practice
Medical school affiliation	Primary teaching hospital
Offer residency training	Offer residency training (Y/N)
COTH Member	COTH Member
General description of services (e.g., gen'l acute care, cancer)	General description of services (e.g., gen'l acute care, cancer)
	Clinical capabilities and services
	% of patients by patient insurer
	% of facility total revenue by patient insurer
	% insurance type (e.g., HMO, PPO, fee-for service) by insurer
	Receipt of Medicaid Disproportionate Share Funding
	Capital investment plans
	Number of Licensed Independent Practitioners (LIP), Tele-LIP, Locum-Tenens by specialty type
	Number hospitalists and medical service
	Number other employed inpatient staff
	Number Certified RN Anesthestists
	Number of open nursing positions
	Unionization of staff
	Avg. monthly number of trainees by discipline
	Health information functionality by hospital unit & degree of linkage between units
	Medical coding – software & avg, median, mean no. diagnoses and procedures per patient

RAND also recommended that, in addition to the variables shown in Table S.2, brief focused modules be included in the feasibility study to determine whether limited modular components could be "added on" to the general-purpose survey. For the feasibility study, we included modules on acute myocardial infarction, psychiatric inpatient care, and asthma, based on the recommendations of the National Heart, Lung, and Blood Institute (NHLBI), Substance Abuse and Mental Health Services Administration (SAMHSA), and the Agency for Healthcare Research and Quality (AHRQ), respectively. Condition-specific variables included diagnostic tests (e.g., radiology), medications, treatments, and admission and discharge criteria specific to the condition being studied.

The results of this effort led to the development of a Patient Abstract Form to be tested in the feasibility study. This form consists of 70 questions (54 included in the general module) and over 500 data fields to be field-tested for feasibility, compared with the 19 questions and just over 100 data fields in the current NHDS. To provide more in-depth information about the hospitals participating in the abstraction process, RAND and NCHS also developed a Facility Questionnaire, which was designed to leverage and build on the information hospitals already provide to the American Hospital Association (AHA) hospital database on an annual basis. Variables were added to allow NCHS to track and trend issues raised in the conceptual framework, including the types of providers caring for patients in hospitals and trends in HIT adoption. The current NHDS does not collect facility-specific data from hospitals, with the exception of a commercially provided file used for sampling hospitals and information obtained relevant to the abstraction process.

Feasibility Study

With input from NCHS, RAND selected and recruited hospitals for the feasibility study. Hospitals that agreed to participate were provided with a *Field Manual* (Hilborne, Meili, Berry, et al., 2007) to guide them through the sampling and abstraction process, and relevant personnel were also trained by RAND. Seven of eight hospitals that agreed to participate in the feasibility study ultimately completed it over a period of three months. Rural and urban, large and small, and for-profit and nonprofit hospitals were included.

Results of Abstraction

On the whole, hospitals were successful in abstracting the vast majority of data elements without difficulty. Moreover, hospitals were also successful in abstracting some variables that we had anticipated would be more challenging (e.g., English proficiency, mother's medical record number for newborns). Hospitals did face challenges in abstracting some variables, which in many cases were anticipated. We briefly highlight a few of those points here:

- **Protected health information.** Although abstractors had no difficulty obtaining protected health information (PHI) from the medical record and billing forms, these data were not always fully removed from the patient records, which is necessary to ensure that patient confidentiality is maintained. This did not have an effect on the feasibility study, since all records were left at the hospitals; however, subsequent NHDS redesign

phases that actually remove PHI from the facility should confirm that hospital administrators, legal staff, and privacy officers are satisfied with the process used to protect the confidentiality of this information.

- **Dates and times.** Dates, and especially specific times (e.g., admission and discharge times, transition times from emergency department to observation), were problematic for both hospital and RAND abstractors. Charts often contain multiple, conflicting times for these events, and times in the hospital information systems generally do not agree with the specifics documented by health care practitioners in the record.

- **Demographics.** Some of the demographic information requested on the abstraction form was not readily available. Problematic items include patient occupation and education.

- **Clinical variables.** Although clinical variables were available from all hospitals, the entries made by hospital abstractors and RAND abstractors did not always agree, particularly when a variable required unit calculation (e.g., weight in pounds and ounces converted to kilograms or grams, daily smoking use as pack years), clinical interpretation (e.g., functional status, asthma management plan), or the first value recorded (e.g., pain assessment, vital signs).

- **Provider identification.** Hospitals could usually identify the attending physician and operating physician, but were typically unable to provide the Unique Physician Identification Number (UPIN) for other types of providers.

- **Diagnoses and procedures.** Although hospitals provided discharge abstracts listing coded diagnoses and procedures as paper printouts, they did not abstract this information onto the Patient Abstract Form, and less-significant diagnoses (e.g., noncontributory chronic conditions), procedures (e.g., minor surgical procedures), and external causes of injury (i.e., E-codes) were infrequently recorded.

- **Medications.** Although admission and discharge medications were available from most records, information on medications received during hospitalization, when available, typically was not transferred to the abstraction form, but rather sent on a hard copy.

- **Financial information.** Hospitals used hard-copy printouts for financial data. There was variation in the types of financial information provided: All hospitals provided information on charges, four of seven provided expected and actual payment information.

- **Newborns.** Most of the clinical data either were not applicable to newborns (e.g., English proficiency) or required unit calculations (e.g., weight in pounds and ounces converted to kilograms or grams).

- **Clinical modules.** Hospitals were able to abstract the clinical modules. However, in a few cases, persons without clinical expertise performed the abstraction.

Completion of Facility Questionnaire

Hospitals were successful in completing the Facility Questionnaire. However, hospitals reported that, overall, completion of the form was time-consuming and burdensome. Very little of the requested information is readily available from routinely produced reports; therefore, manual analysis and assembly were required. Data elements that we anticipated would be particularly difficult (detailed hospital unit and clinical service capacity and volume) indeed were not available. Other elements were particularly time-consuming (staffing). Financial elements are generally available in financial systems but would require programming to extract.

Procedural Issues

The feasibility study provided several insights relevant to the sampling and abstraction process. It should be noted that all hospitals approached sampling and abstraction as a one-time event and noted that, had this been an ongoing process, they would have invested time in programming and other processes to simplify the extraction of the desired variables.

Sampling. Despite the complexity of the sampling plan, none of the hospitals considered sampling to be a difficult task. RAND provided sampling assistance to one of seven hospitals, and only four errors were identified in the sampling overall.

Abstraction. Hospitals were able to abstract the majority of the elements included as part of the abstraction form. Abstractors noted that they had limited need for the *Field Manual* because they thought the questions as stated in the abstraction form were self-explanatory. Most sites used one or two individuals to conduct the abstraction; however, two sites subdivided the task among six people, intending that each would assume responsibility for the accuracy of the content of specific sections. Neither of these two sites designated one person to look at each case in its entirety.

Substantial time was required to conduct the abstraction. It is likely that even more time would be required in the normal survey than in the feasibility study, which excluded hospital stays exceeding ten days from the sample (approximately 10 percent of admissions) and did not require full abstraction of in-hospital medications.

Recommendations for Sampling, Variables, and Abstraction

The findings of the feasibility study led to some specific recommendations for changes to the abstraction form, including the deletion of some items and modifications to others. We offer these additional recommendations to guide pilot-testing and future applications of the redesigned survey:

- Although most hospitals were able to complete a stratified sample independently, future studies must be able to accommodate the needs of organizations for which such a complex sampling plan could be a potential obstacle. Based on our findings, the instructions provided by RAND in the *Field Manual* (Hilborne, Meili, Berry, et al., 2007) should adequately meet the needs of facilities for assistance.

- Depending on the strategy selected for data abstraction and collection (i.e., by facilities or by NCHS contract staff), the length of the form may discourage some organizations from participating on an ongoing basis. The data contained in the abstraction form include a combination of data available in the Uniform Billing (UB) form and other clinical data elements. With this in mind, we redesigned the abstraction form after the feasibility study to group the subset of data elements that are contained in the UB-04 (used by hospitals beginning in March 2007). As hospitals adopt the UB-04, it will be important to validate the reliability of the data elements it contains and the validity of our recommendations to rely on it for many data elements.

- As hospitals adopt electronic health records that are increasingly based on standardized data, it may be possible to use electronic transmission to extract some data elements that are difficult to abstract at this time (e.g., medications administered). Migrating to a computer-assisted abstraction tool that selects subsequent questions based on data already entered is more amenable to complex skip patterns, which ask for more-detailed clinical information that is appropriate for a given patient type, than are the current paper-based tools.

Recommendations for Facility Questionnaire

Because we obtained results from only four hospitals, we were reluctant to recommend sweeping changes to the form. However, the burden of collection made it clear that simplification of the form is required. Specific recommendations for simplification include linking to the AHA hospital database to receive hospital demographic, bed-capacity, and general utilization statistics; and elimination of residency staffing statistics that must be obtained from other sources. Some variables that hospitals reported as being challenging (e.g., median and maximum number of diagnoses and procedures per patient and other hospital staffing) have been retained and recommended for further testing.

Statistical Considerations

RAND assessed the statistical implications of the redesign to inform the discussion regarding trade-offs between statistical power and the burden of data collection when questions are posed by those desiring to use the redesigned survey.

The NHDS has great value as a national probability sample of discharges, but it must adapt to a changing environment to offer the most value to potential users. The NHDS' major strength relative to the National Inpatient Sample (NIS), the largest all-payer inpatient database in the United States, is that it is a representative sample of discharges in the United States and thus yields unbiased national estimates. In addition, the NHDS is clearly preferable in the geographic areas where NIS does not collect the data. Although NIS is a biased estimator of the national population, the current structure of the NHDS makes it imprecise for some outcomes, so that it is an empirical question as to which survey currently yields more-accurate estimates for a given measure when considering both bias and precision.

The NHDS can substantially improve precision by dropping a third tier of sampling hospitals within primary sampling units (PSUs) and may be able to realize some additional gains by reducing disproportionate sampling. Such an improved NHDS would probably have higher statistical accuracy than NIS for the many measures the surveys have in common at current NHDS sample sizes, and perhaps even at reduced sample sizes. It will be important for the NHDS to educate its potential users about the situations in which the NHDS outperforms other surveys with larger nominal sample sizes because bias is invisible to standard statistical software, and sample size (and variance) is not.

The greatest potential for the NHDS to increase its utility is to achieve greater clinical depth of elements, allowing more-sophisticated health services and health policy analyses than are currently possible. Such an expansion of depth would be more costly as sample size increases, so that the current NHDS size of approximately 300,000 discharges annually would probably have to be reduced. Analyses of 16 sample designs suggest that, with a less disproportionate two-stage sampling approach, as few as 50,000 discharges annually, if drawn from 500 hospitals, might provide appealing measurement precision that would support many such analyses ("good" measurement precision for most scenarios and "acceptable" for others). If this cannot be afforded, 12,500 discharges from 250 hospitals should probably be considered minimum targets, although they provide notably less precision than 50,000 discharges from 500 hospitals.

Conclusions

RAND believes that it is essential to maintain those properties of a general-purpose survey that have served NCHS so well over the past 40 years. We have demonstrated, however, that it is possible to incorporate depth and breadth into the survey without compromising the basic premise on which the NHDS was founded.

Although the proposed redesign is clearly ambitious, its implementation offers an opportunity for the survey to continue to be invaluable to the health policy and research communities in the decades to come. The proposed redesign introduces new classes of variables that, in combination, will allow researchers to address a broad range of policy and research questions that will be important to guide health and health care policy decisions in the future. It also offers opportunities to better inform current research by providing greater depth than is currently available from existing surveys and provides a structure for incorporating modules that can focus in detail on selected issues of interest (e.g., appropriateness of care, management of HIV). The addition of the Facility Questionnaire further offers the opportunity for insights into differences in clinical care based on the type of hospital organization in which that care was provided.

Research and Policy Questions That Can Be Examined Through the Redesigned Survey

The redesigned survey will allow for a range of new research and policy questions to be explored. Below, we highlight a few examples relevant to the five high-priority policy issues identified by the Workgroup.

Cost of Care and Resource Use. New variables related to reimbursement for care will supplement existing cost information and allow for examination of more-complex issues, such as cost shifting among different payers and patients, and the relationship among costs, charges, and actual reimbursement. By introducing information on both expected and actual reimbursement, the survey will allow for better understanding of the allocation of resources and the need for greater transparency in cost and pricing. Cost data from the survey can be used in conjunction with data from the Facility Questionnaire to explore such issues as whether individual patient encounters are profitable or unprofitable. The NHDS dataset can also be used to generate models to predict expected costs and to identify facility characteristics that result in higher or lower costs and lengths of stay than expected.

The general survey will not have sufficient depth to answer very focused questions related to cost of care (e.g., the cost of laboratory services for patients admitted for treatment of thyroid cancer). However, special modules designed specifically for such analyses can be used to answer more detailed questions.

Quality of Care and Patient Safety. Drawing meaningful inferences regarding quality of care requires a clinical context in which that care is provided. The proposed redesign dramatically expands the survey's clinical information by incorporating laboratory data, vital signs, medications on admission and discharge, American Society of Anesthesiologists (ASA) physical status classification and other clinically relevant variables. The redesign also captures whether diagnoses existed on admission, an important determinant in differentiating between adverse situations that led to hospitalization and complications that resulted from the care provided. The redesigned survey begins to define variables that will link facility structure, processes, and outcomes of care. The richness of the data contained in the redesigned survey could also facilitate policy analyses to determine strategies for incorporating additional, non-administrative variables that better adjust for patient severity.

The survey also provides the opportunity to look beyond the hospital care received to evaluate the mortality impact of the care through linkage to the National Death Index. By capturing the attending and operating physicians' National Provider Identifiers (NPIs) as part of the discharge abstract, it offers the ability to link the individual patient's care with the specialty of the providers from whom care was received. Moreover, our discussions with national patient safety leaders suggest that the additional proposed clinical variables will facilitate strategies to improve the specificity of AHRQ's Patient Safety Indicators (AHRQ, 2006).

The general survey lacks sufficient detail to adequately address issues related to appropriateness of care or to fully respond to the wide range of quality indicators either being used or developed. However, because appropriateness criteria are specific to patient condition and procedure, this type of assessment is uniquely amenable to focused modules.

Care Delivered Throughout the Hospital. By incorporating data on patients with "observation" status, the redesigned survey provides a more complete picture of care delivered throughout the hospital than has been possible in recent years. Incorporating short-stay or observation "outpatients" into the NHDS will help to reconstitute the patient composition of the survey of previous decades, thereby

making possible, for the first time, an understanding of the impact this practice shift has had on the services, intensity of care, costs, reimbursement, and outcomes. Future studies may wish to explore whether all patients occupying hospital beds, whether considered observation patients or simply outpatients occupying a hospital bed, should be included in the NHDS.

Continuity of Care and Transitions. Continuity of care, particularly as patients transition from the hospital environment to lower levels of care (e.g., home, assisted living, hospice, intermediate care), is frequently cited by patients as a major weakness. Health policy experts also frequently noted the lack of longitudinal data. Although practical considerations limited the extent to which longitudinal data could be included in the redesigned survey, the redesign will allow for examination of the impact of patients' discharge arrangements on their use of hospital services (e.g., using variables such as discharge location, length of stay, and 30-day readmission).

Disparities and Access. The redesigned survey will facilitate studies of equity in care by providing additional detail by which to identify patient personal characteristics (e.g., English proficiency) unrelated to their clinical condition. A better understanding of patient socioeconomic status will be possible because the new address variable in addition to zip code will facilitate sophisticated geocoding, thus allowing for better estimates of patient and family income, race and ethnicity, and education. Relating patient socioeconomic status (SES) to insurance status and hospital type (e.g., rural or urban), particularly after adjusting for acuity at discharge, will offer insight regarding the extent of differences in care that patients of different SES receive.

Costs of Data Collection

Adding a requirement for primary data collection does not come without a substantial increase in per-record cost. RAND acknowledges this reality; however, we strongly believe the additional investment in this survey will give it the ability to address policy and research questions that will ensure that future health care investments–which are orders of magnitude more costly than the added cost of the survey–are well spent. The actual cost of the survey will vary depending on a number of elements, which we briefly describe here:

- **Number of participating hospitals.** The number of hospitals affects induction and training requirements, as well as the sampling and abstraction process.
- **Number of records abstracted per facility.** Although it may be possible to reduce the number of records per facility if the number of facilities and their geographic dispersion increases, it is important to maintain collection of a sufficient number of records at each facility to ensure that the facility makes a substantive contribution to the survey. Abstracting a sufficient number of records per facility increases incentives to develop electronic approaches to data collection.
- **Number of data elements abstracted per record.** We anticipate that the current abstraction form will require an average of 45 minutes per record to complete, although the time requirement may decrease with

experience. Additional hospital costs include computer programmer time, record-pulling time, and facility form completion. The marginal cost of data collection might be reduced by shortening the abstraction.

There are options for reducing the costs of abstraction. Over time, the average per-record abstraction cost should be reduced by upfront programming of hospital computer systems (high initial fixed cost), followed by electronic means of data collection and submission (lower marginal per-record cost). In addition, the introduction of focused modules minimizes the nonproductive collection of data elements that results when static survey designs cannot restrict data collection to those patients for whom specific elements are relevant. The statistical analysis presented in Chapter 10 offers redesign considerations that minimize the number of records required, with minimal loss of statistical power to draw significant observations.

Future Considerations

In moving forward with the pilot study, NCHS should also keep other considerations in mind:

Abstraction Tools. Future pilots using computerized data abstraction tools should have the ability to better incorporate skip patterns and contextually relevant questions (e.g., disease- and age-specific branching logic). This ability will both expedite data collection by minimizing irrelevant data abstraction and allow the survey to be used to probe more-detailed questions when clinically relevant (e.g., cardiac enzymes in the setting of chest pain or myocardial infarction).

Creating Files for Public Use. The proposed redesign survey collects additional patient-identifiable data that must be deleted before survey files are made available for public use. The NHDS will require the infrastructure to create necessary linkages to external files (e.g., Social Security number and the National Death Index, National Provider Identifier and provider type), obtain the requisite demographic and other data, and then delete sensitive information before public release.

National Statistical Hospitals. The Workgroup recommended that NCHS focus on identifying and developing a network of National Statistical Hospitals through which they could explore alternative data-collection strategies. Strategies discussed in this document could streamline data collection by, for example, prospectively incorporating patient consent to use patients' PHI in their admission forms. National Statistical Hospitals partner with NCHS to electronically collect data and perhaps extend data collection longitudinally.

Limitations

Before a full survey can reach the field, a number of limitations imposed on the feasibility study must be explored. The study timeline did not permit us to randomly select participating facilities. This was a one-time data collection, so hospitals did not have the incentive to undertake the necessary programming to electronically extract data that would be more likely to facilitate ongoing data collection. By using a convenience sample, we did not fully test hospitals' recruitment and approval

processes and timelines. The limited nature of the feasibility study and the retention of PHI within the hospital may have limited the scrutiny required by hospital institutional review boards (IRBs). Finally, there was not sufficient time to formalize and conduct rigorous training, an activity that could have reduced misunderstandings and discrepancies observed during the feasibility study.

Acknowledgments

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Cedars-Sinai Medical Center, Los Angeles, California

Lodi Memorial Hospital, Lodi, California

Prince George's Hospital Center, Cheverly, Maryland

Ridgecrest Regional Hospital, Ridgecrest, California

St. Mary's Hospital, Leonardtown, Maryland

Sierra-Kings District Hospital, Reedley, California

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Abbreviations

Symbol	Definition
ACS	acute coronary syndrome
ADLs	activities of daily living
ADT	Admission/Discharge and Transfer systems
AHA	American Hospital Association
AHIC	American Health Information Community
AHIMA	American Health Information Management Association
AHRQ	Agency for Healthcare Research and Quality
ALOS	average length of stay
AMA	American Medical Association
AMI	acute myocardial infarction
APN	advanced practice nurse
ARF	Area Resource File
ASA	American Society of Anesthesiologists
CCHIT	Certification Commission for Health Information Technology
CDAC	Clinical Data Abstraction Center
CDC	Centers for Disease Control and Prevention
CEO	Chief Executive Officer
CFR	Code of Federal Regulations
CMO	Chief Medical Officer
CMS	Center for Medicare & Medicaid Services
CNA	Certified Nurse Anesthetist
COTH	Council of Teaching Hospitals
CPOE	computerized provider order entry
CPSC	Consumer Product Safety Commission
CPT	Current Procedural Terminology (AMA's Procedure Coding), HCPCS Level I codes
DAWN	Drug Abuse Warning Network
DEFF	(statistical) design effect(s)
DHHS	Department of Health and Human Services
DME	durable medical equipment
DNR	Do Not Resuscitate order
DRG	Diagnosis-Related Group
ED	emergency department
EHR	electronic health record
EMR	electronic medical record
ERB	Ethics Review Board (CDC IRB)
ESS	effective sample size
FAQ	frequently asked questions
FTE	full time equivalent
HCPCS	Healthcare Common Procedural Coding System
HCUP	Healthcare Cost and Utilization Project
HDS	Hospital Discharge Survey (Number)
HIC	Health Insurance Claim (Medicare number)

Symbol	Definition
HIMSS	Health Information and Management Systems Society
HIPAA	Health Insurance Portability and Accountability Act
HIT	health information technology
HMO	health maintenance organization
HQA	Hospital Quality Alliance
ICC	intraclass correlation coefficient
ICD-9	*International Classification of Disease*, 9th Revision
ICU	intensive care unit
IP	inpatient
IRB	institutional review board
IT	information technology
IV	intravenous
LPN	licensed practical nurse
MAR	medication administration record
MEDPAR File	Medicare Provider Analysis and Review File
MEPS	Medical Expenditure Panel Survey
MMWR	*Morbidity and Mortality Weekly Report*
MRSA	Methicillin-resistant *Staphylococcus aureus*
MSE	mean standard error
NA	not applicable or not available
NAHDO	National Association of Health Data Organizations
NAMCS	National Ambulatory Medical Care Survey
NCHS	National Center for Health Statistics
NEISS	National Electronic Injury Surveillance System
NHAMCS	National Hospital Ambulatory Medical Care Survey
NHANES	National Health and Nutrition Examination Survey
NHCS	National Health Care Surveys
NHDS	National Hospital Discharge Survey
NHIN	National Health Information Network
NHIS	National Health Interview Survey
NHLBI	National Heart, Lung, and Blood Institute
NIS	National Inpatient Sample (from HCUP)
NPI	National Provider Identifier
NSAS	National Survey of Ambulatory Surgery
OMB	Office of Management and Budget
OP	outpatient
PHI	protected health information
PI	principal investigator
PO	post office
PPO	preferred provider organization
PSI	Patient Safety Indicator
PSU	(Geographic) primary sampling unit
RFD	Rural Free Delivery
RHIO	Regional Health Information Organization
RN	Registered Nurse
RSE	relative standard error

Symbol	Definition
SAMHSA	Substance Abuse and Mental Health Services Administration
SE	standard error
SES	socioeconomic status
SID	State Inpatient Database (from HCUP)
SLS	Sample Listing Sheet
SNF	skilled nursing facility
SPARCS	Statewide Planning and Research Cooperative System
UB-04	Uniform Billing Form (effective March 2007)
UB-82	Uniform Billing Form (adopted May 1982; used through Sept. 1993)
UB-92	Uniform Billing Form (in use October 1993 - February 2007)

1. Introduction

Overview

With the signing of the U.S. National Health Survey Act by President Dwight D. Eisenhower in July 1956, the United States formally recognized the need to obtain standardized statistics on disease, injury, impairment, disability, and related topics about the health of the general population. Initial audiences for this information were public and private health agencies, which during this time were shifting their focus from the control of infectious diseases to the screening and monitoring of chronic diseases. The National Health Survey Act established a continuing set of health surveys.

The National Center for Health Statistics (NCHS) has played a pivotal role in providing statistical information to guide actions and policies to improve the health of the American people. In addition to being the repository of the nation's vital statistics and to conducting the National Health and Nutrition Examination Survey and the National Household Interview Survey, the Center is responsible for developing and maintaining a portfolio of national surveys on health care delivery, referred to collectively as the National Health Care Surveys (NHCS) (Table 1.1). These surveys are designed to measure utilization of the health care delivery system and are used for a variety of public- and private-sector purposes.

The oldest component in the portfolio of surveys is the National Hospital Discharge Survey (NHDS). First carried out in 1965, the NHDS has since its inception been a principal source of information on inpatient utilization in short-stay nonfederal hospitals in the United States. With its focus on hospital inpatient care, the NHDS is an essential component of NCHS's broader portfolio of surveys of health-care providers, which cover outpatient care, emergency room care, nursing home care, home health and hospice care, and ambulatory surgery center care. An important feature of the NHDS is its use of probability sampling, which allows the results to be generalized to the United States.

Table 1.1
National Health Care Surveys Portfolio

National Ambulatory Medical Care Survey
National Hospital Ambulatory Medical Care Survey
National Survey of Ambulatory Surgery
National Hospital Discharge Survey
National Nursing Home Survey
National Home and Hospice Care Survey

Although the NHDS has served the country well for more than 40 years, it was formulated in the context of the health care delivery system and hospital and patient universe of previous decades. NCHS has therefore undertaken an evaluation to determine the role a redesigned NHDS might play in informing current and future policy and research issues.

RAND Health, a division of the RAND Corporation, was selected to assist in developing an approach for the redesign and to identify and test specific data elements to be included in the redesigned survey. This report documents this process, including the development of a conceptual framework for the redesign, a feasibility study to test variables for a redesigned survey, and key statistical issues and considerations that can inform the NHDS redesign process.

Appendix A contains the final forms that emerged from this process, including the Facility Induction Form, Facility Questionnaire, Patient Abstract Form, and Patient Abstract Instructions.

Current Role and Design of the NHDS

The NHDS is important to a broad spectrum of users in both the public and private sectors. Users of these data include government agencies (e.g., the Agency for Healthcare Research and Quality [AHRQ]) that track the effect of policy changes and the progress on national goals, such as reduction of health disparities, quality improvement, and patient safety. Other NHDS users include consultants, private-sector health plans, insurance companies, and medical device companies, hospitals, and other providers that use the data for forecasting and benchmarking. State and local governments can use the data to benchmark against national standards for planning and progress on goals at the state level. Publications produced from the data indicate that the NHDS is primarily used to understand the epidemiology of patients treated in hospital settings, to identify changes in the use of procedures, and to assess the effect of policies and regulations on the use of hospital services (National Center for Health Statistics, 2007).

Throughout its history, the NHDS has used only two major statistical designs: the original design, a two-stage probability sample of hospitals and inpatient discharges within hospitals used from 1965 to 1987; and a second design, a three-stage design of geographic areas, hospitals within areas, and inpatient discharges within hospitals, which was initiated in 1988. Data elements within the survey have changed little over the past 40 years. NHDS patient-level data come from the hospital discharge abstract (the Uniform Bill or UB) prepared by medical coders and billing specialists at the time a patient is discharged. Over 60 percent of the NHDS records are supplied electronically from administrative databases that aggregate the UB (UB-82, UB-92, and UB-04 beginning in 2007 and the electronic versions, e.g., 837I-4010 and upcoming 837I-5010). Consequently, in its current format, the NHDS is restricted to data elements contained on the UB and therefore lacks the flexibility to add data elements or modify the survey to respond to changing needs or external requests. Limited facility-level data come from Verispan and are primarily used for hospital sampling.

Changing Context for Inpatient Care

For the NHDS to remain relevant, it must address important policy and research issues and reflect the types of care and services offered in America's hospitals. However, since the survey's inception, and particularly over the past two decades, significant changes have occurred in both the role of inpatient care within the spectrum of care and in the data sources available to understand the characteristics

of care. For example, although hospital care remains a major component of the U.S. health care system, the role of inpatient care has changed significantly since the 1960s. Previously fatal diseases once treated almost exclusively in inpatient settings have become chronic conditions treated primarily in outpatient settings. Today, many patients with conditions that, only a decade ago, would have required admission to a hospital for a day or two of care, are now treated as outpatient "observation" patients, a designation that precludes their incorporation into an "inpatient only" database. Moreover, during the past 25 years, the average length of stay in hospitals has dropped 40 percent. At the same time, the costs of hospital care have remained high. Even as inpatient care has declined as a percentage of health care expenditures (for Medicare, 68 percent [$25 billion] of spending was for inpatient care in 1980, compared to 43 percent [$145 billion] in 2005), it still represents a significant expense.

Data-collection methods and sources also have changed. In the 1960s, to collect patient-level hospital data, abstractors were required to engage in an entirely manual examination of the medical record, and the presence of billing systems and standardized records was rare. In subsequent decades, accreditation, regulatory, and reimbursement requirements have encouraged standardization of medical-record structures, although the "hybrid record" of today uses both the paper record and electronic sources. Most billing and discharge information is automated because of submission requirements imposed by outside entities or for efficiency and cash flow. Diagnostic test data (e.g., laboratory tests, radiography) are also increasingly automated, as is documentation of some therapeutic interventions (e.g., pharmaceuticals).

Changes in the context of care such as those just described suggest that the NHDS must change in order to remain a key policy and research tool for the coming decades. At the same time, a redesign of the survey at this point also provides a useful opportunity for the NHDS to reevaluate and ultimately expand its role as the critical source of data on the patient who occupies a hospital bed (whether as inpatient or outpatient, e.g., observation care). Despite an explosion in the number of health care data-collection efforts exerted by federal, state, and private entities over the past 20 years, none provides an in-depth look at hospital patients. Nor do these data sources provide a deep understanding of the characteristics of the patient or of the ways in which these characteristics influence the nature and direction of the patient's care. These are all important areas of opportunity for the redesigned NHDS.

Scope of the Redesign Effort

In deciding to undergo a redesign of the NHDS, NCHS did not limit the redesign options to the inpatient stay. Instead, the question posed at the project kickoff meeting was: "In the context of a survey designed to measure inpatient care, what data are currently lacking or limited in their availability that are needed to answer important policy and research questions for the next 10 to 20 years?" This question included how hospital structural components influence the care provided.

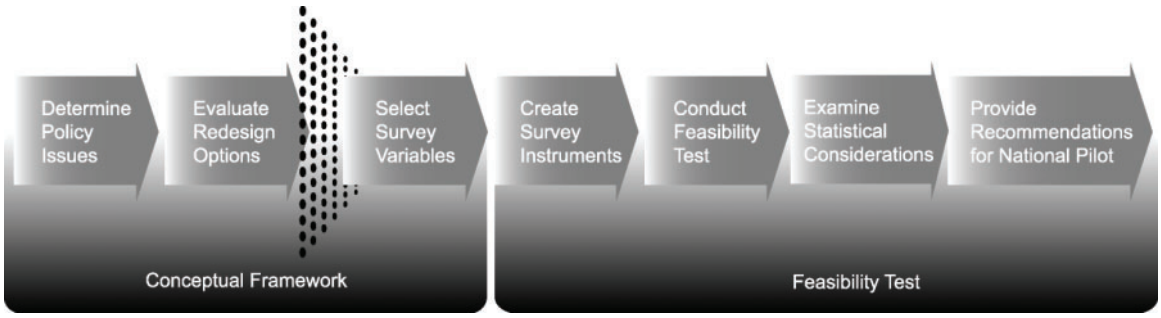
Addressing this question requires appreciation of at least three different elements. First, it is important to understand critical health policy research questions (and the related key policy issues) that will need to be addressed in the next few

decades. Second, efforts should specifically focus on redesign options that add value to, rather than duplicate, information being collected by other surveys or databases. The gap between what researchers, policymakers, providers, consumers, and others need to know and the data that are currently available points to the most important redesign options and helps identify the data elements that can create maximum value for the NHDS. Lastly, any design must be sensitive to logistical constraints, including the length of the survey, the types of data abstracted, the number of hospitals in the survey, the number of records abstracted per hospital, the use of personal health information, and the budget available for the survey.

Key stakeholders and other experts with whom we spoke during the course of this project and our reviewers acknowledged the benefit that could accrue from coordinating hospital-based data-collection efforts, particularly within the federal government. RAND recommends that serious consideration be given to the sentiments expressed by so many stakeholders. However, exploring the logistics of such a coordination was beyond the scope of this project.

Figure 1.1 shows RAND's approach for the NHDS redesign, which constitutes the first phase of the survey redesign and concludes with recommendations to be used in a national pilot (the second phase). As shown in the figure, there are two main components to the first phase redesign effort: (1) development of a conceptual framework for the redesign (12 months), and (2) a feasibility study of the variables produced by the conceptual framework redesign (six months). Although the figure suggests that these steps were carried out in a linear sequence, the initial steps in the process were carried out iteratively. Redesign options were not only informed by our understanding of critical policy issues but were also used to refine our understanding of those issues. RAND also assessed the statistical implications of the redesign to inform the discussion regarding trade-offs between statistical power and burden of data collection when questions are posed by those desiring to use the redesigned survey. These implications will be discussed in detail in Chapter 10.

Figure 1.1
The NHDS Redesign Project Components



Organization of This Document

The remainder of this document is organized in four parts:

- Part One focuses on the development of the conceptual framework for the redesign, including the identification of critical research questions and important policy issues that could be addressed by a redesigned survey, as well as the selection of patient (Appendix A – Patient Abstract Form) and facility (Appendix A – Facility Questionnaire) variables for feasibility testing.
- Part Two focuses on the design and results of the feasibility study, which was carried out in a limited number of representative hospitals. This part describes findings and recommendations regarding both the inclusion of specific variables and the procedures used during the abstraction process.
- Part Three focuses on the results of a statistical analysis carried out to identify recommendations for a revised sampling approach that can maximize the economic feasibility and informational value of the redesigned survey.
- Part Four provides overall conclusions for the report.

Parts One, Two, and Three are each divided into several chapters. Each part includes a description of the methods used, the key findings, and a discussion section.

The document also includes multiple appendixes:

A. Revised Forms and Documents

B. National Hospital Discharge Survey Interviewees

C. National Hospital Discharge Survey Workgroup Panel Members

D. Description of Policy Issues and Sample Research Questions

E. A Menu of Non-Mutually Exclusive Options for Redesigning the NHDS

F. Mapping Research Questions to Variable Categories

G. Patient Abstract Form – Feasibility Study 2006

H. Pilot Site Recruitment Contact Tracking Sheet

I. Facility Induction Form – Feasibility Study 2006

J. Key Contacts List

K. Feasibility Study On-Site Debrief Questions

L. Statistical Tables

A companion volume to this report reproduces the contents of the field manual used by the RAND team in conducting the feasibility study (referred to as the *Field Manual*; Hilborne, Meili, Berry, et al., 2007). The *Field Manual* contains the following:

- NCHS and Study Background

- Hospital Selection
- Sampling instructions, sample listing sheets, and fax form for RAND assistance in randomization
- Patient Abstract Form and instructions
- Feasibility assessment forms
- Information on the Health Insurance Portability and Accountability Act (HIPAA) privacy rule and public health
- NCHS Ethics Review Board (ERB) approval letters
- Facility Questionnaire
- Introductory letters
- Hospital induction agenda
- Frequently asked questions.

Part One:

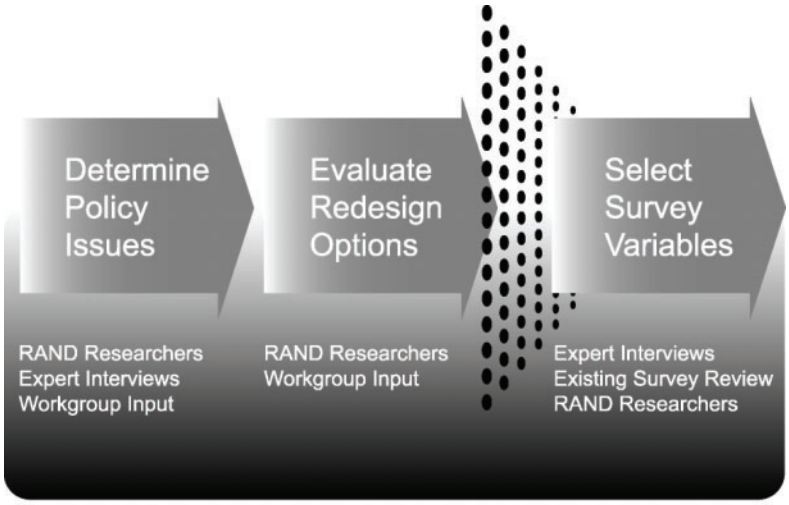
Development of a Conceptual Framework for the NHDS

2. Methods Used in Developing a Conceptual Framework for the Redesign

We now turn to a discussion of the development of the conceptual framework for the redesigned NHDS, a process that involved the first three of the seven steps shown in Figure 1.1. This chapter describes the methods used in developing the conceptual framework for the redesign. Throughout the project, RAND worked closely with survey experts at the National Center for Health Statistics. The output from each step, therefore, reflects the wisdom and guidance received from the Center's staff.

As shown in Figure 2.1, input and expertise from four different sources were used throughout the three steps of the development process for the conceptual framework. Input from RAND researchers, policy experts, and a workgroup of government and private-sector health policy experts was used to identify critical research questions that might be answered through a redesigned survey. These questions were grouped in relation to a set of key policy issues. These issues and the related research questions provided insights that were used to identify priority redesign options. The critical research questions also provided a foundation for selecting variables for the redesigned survey. Lastly, a review of existing surveys provided a context in which the redesigned survey could provide added value and information.

Figure 2.1
Steps Used in Developing the Conceptual Framework



The remainder of this chapter briefly discusses each of the three steps involved in the conceptual framework redesign; it then describes our approach for seeking and integrating input from each of the four information sources.

Steps in Developing the Conceptual Framework

Step One. Identification of Policy Issues

The first step involved the development of a set of critical research questions and policy issues (e.g., cost, quality, and access) that are and will continue to be important in the context of providing hospital-based care and that could potentially be addressed through information provided by a redesigned NHDS. RAND researchers and experts interviewed were asked to identify important current and future health policy and research issues, along with questions a redesigned survey might ask to address those issues. RAND and NCHS consolidated the input from RAND researchers and expert interviews, and created a list of 13 key policy issues that were presented to the Workgroup for discussion and validation. These policy issues were also used to inform the next two steps, as described below.

Step Two. Identification of Potential Redesign Options

The next step was to identify a set of options for a potential redesign of the NHDS that would address key policy issues. A set of non-mutually exclusive options was developed by RAND in conjunction with NCHS. These redesign options were informed by discussion with RAND researchers and external experts. Each redesign option was framed in terms of (1) the broad theme or concept defining the option; (2) the types of data elements that might be included in a redesigned survey that include options of this particular type; and (3) potential strategies for collecting the data. Once the redesign options were developed, they were discussed with the Workgroup to help prioritize those options most likely to add value in a redesigned survey.

Step Three. Selection of Survey Variables

Given that the NHDS redesign aims to bridge the gap between the types of information that experts believe will be important for the future and the types that exist today within the current NHDS and in other surveys, we needed to identify variables that would be useful in addressing high-priority research questions relevant to key policy issues. Recognizing that inclusion of all potential variables would be logistically impractical and fiscally unattainable, RAND worked closely with NCHS to select those variables that mapped most closely to the prioritized redesign options.

Patient Abstract Form. The selection of Patient Abstract Form variables was also informed by a review of the National Association of Health Data Organizations' (NAHDO) recommendations and the pioneering work in existing or proposed national (e.g., Hospital Quality Alliance, CMS/Premier Hospital Quality Incentive Demonstration) and state surveys (primarily California, New York, Pennsylvania, and Wisconsin).

To select variables for inclusion in the Patient Abstract Form, we asked several questions related to the high-priority policy issues identified by our informants:

- What data are needed to answer this research question?
- What categories of variables (socioeconomic status, payer, discharge status, etc.) could provide data to address this question?
- What specific variable(s) within these categories could best answer this question?
- Is the specific variable feasible for inclusion in the survey (based on cost, availability of data, etc.)?

Given this approach, we identified variables to be included in the feasibility study. These variables were grouped into three categories: (1) those already included in the existing survey, (2) those that could likely be incorporated given a primary data collection, and (3) those that would be challenging to abstract, given the status of health information technology in hospitals today, but that are included anyway for testing purposes. We also identified some variables that, given the scope of the NHDS and practical limitations, should not be incorporated into this survey redesign.

Facility Questionnaire. The selection of variables for the Facility Questionnaire was informed by a review of the existing American Hospital Association (AHA) annual survey of nonfederal acute care facilities and other facility-based surveys conducted by the NCHS, primarily the National Hospital Ambulatory Medical Care Survey (NHAMCS).

The NCHS and RAND developed the Facility Questionnaire jointly for participating sites to provide detailed information on hospital capabilities, capacity, and characteristics. The following questions were considered when deciding which variables to incorporate into the Facility Questionnaire:

- What policy issues are not addressed by collecting patient-level data, but could be informed through a better understanding of facility capabilities and characteristics?
- What facility data are needed to provide an understanding of the environment in which care is rendered?
- What data would facilitate comparison of care across selected facility characteristics?
- What hospital information would be valuable from a nationally representative sample that is not presently collected?

Using this approach, we identified variables for the feasibility study in a manner similar to that which we used for the Patient Abstract: (1) variables included in existing surveys; (2) those that could likely be readily obtained by the facility; (3) those that we believed worth testing but thought would be challenging, given that hospitals do not generally report facility statistics at such fine levels of detail.

Data Sources

RAND used four sources of information to shape our understanding of the three major steps just described:

- Discussion with RAND researchers
- Review of existing surveys relevant to hospital care
- Health policy expert interviews
- An expert Workgroup.

In this section, we detail the methods used to gather information from each of these sources.

Discussion with RAND Researchers

To begin to identify the important future issues that might be covered by a redesigned survey, early in the project RAND convened a group of RAND health policy experts, including physicians, economists, and social, behavioral, and health information scientists. Participants were asked to consider the following questions in a semi-structured meeting format, which ensured participation of all in attendance:

Broad Issues and Challenges

1. What key health policy and health services research issues currently exist in the United States?

2. What information is needed but unavailable to address these issues? What policy issues will likely face the U.S. health care system for the foreseeable future (e.g., 20 years)?

Questions That Could Be Answered by a Redesigned Survey

1. What questions must be asked to understand current health care issues and challenges? (What information is needed but unavailable to address current issues?)

2. What questions must be asked to inform the planning and delivery of health care for the future? (What information will be needed that databases are unlikely to be able to provide?)

Review of Existing Surveys

RAND reviewed public and selected private patient-level facility-based surveys to understand the data currently available to researchers and policymakers and to determine the extent to which high-priority policy issues and related research questions were being addressed through existing surveys.[2] The surveys reviewed included the following:

- The National Health Care Surveys family from NCHS

[2] We chose not to analyze Solucient's dataset because it provides both HCUP and NHDS with data. Solucient is a claims-based dataset similar to MedStat and Ingenix.

- The Healthcare Cost and Utilization Project (HCUP) family from The Agency for Healthcare Research and Quality (AHRQ)
- The Medical Expenditure Panel Survey (MEPS) family from AHRQ
- The National Electronic Injury Surveillance System (NEISS) from the Consumer Product Safety Commission (CPSC)
- The Drug Abuse Warning Network (DAWN) produced by the Substance Abuse and Mental Health Services Administration (SAMHSA)
- The Medicare Provider Analysis and Review (MEDPAR) produced by CMS
- The American Hospital Association Survey
- MarketScan® produced by MedStat
- Ingenix®, a subsidiary of United Health Group.

The review excluded datasets that are not readily available, such as those of the University HealthSystem Consortium and Kaiser Permanente. It also did not include public reporting done through medical-record abstraction, such as the Joint Commission's ORYX measures or efforts to publicly report metrics based on administrative data, such as the HCUP-derived quality indicators (i.e., Prevention Quality Indicators, Inpatient Quality Indicators, Patient Safety Indicators, and Pediatric Quality Indicators).

Variables were analyzed and categorized in sufficient detail to provide insight regarding the extent to which information was being collected to address high-priority policy issues and related research questions. For each survey, we mapped variables to broad descriptive categories, such as comorbidities (e.g., malignancy, diabetes, anemia, age), cost, and payment (e.g., charges, actual payment), diagnoses, procedures, facility information).

To understand the types of data currently collected and the reasons for collecting those data, we also investigated some leading state initiatives that either collect general-purpose patient-level data or collect data for a focused purpose or function (e.g., administrative data, billing data). We looked specifically at those states that, based on information from NAHDO, appeared to be cutting edge in terms of developing public-domain hospital and hospital-related datasets to address state and local issues.

Health Policy Expert Interviews

RAND and NCHS staff interviewed people from government agencies, policy experts, researchers, and other users of data to refine our understanding of what the broader community believes to be the major health-related issues for the coming decades. Input from discussions with RAND health policy researchers helped shape the interview protocol. Interviews were conducted primarily by telephone, using an open-ended interview protocol. Thirty-four interviews were conducted by RAND and NCHS staff. For a list of interviewees, see Appendix B.

Interviewees were asked about the key issues that they considered the NHDS to be able to address, their current data needs, and the strengths and weaknesses of the NHDS. The following questions were used to guide the interviews:

1. What research are you conducting using facility-based databases (e.g., NHDS, HCUP)?
2. What databases do you use, and why have you chosen these over others?
3. If appropriate, describe the strengths and weaknesses of the NHDS, as you understand them.
4. What likely issues will face our health care system in the near future (e.g., 20 years)?
5. Thinking about these issues, what are the most important research, policy, and other questions the data collected from a redesigned NHDS should be able to address?
6. What data are critical to being able to address these questions? Are these data available and, if so, how easy is it to access them?

Expert Workgroup

A Workgroup of government and private-sector health policy experts was jointly constituted by RAND and NCHS to review the policy issues and redesign options and provide input and guidance concerning the conceptual framework for the redesign of the NHDS. Members (listed in Appendix C) were selected to represent both public and private stakeholders for a hospital facility-based survey.

RAND individually briefed the participants on the purpose of the project and the upcoming Workgroup meeting. Participants were provided with a description of the conceptual redesign project, a summary of important health and health care policy issues derived from the RAND group and interviews, and the types of research questions a revised survey might address (identified with input from RAND researchers and expert interviews). Participants were asked to individually rate the importance of the policy issues on a five-point scale. They were then asked to rank the three issues believed to be the most important to consider for a redesigned national survey. Participants were also encouraged to identify additional categories of issues not captured as part of the original list.

Panelists met over two days (March 29-30, 2006) in Hyattsville, Maryland, to discuss, first, the policy issues and, then, the redesign options. In advance of the meeting, Workgroup members were provided with the results of the individual and group ratings and rankings that they had submitted prior to the meeting. On the first day of the meeting, discussion focused on the newly identified policy issues and on situations in which panelists strongly disagreed about the relative importance of a policy issue. There was neither the expressed nor implied intent to achieve a consensus regarding the prioritization of issues; rather, participants had the option of reconsidering their individual priorities following clarification of any unclear areas, introduction of new areas by panel members, and input from other Workgroup members.

Although the intent was to have Workgroup members re-rate the issues at the conclusion of their discussion, the members felt that the discussion had not altered their initial ratings (and rankings).

On the second day, the Workgroup discussed the initial set of redesign options proposed by RAND and NCHS, taking into consideration the discussion on policy issues from the prior day. They were also asked to determine whether there were additional options that should be considered. To facilitate this discussion, participants were also provided with a summary of the types of data collected by other commonly used facility-based surveys and were provided with the data-collection instruments for the major national surveys reviewed. At the conclusion of the discussion, the Workgroup was asked to rate the original and any additional options identified during the second day's discussion to identify those options that the Workgroup considered to be of the highest priority for the NCHS to consider as part of the redesign. This rating was informed by a discussion of the relationship between the proposed options, the feasibility with which data elements could be defined and collected, and the extent to which each option addressed key policy issues discussed the previous day.

3. Findings: Critical Information Needs for the Conceptual Framework

The NHDS redesign seeks to meet current and projected needs of key audiences for hospital-based patient-level information. In this chapter, we discuss our major findings in relation to critical information needs that could be addressed through a redesigned survey. These findings draw upon and integrate the input gained from research and policy experts, as well as from RAND's analysis of current data sources to determine existing information. We first discuss the critical information needs that a redesigned NHDS might address and then present the Workgroup's prioritization of potential redesign options.

Key Policy Issues

Our discussions with our stakeholder groups (RAND researchers, health policy experts, expert Workgroup) resulted in a list of key policy issues and related research questions that researchers and policymakers are interested in addressing.

Overall, interviewees were strongly interested in obtaining increased detail on hospital patients, including clinical data, to facilitate risk adjustment and quality assessment; cost and resource-use data to support increased financial transparency; and patient demographic data to better understand barriers to access. Interviewees also expressed a strong interest in being able to understand care at a much greater level of geographic and hospital specificity than is currently available through the NHDS or other surveys. Experts also commonly cited the desire to study care longitudinally and the ability to link datasets (e.g., to the National Death Index, MEDPAR). Linkages expand opportunities to study high-priority topics (e.g., quality indicators). As listed in Table 3.1, 13 policy issues were initially identified as being important for health and health care research. This list of issues was developed with input from RAND researchers and other health policy experts and was later validated by the Workgroup. Each policy issue should be understood as a category that incorporates multiple related subtopics and questions of interest. The Workgroup was asked to rate all the issues on a five-point scale. These ratings reflect panel members' view of the importance of each issue to U.S. health policymakers and researchers over the next 20 years. A rating of "1" equals "not important" and "5" is "very important."

RAND recognized that a redesigned NHDS would not be able to address all of the important policy issues, and some of these issues might not provide the appropriate focus for a hospital discharge survey. Thus, we asked Workgroup members to consider how the NHDS might address key questions related to policy issues on this list and to identify those issues they felt should be given highest priority for the redesigned survey.

The results of the rating and ranking process are shown in Table 3.1. The five issues in the table receiving the most votes for "highest priority" are listed first and shaded; other issues are listed in the order of their average numerical rating.

The highest ranked issues were, in rank order:

- Cost of care and resource use
- Quality of care and patient safety
- Care delivered throughout the hospital
- Continuity of care and transitions
- Disparities and access.

Although the Workgroup felt that certain policy issues should be given priority for the survey, they also agreed with the importance of the full list of policy issues overall (12 of the 13 issues averaged a rating higher than "3") and indicated that a redesigned survey might also provide value in other areas as well.

Table 3.1
Workgroup Rating and Ranking of Policy Issues

Issue	Group Average Rating	Workgroup Ranking
Cost of care and resource use	4.7	First
Quality of care and patient safety	4.5	Second
Care delivered throughout the hospital	4.1	Third
Continuity of care and transitions	3.8	Fourth
Disparities and access	3.6	Fifth
Standards against which performance can be measured (benchmarking)	3.9	
Use and value of technology and innovation	3.8	
Role and value of electronic health records	3.6	
Mix and use of labor	3.4	
Care migration away from inpatient hospital settings	3.3	
Public health and surveillance	3.3	
Focused studies	3.1	
Impact of globalization	1.9	

The Workgroup also noted that many of these policy-issue categories were closely related or overlapping and that an alternative way of understanding these issues would be to group them into five broad "domains":

- Cost of care and resource use
- Quality of care
- Care within and beyond the hospital
- Public health
- Globalization.

While RAND recognized that consolidating the issues into these five domains has utility as an organizational construct, we felt that the list of 13 policy issues, and especially the five issues that were ranked the highest by the Workgroup (cost of care and resource use, quality of care and patient safety, care delivered throughout

the hospital, continuity of care and transitions, and disparities and access) would provide a finer level of detail that would be useful in moving toward the selection of variables for the redesigned survey. Therefore, we chose to emphasize the 13 policy issues cited by our informants and validated by the Workgroup, with particular emphasis on the five high-priority issues.

Table 3.2 provides examples of important research questions in relation to the full list of 13 key policy issues. These questions were among those cited by participants in the RAND researcher discussion, by interviewed experts, and by the Workgroup. Questions related to the high-priority policy issues are shown first.

Below, we briefly describe each of the policy issues and provide further examples of the types of research questions cited by participants in the RAND researcher discussion, interviews, and Workgroup. We first discuss the five issues that were ranked as high-priority by the Workgroup and then discuss the other issues, which were also given consideration in the survey redesign to the extent possible. Because this discussion of policy issues is used to inform the selection of variables for a redesigned NHDS, we also briefly discuss RAND's assessment of the types of data that would be needed to address questions concerning each policy issue. A full description of each issue can be found in Appendix D.

Table 3.2
Key Policy Issues and Important Research Questions

Policy Issues	Research Questions
Cost of care and resource use	How much improvement in health is obtained for each dollar spent? How much is paid for care and by whom? In what venues is care most productive or efficient?
Quality of care and patient safety	What is the quality and appropriateness of care for people across care settings? What conditions and comorbidities are present at admission? What is the mortality rate of patients following hospitalization (e.g., 30-day)?
Care delivered throughout the hospital	What physicians and other caregivers provide care for the patient during his/her hospitalization? How consistent are admission and discharge diagnoses? Which physicians provide care for the patient during the patient's hospitalization? What are the patterns of drug utilization and when are drugs administered? Which diagnostic tests are ordered and provided?
Continuity of care and transitions	Are patient characteristics associated with the number and type of transitions of care? How do we track the care of patients with chronic disease (particularly the elderly)? How do patients access the health care system over time? How do transitions of care affect quality?
Disparities and access	Are there differences in hospital utilization by various socioeconomic characteristics? Are there socioeconomic differences across patients by disease or procedure? Are there socioeconomic differences in processes or outcomes of care? Do rates of utilization vary by insurance status?
Standards against which performance can be measured (benchmarking)	What benchmarks exist at local, regional, national, and global levels? Can we compare care delivered by institutional characteristics (e.g., size, ownership)?

Table 3.2, Cont.

Policy Issues	Research Questions
Use and value of technology and innovation	What is the value of different innovations (drugs, devices) for treating a given condition? How are treatment approaches for diseases changing over time? What are the use and rate of adoption of complex technology?
Role and value of electronic health records (EHR)	What must be done to ensure linkages to leverage data that will increasingly be available? Are processes and outcomes of care better at facilities with advanced EHR products? Can NCHS play the role of an "honest broker" for clinical information?
Mix and use of labor	What provider types (disciplines, specialties) deliver care for a given condition? Is the mix of providers associated with differences in processes or outcomes of care? Do procedure volumes relate to concentrations of different care professionals?
Care migration away from inpatient settings	Which procedures are performed in what care settings? How is this changing? What burden of illness do patients bring to each care setting? How is this changing? How do patients access the health care system over time? How do transitions of care affect quality?
Public health and surveillance	What environmental factors contribute to hospitalizations? What interventions (e.g., vaccinations) precede hospitalizations?
Focused studies	How can we track and trend relatively rare diseases? How can we track and trend the most prevalent diseases (cost or volume)?
Impact of globalization	How would seeking care globally affect the domestic workforce and bed demands? On what measures should U.S. health care be compared to other countries'?

High-Priority Policy Issues

Cost of Care and Resource Use. Most of the experts with whom we spoke affirmed that it is important to understand the value of care received for resources expended. Stakeholders expressed interest in better understanding the value received for the amount invested in health care, the allocation of resources, and the need for greater transparency in cost and pricing. The Workgroup also pointed to two related issues: the level of waste in health care services and the ability of an aging hospital infrastructure to support changing health care needs. In general, it was the view of our expert sources that the information on costs available in today's databases (i.e., total charges) would be insufficient to address complex issues, such as cost shifting among different payers and patients, and the relationship among costs, charges, and actual reimbursement. Even sophisticated cost systems may not reflect real resource use, such as actual staff time devoted to each patient or inefficient care practices. RAND agreed that many important questions will require data on charges at more detailed, or "granular" levels (e.g., individual cost centers), as well as data on costs and reimbursement.

Quality of Care and Patient Safety. Our stakeholders agreed that quality of care and patient safety is and will continue to be a critical issue for health services research. One key area of focus is understanding the degree to which processes of care are consistent with recognized quality standards and practice guidelines. The NHDS provides the opportunity to retrospectively examine new procedures and areas of care to assess their effect on quality and outcomes. The Workgroup considered adding end-of-life care to the list of key policy issues in order to account for topics such as aggressiveness of care and the use of technology; however, they concluded that questions related to this important and vulnerable population were

broadly captured within the category of quality of care. Answering research questions concerning this issue generally would require data on services provided at a sufficient level of granularity to allow researchers to adjust for patients' conditions or to explain variations in services (e.g., angioplasty versus bypass).

Care Delivered Throughout the Hospital. Changes in where care is provided in a hospital (e.g., emergency department, outpatient clinics, outpatient surgery, observation status, extended stay, inpatient) raise many questions about potential differences in the range and intensity of services provided. Areas of interest cited by our stakeholder groups include potential differences in patterns of drug utilization and the administration of diagnostic tests. Answering questions concerning this issue will require having access to detailed patient records and data, irrespective of the hospital venue in which care was received.

Continuity of Care and Transitions. Nearly every stakeholder with whom we spoke placed particular emphasis on understanding how and how well patients are cared for as they move between sites and levels of care. Transitions from the hospital setting to lower levels of care represent one of the best opportunities to improve safety and quality of health care (Coleman, Mahoney, and Parry, 2005). In particular, the Workgroup recognized that an understanding of continuity of care will require data from both within and outside the hospital; therefore, many questions related to this issue will require either directly approaching patients or linking to datasets.

Disparities and Access. Health services researchers and policymakers alike repeatedly cited the importance of understanding potential barriers to care that restrict patients from seeking or receiving optimal care. Among these potential barriers are race and ethnicity, gender, socioeconomic status, residency locations, language, and insurance type. Some of the elements required to address questions related to these barriers currently reside in national surveys and serve as the basis for AHRQ's National Healthcare Quality and Disparities reports (AHRQ, 2005a, b). However, as improved and more-frequent quality and safety reporting occurs, new questions arise, requiring increased specificity (e.g., English proficiency, occupation, address for geocoding).

Other Policy Issues

Standards Against Which Performance Can Be Measured (Benchmarking). Data from U.S. hospitals could be used to establish benchmarks for performance in key areas. For example, comparisons might focus on utilization of health services, care and treatment options, and best attainable outcomes of care. Particularly with the growth of value-based purchasing or pay-for-performance[3] initiatives, a nationally representative hospital sample would be invaluable for determining both general performance benchmarks and levels consistent with exceptional performance. Benchmarking research would generally be conducted in relation to

[3] Pay-for-performance or value-based purchasing uses financial incentives to motivate providers to change their behavior to deliver high-quality and/or cost-efficient care. Providers receive differential payments based on their performance on a set of specified measures that can include clinical quality, efficiency, patient experience, and information technology use or capabilities.

other policy issues (e.g., cost, quality, continuity) and would be most relevant for focused studies.

Use and Value of Technology and Innovation. New and emerging technology represents one of the key drivers of improved care and is also a significant contributor to increasing health care costs. Research questions of interest focus on understanding the appropriate roles and value of technology. For example, policymakers may wish to understand the impact of robotic surgery in terms of both its cost and improved safety and efficacy compared to conventional surgical interventions. Data are needed to identify specific technologies (e.g., Healthcare Common Procedure Coding System [HCPCS] codes) and their respective costs, which can then be related to outcome measures (e.g., length of stay, complications, and mortality).

Role and Value of Electronic Health Records. The federal government is making major investments in building the health information technology (HIT) infrastructure in an effort to achieve efficiency and promote patient safety and quality. America's hospitals are a primary focus for implementation of robust health information technologies. The NHDS, as a nationally representative survey, offers the ability to provide insight regarding the extent of national penetration of electronic health records through the redesigned facility questionnaire.

Leveraging the diffusion of HIT offers the opportunity to increase the value of the NHDS, given that manual data collection is the most significant financial and logistical barrier NCHS has to increasing the breadth and depth of information contained in its surveys. Developing computer-assisted record abstraction, monitoring the trends in how data are submitted to the NHDS over time, and working with participating hospitals to test electronic transmission will permit the NHDS to adapt to the changing health information technology environment. RAND researchers and the Workgroup felt that NCHS should champion national efforts to electronically acquire and integrate detailed patient data (e.g., test results, medications) into a nationally representative sample.

Mix and Use of Labor. In efforts to improve efficiency, many health care organizations have adopted strategies that allow providers with a certain level of training and certification (e.g., nurse's aides) to safely provide some types of care that previously required individuals with higher levels of training and certification (e.g., registered nurses). Members of our stakeholder groups expressed interest in better understanding how the types and experiences of health care professionals who deliver services to patients in the United States affect the quality, outcomes, and costs of care. Some of the policy questions cited (e.g., the substitution of physician's assistants and advanced-practice nurses for physicians) might be sufficiently addressed with data about the types of providers rendering service. More-complex research questions (e.g., efficiency and waste in the health system) will require analysis of provider skills and experience (e.g., years in practice, subspecialization) and detailed time and motion studies.

Care Migration Away from the Inpatient Hospital Setting. Many stakeholders expressed the need to better understand how the ongoing and growing practice of providing care (previously confined to the inpatient setting) at alternative treatment sites (e.g., ambulatory surgery centers, physicians' offices) or at lower levels of care within a facility (e.g., hospital outpatient facilities) is affecting the

quality and outcomes of care. These changes are driven by, for example, improved technology and changes in payment policy. Similar to understanding continuity of care, understanding the migration of care will require data both from facilities at which care was initially provided and from those where patients previously received or subsequently receive care.

Public Health and Surveillance. Hospitals may be one of the first places in which new and emerging diseases are identified. Just as the National Health and Nutrition Examination Survey (NHANES) was the first survey to identify trends in obesity within the United States, examination of NHDS analyses illuminates, for example, public understanding of conditions increasingly treated in America's hospitals or the emergence of new patterns of drug resistance (e.g., methicillin-resistant *Staphylococcus aureus* [MRSA]). Many of the stakeholders with whom we spoke recognized the value that the NHDS will continue to contribute to recognizing and identifying important public health trends.

Focused Studies. Many of the stakeholders with whom we spoke were interested in conducting focused studies on specific diseases or operational areas that were of interest to many stakeholders. Indeed, NCHS currently receives numerous requests from government and nongovernment entities wishing to collect detailed information on specific conditions (e.g., lung cancer, rheumatoid arthritis), the use of specific services (e.g., implantable devices), or how resources (e.g., labor, supplies) are used in hospitals. As previously noted, the current study design lacks the flexibility to accommodate such requests. By incorporating strategies to conduct focused, time-limited studies, the NHDS will dramatically increase in value for clients in search of a well-designed, nationally representative sample of patients with specific conditions or recipients of selected services. For example, a study focusing on patients hospitalized for rheumatoid arthritis might require more-detailed information on functional status, medications, laboratory and radiology procedures, and physical therapy.

Impact of Globalization. RAND researchers and, to a lesser extent, national experts, mentioned the potential effect of care offered to expatriates in international markets (e.g., Thailand, Singapore, India) as an important area for research. Although medical tourism is growing slowly, at present relatively few Americans voluntarily seek care outside the United States. However, as costs of care in the United States continue to rise and the number of uninsured and underinsured grows, alternatives to mainstream U.S. medicine may become increasingly attractive. Research might explore the potential role of the global health care market in providing care to U.S. residents over time. Opportunities exist to benchmark U.S. health care performance with the global health care marketplace, provided that agreement can be reached regarding standardized data elements and their definitions.

Limitations of Existing Surveys

The discussion of key policy issues and research questions provides important guidance about the direction the redesigned study might take. But in order to determine how the NHDS might be redesigned to address some of these issues, it is also important to understand how well the current NHDS and other existing surveys can be used to answer the types of research questions described in Appendix F,

particularly at the level of detail required. Understanding the complexities of care in today's health care environment, particularly an understanding of the high-intensity services provided in America's hospitals, typically requires a high level of detail and specificity (i.e., granularity) about the care of the patient. For example, assessment of quality and appropriateness of care requires clinical data elements specific to a given patient's condition at a level of detail unavailable in publicly available datasets (Brook, McGlynn, and Shekelle, 2000).

Our review of existing surveys indicated that a significant opportunity exists for the NHDS to offer data at this more granular level, thereby providing better national assessments of hospital-based care. The majority of stakeholders with whom we discussed the redesign expressed enthusiasm regarding a redesigned NHDS that would begin to bridge the "granularity gap."

Some of the specific areas for which more detailed data would be helpful are discussed below.

Payment Information

Cost of care and resource use was the highest-priority policy issue according to Workgroup rankings and one of the most frequently mentioned needs by other informants. However, lack of data makes questions related to this issue difficult to answer at present. Our review of existing surveys indicated that, except for claims data, information is extremely limited regarding actual payment for services. Hospital charges are readily available, and approximation of cost can be determined using reported cost-to-charge ratios; however, little is known publicly about the actual case-level profit or loss experienced by America's hospitals. Information in the aggregate regarding reimbursement for services will provide much-needed insight to policymakers and researchers. Identifying gaps between actual costs and reimbursement by payer source (e.g., Medicaid, self-pay) could highlight situations in which patients are particularly vulnerable in terms of access and continuity of care.

Medication Information

We were repeatedly told by our stakeholder groups that having more-detailed medication-use data would be invaluable to policymakers and researchers. Such information can be used to address questions related to many policy issues, including cost and resource use, quality of care and patient safety, and care delivered throughout the hospital. However, detailed information about medication use preceding, during, and immediately following hospitalization is not available in publicly available databases. Some special-purpose data sources (e.g., Hospital Quality Initiative) do contain medication information relevant to the study population (e.g., beta blockers in congestive heart failure). And although Medicare Part D databases may soon provide some insight into outpatient prescription drug use, this new data source will not provide information about medication use among hospitalized patients.

Patient Status and Outcomes

Many of the policy issues of interest to stakeholder groups (e.g., quality and patient safety, disparities and access, use and value of technology, benchmarking) require

detailed information about patient status at admission and discharge, diagnostics, and outcomes from procedures performed. We found that existing surveys provide only limited data to answer the kinds of research questions of interest to our stakeholder groups. Existing gaps include the following:

- **Clinical information.** With the exception of some special-purpose surveys, most surveys have little or no clinical information (e.g., vital signs, laboratory and other diagnostic test results, functional status, medications). Researchers and policymakers must currently rely solely on administrative data to understand outcomes and must risk-adjust[4] findings. A recent study commissioned by AHRQ indicated that collection of present-on-admission codes and numerical laboratory values substantially improved the ability to risk-adjust hospital performance (Pine, Jordan, Elixhauser, et al., 2007).

- **External causes of injury.** The *International Classification of Disease, Ninth Revision: Clinical Modification* (ICD-9-CM), provides a mechanism for documenting external causes of injury or poisoning, such as a motor-vehicle accident, a fall, or an accidental drug overdose, through the use of E-codes. However, these codes, although acceptable on the UB-92,[5] are rarely captured by hospital coders because they do not influence reimbursement. Particularly in recent years, with the scarcity of medical coders and the increase in coder salaries, pressure on hospitals to reduce costs has resulted in recommendations to capture on the patient bill the minimum number of codes necessary to ensure appropriate reimbursement.

- **Linkage of maternal and child records.** Linking maternal and child records in hospital and reporting systems is surprisingly difficult. Such linkages would be extremely helpful in facilitating a better understanding of, for example, the outcomes of pregnancy, of high-risk pregnancies on neonates, and of multiple births and birth trauma on mother and neonates.

- **Diagnostic test data.** Except for some outpatient and claims-based datasets, it is difficult to determine which diagnostic tests were performed during the course of a hospital encounter. In some situations, a determination of quality processes can be made by knowing that a particular diagnostic test (e.g., laboratory or radiographic study) was performed. In other settings, knowing that the test was done is insufficient. To assess quality, or to risk-adjust for severity of illness,

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[4] Risk-adjustment – The statistical approach for adjusting for the clinical conditions, severity of illness, or risk of mortality to normatively report measures of interest across facilities. Adjustment minimizes patient-specific factors to provide greater assurance that differences observed reflect actual differences in care provided in the facility.

[5] UB-92 – The National Uniform Billing Committee (NUBC) was formed in 1975 by the American Hospital Association to develop a single billing form and standard dataset that could be used nationally by institutional providers and payers for handling health care claims. Since 1996, the public health sector and electronic-standards-development organizations were added to membership. There have been three uniform billing sets developed since its inception – the UB-82, UB-92, and UB-04, the list of which is being implemented in 2007.

information is needed on the actual findings from the diagnostic study. Most inpatient hospital data that are publicly available, particularly those from administrative sources, are not capable either of capturing that a diagnostic test was (or was not) performed or of providing the test results. However, efforts are under way to establish both HCPCS "G-codes" and CPT Category II codes to facilitate reporting of performance metrics, a number of which rely on diagnostic test data findings (e.g., HbA1c less than 7 percent).

Patient Socioeconomic Data

The rising costs of health care, increased employee responsibility for financing care among the employed, the issue of care for the homeless, and the huge gaps in care for those who are uninsured and underinsured—all raise questions about disparities in care, variability in access to needed services, and quality and outcomes of care. Access to patient socioeconomic data would provide insight into these issues by allowing patients' socioeconomic data to be related to the types and quality of care they receive or do not receive. The extent to which individual socioeconomic data are available, such as through geocoding using zip code or an actual address, will determine the granularity with which this information can be related to processes and outcomes of care.

Provider Characteristics

The American Hospital Association (AHA) annual survey is the primary source of information on general acute care, nonfederal hospital characteristics in the United States. The survey provides information on the numbers of beds and types of clinical services provided, discharge and visit volumes, gross income and revenue by payer type, and numbers of physician, nurse, and other staff. Both the NHDS and HCUP provide restricted linkages of patient-discharge abstract data to the AHA file. Limited information about the types of information technology used within hospitals' outpatient departments is collected by the National Hospital Ambulatory Medical Care Survey (NHAMCS) when inducting hospitals into the survey. The Health Information and Management Systems Society (HIMSS)-Dorenfest database provides data on over 4,000 U.S. hospitals but does not include free-standing hospitals with fewer than 100 beds or hospitals that are not part of health systems. There is no national survey or database that can, through the same survey, relate clinical characteristics of patients to facility and provider capabilities and characteristics.

Identifiers to Link Databases

Many of the key policy issues of interest to the Workgroup and other stakeholders require data on care received in different settings (e.g., in different parts of the hospital, in outpatient as well as inpatient settings). Exploration of research questions related to these issues requires linkages between databases. However, our review of existing databases found that key linkages were usually lacking. For reasons of privacy and confidentiality, publicly available data do not contain patient-, provider-, or facility-specific identifiers, although some surveys can provide restricted linkage to AHA files. These linking data elements would permit a more detailed

understanding of patients, providers, and facilities and would facilitate analyses of, for example, the disciplines (e.g., physicians, physician assistants, nurse practitioners) and specialties (e.g., family physicians, surgical specialists) responsible for patient care in America's hospitals. Additionally, having certain protected health information (e.g., Social Security number, name, birth date) would permit linkage to vital statistics and other databases. For example, such linkages would allow for analysis of long-term, post-hospital mortality by diagnosis or procedure, including cause of death. These elements are essential to determine outcomes of care beyond in-hospital mortality and complications.

All of the areas discussed in this section represent information gaps that a redesigned NHDS might address.

Redesign Options

Given the discussion of some key policy issues of interest to researchers and policymakers and the identification of information gaps that the survey might address, the following section discusses *how* the NHDS might be redesigned. Clearly, it would not be feasible for the NHDS to address all of the key policy issues or the information gaps. To assist in the process of determining an appropriate course of redesign, RAND worked with NCHS to develop 14 non-mutually exclusive options for the redesign (Appendix E). Some options focused on addressing the key issues by establishing coordination between the NHDS and other NCHS and governmental surveys. Other options focused on adding depth or breadth to the survey to provide better explanatory power for addressing cost, quality, safety, and related issues. Lastly, some options recommended increasing the breadth of the survey to include patient types not captured in the current NHDS, including short-stay observation patients.

Options Prioritized by the Workgroup

The options presented to the Workgroup on the second day are summarized in Table 3.3 (the specific document provided to the panel is contained in Appendix E). Prioritization ratings are shown in the right-most column (a lower number indicates a higher priority). Of the 14 options, eight options were considered most relevant for the survey redesign (options 5, 6, 7, 8, 11, 12, 13, 14).

The Workgroup reviewed detailed descriptions of all the options, but it focused much of the discussion on several options that were among those considered "most relevant" for the survey redesign. We summarize the options and highlights from the Workgroup discussion here.

Table 3.3
Descriptions of Redesign Options Rated from 1 (Highest) to 5 (Lowest)

Basic Description	Average Rating	Option No.
Coordinate DHHS Inpatient Data Collection, Particularly HCUP	1.8	3
Increase Hospital Resource Use Information	1.8	7
Increase Clinical Depth	1.9	5
Obtain Outcome Data	1.9	14
Increase Patient Demographic Information	2.1	6
Track Disease-Specific Care	2.8	13
Incorporate Inpatient and Short-Stay Admissions	2.9	11
Incorporate Patient Care Encounters Throughout the Hospital	2.9	12
Obtain Data on Pre- and Post-Hospital Care	3.2	8
Continue NHDS as It Currently Exists	3.4	1
Track by Episode of Care	3.5	9
Use NHDS to Supplement MEPS and Vice Versa	3.6	4
Conduct Longitudinal Tracking of a Patient Cohort	3.6	10
Eliminate NHDS as It Currently Exists	4.8	2

Coordinate DHHS Inpatient Data Collection (Option 3). The Workgroup strongly agreed that maintaining national data on hospital utilization was very important. However, they also expressed a strong sentiment that alignment of inpatient data-collection efforts between HCUP and the NHDS could allow for an important stewardship of limited resources. Such an alignment could mean that the NHDS supplements HCUP in the states where there is no State Inpatient Database (SID). Appendix E discusses potential approaches to this option; however, further consideration is beyond the scope of this project.

Increase Resource Use Information (Option 7). Inpatient care continues to represent the largest share of the U.S. health care dollar. Understanding the costs and general resource use associated with delivering care in the inpatient setting provides information to assist in allocating resources more efficiently and effectively. Within the hospital sector, there is no publicly available way to reliably understand differences in billed charges, actual cost of delivering care, and reimbursement for care provided. This option would continue to collect billed charges and add data on expected and actual reimbursement. It could also incorporate information on resources used in the care of the patient throughout hospitalization, including detail on the numbers of days the patient spent at various levels of care (e.g., intensive care unit [ICU], observation prior to hospitalization, or general medical/surgical), the drugs and supplies used, and the types of technology used to care for a patient (e.g., monitored bed, ventilators, endoscopy services). Depending on the facility, cost and reimbursement information may be sensitive and perhaps contractually precluded from public disclosure. The Workgroup acknowledged that addressing this information would be invaluable to researchers, health care organizations, and policymakers.

The cost associated with this option would depend on the depth to which data are collected. Extending data collection beyond charges requires going to sources other than the UB-92 or UB-04. Such data are not available in the medical record; they require an additional, separate abstraction from administrative financial systems or primary data collection. Most hospitals now have relatively sophisticated billing and reimbursement systems, and many are implementing decision support tools as

part of those systems. However, cost-accounting systems are far less widely dispersed in hospitals. Once programming of the financial systems has occurred to provide the requested data, the effort to collect reimbursement data should be as easy as or easier than that required to collect clinical data, at least at the present time, because clinical systems are only beginning to catch up with financial systems in comprehensiveness. Provided that data are available in electronic formats, NCHS must have strategies to accept these data to eliminate the cost and error associated with manual data entry. Unit-level cost information such as the use of labor on one medical floor would still require special studies.

Increase Clinical Depth (Option 5). This option adds clinical variables to facilitate a better understanding of hospital care. Clinical detail is essential for assessing the quality and appropriateness of health care, yet no existing publicly available survey collects in-depth information on clinical services provided to hospitalized patients. There are two levels of clinical-variable information, which involve increasing complexity of collection: (1) information to indicate that a particular service or procedure was provided, and (2) information on the actual clinical result (e.g., glucose level, Apgar score, blood pressure). For some clinical analyses, knowing that a service was provided is sufficient (e.g., rescue medication following a dangerous drug administration). For most situations, however, clinical value is intrinsic to the actual result, and simply knowing that a service was provided is inadequate.

Collecting clinical depth was among the redesign options ranked highest by the Workgroup because it represents a new level of explanatory power for statistical surveys. Adopting this redesign option has clear cost implications. Specifically, clinical variables are not part of the UB-92 data collection and, with the exception of noting whether a condition was present on admission, they are not part of the UB-04 redesign (effective March 2007). Therefore, at present, alternative abstraction strategies, either manual or semiautomated, would need to be part of the redesign. The actual cost for this redesign option would depend entirely on the number and complexity of variables collected, whether those variables are consistently stored in a common location, and whether systems exist to electronically extract the required elements.

Obtain Health-Related Outcomes (Option 14). This option would expand the information collected through the NHDS to link hospital-related care to specific health-related outcomes. Some hospital-based outcomes already exist in the data collected by the NHDS (e.g., in-hospital mortality, complications). The complexity of this option depends on the outcomes selected for consideration, but in all cases a meaningful assessment of outcomes of care would need to extend beyond the hospital providing care. Links would be needed to uniquely identify patients across all relevant care settings. Even within-hospital measures, such as 30-day readmission, require capturing at a minimum a patient identifier that can link across individual admissions. Depending on the outcome information desired, this option may require patient surveys.

Collection of outcomes of care was highly rated by the Workgroup. Beyond any outcomes collected that are associated with a specific condition (option 13), outcomes for the general-purpose survey would need to be of a general nature. However, provided that patient identifiers are collected, linkages to other databases would be both feasible and desirable. Costs associated with this option include the

increased burden of collecting patient- and potentially facility-specific information. Patient information would be considered protected health information under HIPAA. Although NCHS, as a public health entity, has the authority to collect these data under HIPAA, hospitals may still wish to add additional protections and IRB provisions, given their responsibility to protect the confidentiality and privacy of their patients' data. Similarly, NCHS will need to create datasets containing the information gained from the linkages that are de-identified for public use.

Increase Patient Demographic Information (Option 6). This option would permit a more accurate analysis of socioeconomic status and access to care. In addition to the demographic, administrative, and medical information currently collected, either patient interviews or patient written surveys would be required to collect data on the socioeconomic characteristics of each person sampled through the survey. Patient information could be collected at admission or during hospitalization (if appropriate), or through retrospective telephone or paper surveys. Solicited variables would refine current information and might include address, Census tract, race, ethnicity, income, wealth, education, occupation, neighborhood socioeconomic characteristics, or past socioeconomic experiences (Braveman et al., 2005). Matching race and ethnicity to Census definitions alone would add significant depth to the NHDS. Income and education would permit analytic comparisons with NHANES.

The cost associated with this option would depend on the extent to which the additional data elements collected already exist in the hospital record or would need to be collected through patient interviews or surveys. However, the Workgroup prioritized this redesign option highly. Data elements that are sensitive to this redesign option are most likely to be feasible if they already exist in the patient's hospital or administrative records, rather than requiring new primary data collection.

Track Disease-Specific Care (Option 13). The NHDS is limited in scope because its data-collection efforts have been restricted to elements contained on the UB-92 and previous Uniform Billing documents. The survey, therefore, has been unable to respond to requests from potential clients wishing to collect more-detailed information for specific conditions or situations. NCHS could use the trust that has been built with survey hospitals to collect in-depth clinical (e.g., cancer care, cardiac surgery, diabetes) or operational (e.g., workload, waste) information. The specific issues could be identified either by NCHS or in response to queries or requests from governmental or nongovernmental clients.

The cost associated with adopting this option would be proportional to the number of variables collected and the difficulty of identifying and abstracting them. As NCHS or clients request expanded data-collection efforts for focused conditions, particular attention should be given to focusing the clinical question to minimize the burden of data collection on participating hospitals. The Workgroup recognized the value of focused studies because there are only a few in the field today (e.g., the 21 clinical measures for heart attack, heart failure, pneumonia, and surgical care improvement/surgical infection prevention reported to the Center for Medicare and Medicaid Services (CMS) through the work of the Hospital Quality Alliance). The Workgroup rated this option in the middle. However, RAND supports pursuing this option, recognizing the flexibility it offers NCHS.

Incorporate Inpatient and Short-Stay (e.g., Observation) Admissions (Option 11). This option seeks to include some of the spectrum of services that were previously considered to be inpatient admissions. Treatment for many conditions that were traditionally provided as inpatient care is now provided as outpatient care in hospital settings. These patients may occupy the same beds as hospital inpatients or may be assigned to a separate "short-stay," "24-hour," or "observation" service. Although this classification is primarily driven by payer requirements, the difference shifts the patient's hospital status from inpatient to outpatient, altering the probability that some or all patients with selected conditions (e.g., angina, possible stroke, abdominal pain) would be selected for inclusion in a nationally representative sample using the current NHDS.

Obtaining information on these patients should be relatively straightforward, because the encounters will be part of the hospital's billing system. The data elements required would be those used for hospital-based non-inpatient care. The only major difference is that outpatient procedures are generally recorded in the United States using the American Medical Association's CPT® Procedural Coding system, rather than ICD-9-CM, which hospitals use to capture inpatient procedures. Although the panel rated this option only of medium priority, RAND believes that it is very important to incorporate these stays into a revised NHDS, both because these hospital encounters are not captured elsewhere and because they represent care that is provided in America's hospitals using resources, for the duration of the stay, that are similar to those consumed by inpatients.

Some types of services that have migrated from the hospital setting are now provided in physicians' offices and other ambulatory settings. Information on care provided in these settings can be found in other surveys conducted by NCHS, specifically the National Survey of Ambulatory Surgery and the Hospital Ambulatory Medical Care Survey.

Incorporate Patient Encounters Throughout the Hospital (Option 12). This option seeks to capture the entire spectrum of services that are provided in U.S. hospitals. Although option 11 was confined to incorporating only "hospitalized outpatients," this option captures any patient encounter that occurs within the hospital (e.g., ambulatory surgery, emergency care, hospital outpatient services, rehabilitation, observation, acute inpatient, and hospital-based skilled nursing facilities).

Identifying all hospital encounters would be marginally more complex than identifying only acute inpatient and short-stay visits. However, unlike short-stay visits, which use essentially the same types of resources as acute-inpatient stays, other ambulatory encounters may be less well documented, and ancillary information may be stored in different locations. Although this option received the same rating as short-stay admissions (option 11), the Workgroup did not believe this option was as high a priority, given that other surveys exist to capture ambulatory care.

Obtain Data on Pre- and Post-Hospital Care (Option 8). This option seeks to collect information on the care provided to hospitalized patients in the peri-hospital period (e.g., for the 72 hours immediately before and after admission). Patients are identified as a result of their hospital admission, but data collection extends to include care temporally associated with the admission. This option might include, for example, ambulatory, emergency, institutional, and home care. Services provided

by the participating hospital (e.g., treatment modalities that allow for earlier transitions out of the hospital, discharge instructions, plans for follow-on care) should be available from hospital records, something that the Workgroup felt should be considered. However, encounters at other facilities would necessitate either access to claims data or patient interviews. As discussed in more detail below, the Workgroup recognized the difficulty in extending data collection beyond the hospital stay.

Other Options

Several redesign options were included in the list for the sake of completeness and were eliminated from further consideration by the Workgroup. Others garnered more interest, but they were not considered feasible and were therefore also eliminated. We briefly summarize these options here and will not subsequently discuss them further.

Continue the NHDS (*option 1)* and *Eliminate the NHDS (option 2) as it currently exists* were included in the list for the sake of completeness. Neither was given much consideration by RAND or the Workgroup. To the extent that these options were discussed, the Workgroup said that it was important to continue to produce a nationally representative survey.

The group thought that *Using the NHDS to supplement MEPS* (option 4) would be an interesting way to obtain longitudinal data, but they concluded that this option was not practical because of the inability to predict where MEPS participants would be hospitalized. Furthermore, the small sample of potential annual hospitalizations (approximately 3,000) would allow for sufficient estimates only on the most prevalent conditions.

Episode of care (option 9) and *Longitudinal tracking (option 10)* would require capturing care received in non-inpatient venues. The Workgroup, like other experts with whom we spoke, found these options desirable but rated them low because such a data collection was neither financially viable nor within the scope of the NHDS. They also conveyed concerns that, although these options would be within the purview of the NCHS as a public health agency (45 CFR [Code of Federal Regulations] §164.501), facilities would still have responsibility for protecting their patients' data and might therefore be reluctant to voluntarily provide protected health information (PHI) that is not expressly used for treatment, payment, or health care operations.

Nevertheless, Workgroup members felt that it would be valuable to obtain as many linkages as possible to allow the survey to leverage other data sources (e.g., CMS or the National Death Index). In addition, there are some things that can be collected from the patient's hospitalization addressing the episode of care. These would include medications at admission and discharge (including route), and hospital encounters 30 days pre- and post-discharge. In the future, electronic health records and the growth of Regional Health Information Organizations (RHIOs) and the National Health Information Network (NHIN), if developed with these goals in mind, offer the potential to increase the viability of these options.

Implications of the Discussion of Redesign Options

The intent of the discussion of redesign options was not to select one "best" option but to understand the range of options that might be used in redesigning the NHDS so that it will remain a critical research tool for decades to come. All eight options prioritized as "most important" to consider for the redesign provided opportunities to answer important questions at a level of granularity never before available at a national level.

The prioritized options also pointed to some important objectives for a redesigned survey. A successfully redesigned survey will allow a user of the data to understand the use of resources within hospital settings; gather clinical depth to facilitate accounting for differences in outcomes and resource use; collect information about outcomes of care; and define patient demographic characteristics to provide insights into issues such as disparities in access and outcomes.

Drawing upon the eight options, RAND and NCHS sought to identify survey variables that maximize the ability of the NHDS to broadly address priority research questions and issues. As shown in the next chapter, the variables selected for the feasibility study attempt to respond to this broad goal. We did not pursue any one option in extensive depth, since doing so would occur at the expense of data relevant to other priority options and might compromise the general-purpose nature of the survey.

4. Findings: Selection of Variables to Be Tested in the Feasibility Study

The next step in redesigning the National Hospital Discharge Survey was a feasibility study of the revised forms and process. Variables to be included in the feasibility study were selected according to their ability to help address the high-priority policy issues identified by all stakeholders, including members of the Workgroup. In this chapter, we discuss those variables and address the rationale for their selection.

Identification of Variables That Address Key Policy Issues and Research Questions

The objective in selecting variables for testing was to identify those data elements that could help address key research questions in the high-priority policy issues discussed in Chapter 3 and that would be feasible to include in the survey. The feasibility issue was informed by general cost considerations, as well as by Workgroup priorities for the redesign options (see Table 3.3). To understand what types of variables might be included, we mapped key research questions to potential categories of variables that either directly address the questions or are important covariates for understanding observed differences when studying those questions. We then selected specific variables within the variable categories, listed in Table 4.1.

Table 4.1
Variable Categories

- Facility characteristics
- Socioeconomic status
- Payer
- Admitting diagnosis
- Procedures
- Length of stay
- Functional status at discharge
- Discharge status
- In-hospital mortality
- Hospital care 30 days pre- and post-admission
- Payment amount
- Nonphysician professional services
- Diagnostic tests performed
- Longitudinal patient care
- Patient demographics and characteristics
- Geographic specificity
- Physician identifier
- Discharge diagnoses
- Clinical status at admission
- Functional status at admission
- Admission source
- Do-not-resuscitate (DNR) order
- Mortality following discharge
- Medications
- Charges
- Cost
- Major equipment used in care

Table 4.2 provides two illustrations of the mapping process used to derive specific variables from the high-priority policy issues and research questions. In both cases, we indicate whether the variable or variable category was considered feasible to collect and therefore was included on the survey form used in the feasibility test.

Table 4.2
Illustrations of Variable-Selection Process

Policy Issue	Research Question	Variable Categories	Variable(s)	Feasible?
Cost *Cost and Resource Use*	To what extent do some patients and insurance companies subsidize the care of others?	Payer Charges Payment amount	Expected source of payment Payer type Charges Actual payment	Yes Yes Yes Yes
Quality *Continuity of Care*	How do patients access the health care system over time?	Longitudinal patient care	Trended patient-specific data across multiple care settings	No

In the first example, the four variables shown can provide data that will partially answer the research question. These data have already been collected and are therefore feasible to include in the redesigned survey. However, the second example would require data that would be extremely difficult to collect because the information is not readily available in participating hospitals. Therefore, variables in this category would not be feasible for the redesigned NHDS at this time.

For a detailed mapping of other research questions to specific variables and variable categories, please see Appendix F.

Variables Selected for Inclusion in the Feasibility Study: Patient Abstract Form

In this section and in Tables 4.3, 4.4, and 4.5, we present the variables selected for inclusion in the feasibility study of the general Patient Abstract Form. Selected variables fall into three groups: (1) variables included in the existing NHDS, (2) variables that can likely be included in a redesigned NHDS, and (3) variables that may be difficult to abstract but that should be tested for feasibility. A fourth group includes variables that are potentially very informative to the high-priority issues but that are beyond the scope of this survey at the present time. Particularly Table 4.4, but also Table 4.5, recommends the collection of protected health information, variables that are not technically difficult to collect but that will require special handling by NCHS and the participating facility.

Group 1. Variables Included in the Existing Survey. Given the expressed desire by NCHS to retain the ability to trend and track hospital data that have been collected and analyzed over the past 40 years, RAND recommended that the variables included in the current NHDS be maintained as part of the redesign. The Workgroup reaffirmed this recommendation. All variables that are part of the present survey are incorporated into the recommended redesign (Table 4.3). Each variable is shown in relation to the corresponding variable category (see Table 4.1).

Group 2. Variables That Can Likely Be Incorporated into a Redesigned Survey. The variables shown in this section are those that can likely be abstracted either manually or electronically, assuming that hospitals participating in the redesigned NHDS will be incorporating primary data collection as part of the protocol. The variables within this category are shown in Table 4.4. RAND recommended including these variables in the feasibility study to validate the ease with which they can be collected and determine optimal strategies for collecting them.

Group 3. Desirable Variables That May Be Difficult but Possible to Collect. The variables in this section represent those that map to high-priority research issues and that would be extremely worthwhile to collect. However, given the limitations of today's health information technology, we believe that it may be difficult to either identify these items or reliably abstract them from the current medical record. The variables within this category are shown in Table 4.5. Although we felt that it would likely be difficult to abstract these variables, we believed that it would be worthwhile to include these variables in the feasibility study to confirm the difficulty and reliability limitations. If the variables could be abstracted reliably without considerable effort, they should be considered for inclusion in the pilot survey. If collection were not feasible, we would recommend that NCHS monitor the state of health information technology and incorporate the variables into future revisions to the survey when practical.

Table 4.3
Variables Included in Current NHDS, by Variable Category

Variable Category	Included Variables
Facility characteristics	Hospital identifier to link with AHA
Patient demographics and characteristics	Birth date (or age if no birth date) Sex Marital status Race and ethnicity
Socioeconomic status	Zip code
Geographic specificity	Zip code
Payer	Expected source of payment
Discharge diagnoses	ICD-9-CM diagnosis codes (principal/other)
Procedures	ICD-9-CM procedure codes (principal/other)
Clinical status at admission	Admission type (elective, emergent, newborn)
Length of stay	Dates of admission and discharge
Admission source	Patient location preceding admission
Discharge status	Discharge disposition and location (partial)
In-hospital mortality	Discharge disposition = expired

Table 4.4
Variables Likely to Be Included in a Redesigned NHDS, by Variable Category

Variable Category	Included Variables
Facility characteristics	AHA hospital identifier
Patient demographics and characteristics	Patient name Patient medical-record number Encounter, billing, or visit number Medicare health insurance claim (HIC) number
Socioeconomic status	Patient address
Geographic specificity	Patient address
Payer	Payer type (e.g., indemnity, HMO, PPO)
Physician identifier	National provider identifier (required under HIPAA, May 2007)
Admitting diagnosis	ICD-9-CM Diagnosis code, DRG
Clinical condition at admission	Diagnoses present on admission Height and weight Drug allergies Location and dates of initial care (e.g., acute, ICU, observation) Vital signs Pain assessment ASA classification (surgical patients prior to surgery) Tobacco use
Discharge status	Discharge disposition and location (detailed) Observation/acute (for initial-observation patients) Palliative care Patient follow-up / instructions Vital signs before discharge
Do-not-resuscitate order	DNR order present, and date
Mortality following discharge	Social Security number
Hospital care 30 days pre- and post-admission	Previous or subsequent ED, OP, or IP care dates, diagnoses, procedures
Admission source	Mode of arrival
Medications	Medications on admission Medications administered in hospital Medications prescribed at discharge
Charges	Total charges Charges by revenue center
Payment amount	Actual reimbursement
Cost	Computed cost (based on cost-to-charge ratio) Level of care, by patient day
Diagnostic tests performed	Laboratory test results at admission
Major equipment used in care	Detailed bill for services for specified equipment

Table 4.5
Variables That May Be Difficult to Abstract but That Should Be Tested for Feasibility, by Variable Category

Variable Category	Included Variables
Patient characteristics	English proficiency Occupation Education Mother's medical-record number (newborns)
Clinical status at admission	Living situation on admission
Length of stay	Time of admission and discharge Time in observation, ED, and ICU locations
Functional status at admission	Activities of daily living
Functional status at discharge	Activities of daily living
Payment amount	Expected reimbursement

Variables Beyond the Scope of the Redesigned NHDS. Although they could address many research questions raised by experts and the Workgroup, the variables in this section were felt to be beyond the scope of the current redesign. They fall into variable categories that are extremely difficult to collect, either because they require patient surveys or data not readily available to the hospital (e.g., longitudinal patient care) or because current systems do not reliably collect the information (e.g., actual cost). Variables in this group generally map to redesign options that received lower Workgroup priority, in part because of the data-collection burden they would require of participating facilities. Some variables within this category are shown in Table 4.6.

We recommend that NCHS monitor the state of health information technology, because this group of variables includes some that represent an opportunity for NCHS and the NHDS in the future as data infrastructures improve. Other variables may be appropriate for focused studies and special modules (e.g., nonphysician professional services) if they can be developed in a manner consistent with NHDS data-collection protocols. These variables, therefore, were not part of the recommended general Patient Abstract Form.

Table 4.6
Variables Beyond the Scope of the Current NHDS and Not Recommended for Inclusion in Feasibility Study

Variable Category	Sample Variables
Longitudinal patient care	Encounters in other facilities
Cost	Actual cost (not currently available in most hospital data systems)
Nonphysician professional services	Nursing hours Other allied health hours Consultations (e.g., dietary, pharmacy)

Focused Studies. One of the redesign options that received particular attention was conducting focused, time-limited studies on specific conditions prioritized by either NCHS or potential governmental or nongovernmental clients (redesign option 13). Thus, we recommend that, in addition to the variables shown

in Tables 4.3, 4.4, and 4.5, brief focused modules also be included in the feasibility study to determine whether limited modular components could be "added on" to the general-purpose survey.

During the feasibility study, we would be able to determine both whether participating hospitals could identify the subset of patients on whom the focused modules would apply and could assess the added burden of data collection associated with these patient records. We included modules on acute myocardial infarction, psychiatric inpatient care, and asthma, based on the recommendations of the National Heart, Lung, and Blood Institute (NHLBI), SAMHSA, and AHRQ, respectively. Condition-specific variables included diagnostic tests (e.g., radiology), medications, treatments, and admission and discharge criteria specific to the condition being studied.

Implications of Variable-Selection Process. The result of this effort led to the development of a patient abstract form to be submitted to the feasibility study. This form consists of 70 questions (54 included in the general module) and over 500 actual data fields to be field-tested for feasibility (Appendix G), compared with the 19 questions and just over 100 data fields in the current NHDS. Sample variables for the redesign were reviewed for feasibility of collection within the constraints of a national survey, using an abstracted medical record for primary data collection.

Variables Selected for Inclusion in the Feasibility Study: Facility Questionnaire

In this section we present the questions and variables selected for inclusion in the feasibility study of the Facility Questionnaire. Today NCHS receives descriptive data about the hospital by two means:

- From a file purchased from Verispan containing periodically updated basic hospital descriptive demographic, volume, and affiliation data. These data are used by the NHDS to triannually update the hospital sample and are validated by NCHS field personnel during the induction visit.

- At the hospital induction visit. Although the primary focus of the visit is to understand how and where information is recorded in hospital systems to plan for and facilitate the abstraction process, the visit also inquires about computerization of medical records.

Because the American Hospital Association hospital database is a rich source of hospital-characteristic data and is usually updated annually by nearly all acute care, nonfederal hospitals, the Facility Questionnaire was designed to leverage and enhance the information hospitals already report to the AHA. Variables were added to allow NCHS to track and trend issues raised in the conceptual framework, including the types of providers caring for patients in hospitals and trends in HIT adoption. HIT questions from the facility questionnaire were matched to those from the redesigned National Hospital Ambulatory Medical Care Survey to link information from these two datasets and more broadly assess HIT competencies in today's hospitals. RAND recommends an approach that will require facilities to complete a periodic survey to enable the analysis of patient clinical characteristics in relation to provider capabilities and characteristics. Tables 4.7, 4.8, and 4.9 present the variables included in the revised Facility Questionnaire. These elements are

divided into three groups: (1) variables that are part of the existing NHDS sampling and induction process; (2) new variables that hospitals can likely report on an annual facility form; (3) new variables that may be difficult for hospitals to provide but are recommended for testing.

Group 1: Variables Included in the Verispan File. These data will permit NCHS to continue tracking and trending the hospitals in the NHDS sample. These data are critical for developing and updating the hospital sample and can be obtained commercially (Verispan or the AHA). RAND recommends these variables be maintained in the redesign (Table 4.7) and updated regularly so that the data can be used in conjunction with the enhanced patient variables.

Table 4.7
Variables Included in Verispan File

Category	Variable	On AHA Survey
Hospital Demographic and Key Contact Information	AHA number	Yes
	Hospital name, address, phone, and fax	Yes
	Key contact information for hospital	Yes
Hospital Utilization Statistics	Number of staffed beds by hospital unit (more limited than AHA)	Yes
	Total licensed beds	No
	Average length of stay	Yes
	Inpatient days (derivable)	Yes
	Live births	Yes
	Total discharges	No
	Total acute inpatient admissions	Yes
	Total surgeries – and by inpatient and outpatient	Yes
	Total outpatient visits	Yes
	Total emergency department visits	Yes
Hospital Ownership and Affiliations	Hospital ownership	Yes
	Medical school affiliation	Yes
	COTH hospital	Yes
Hospital Description	Hospital type (e.g., general acute care, pediatric)	Yes
Accreditation and Certification	CMS/Medicare certified	Yes
	Joint Commission accredited	Yes
Emergency Department	Level of trauma care	Yes
Training	Residency training (question asks yes/no)	Yes

Group 2: New Data Elements That Hospitals Can Likely Report on a Facility Questionnaire. These variables increase the depth of hospital structural information beyond what exists today to better facilitate an understanding of how hospital characteristics influence delivery of patient care.

The AHA database contains additional information that NCHS could obtain electronically. Table 4.8 notes the AHA variables likely to be of interest to NCHS, but this does not preclude obtaining all AHA facility data for those hospitals in the NCHS sample. Some elements recommended for inclusion, such as facility staffing and outpatient bed capacity, were included for addressing questions of quality and resource use. Some elements (e.g., the types of HIT in hospitals) were included to allow NCHS to provide a measure of diffusion of HIT, information currently unavailable in a nationally representative way.

Table 4.8
Variables Likely to Be Included in a Redesigned Process

Category	Variables	On AHA Survey
Hospital Utilization Statistics	Days open in reporting period	Yes
	Median length of stay	No
Hospital Ownership and Affiliation	Hospital subsidiary of larger organization	Yes
	Hospital affiliation with organized physician practices	Yes
Hospital Bed Capacity	Number of licensed beds by bed type	No
	Number of staffed beds by bed type	Yes
	Number of nonteaching beds by bed type	No
	Level of care provided by neonatal intensive care unit	No
Clinical Capabilities and Services	Type of services provided by the hospital	Yes
Financial Information	Percentage of patients with insurance type	No
	Percentage of revenue by insurance type	No
	Payer type for Medicare, Medicaid, and commercial (e.g., fee-for-service, HMO, PPO)	No
	Did hospital receive Medicaid disproportionate-share funding in prior year?	No
	Capital investment – If it occurred, for what purpose?	No
Emergency Department	Number of beds/bays total and adult/ pediatric/ psychiatric	No
	Average number of patients per month by bed/bay type	No
	Trauma level	No
Hospital Observation/Outpatient Accommodations	Number of dedicated observation beds	No
	Annual Medicare patients in observation beds	No
	Annual total patients in observation beds	No
	Number of other outpatient beds	No
	Average patients per month in other outpatient beds	No
Facility Staffing	Total medical staff	Yes
	Number of privileged licensed independent practitioners by medical specialty	No
	Hospitalist staffing by hospital unit	No
	Number other hospital staff by hospital unit (AHA has total staff by other trainees, registered Nurses [RN], licensed practical nurses [LPN], all other personnel, nursing home type personnel)	No
	Number certified nurse anesthetists (CNA)	No
	Number of open nursing positions being recruited by advanced-practice nurse (APN), RN, LPN,	No
	Percentage of staff unionized (nurse, other, resident)	No
	Average number of students in training per month by discipline	No
	Residency training by hospital service	No
	Average monthly number residents in hospital by hospital service	No

Table 4.8, Cont.

Category	Variables	On AHA Survey
Health Information Technology	HIT capability by IP, ICU, ED, observation, OP including patient demographics, computerized provider order entry (CPOE), laboratory, imaging, clinical notes	No
	Public health reporting in clinical areas and clinical laboratory	No
	Types of international standards used in HIT systems	No
	Level of linkage of electronic medical record across patient care settings	No
Translation Services	Availability, number of languages, hours per day	No
Ethics Consultation Services	Presence and volume in past year	No

Group 3: Variables That May Be Difficult for Hospitals to Provide. These variables (Table 4.9) would permit analysis of outcomes of care, considering more detail about the types of services available. We recognized that hospitals might not collect utilization statistics at the detailed bed-type level or by clinical service; however, we believed it would be worthwhile to confirm both the availability and variability of these data within the facilities participating in the feasibility study.

Table 4.9
Variables That May Be Difficult for Hospitals to Provide

Category	Variables	On AHA Survey
Hospital Bed Capacity	Number of discharges per month by bed type	No
	Average length of stay by bed type	No
Clinical Capabilities and Services	Annual volume of service by service type	No

5. Discussion and Summary: Research Questions That Might Be Addressed Through a Redesigned Survey

It would be impossible to identify all the important research questions that could be addressed through a redesigned NHDS. However, in anticipation of the completion of the feasibility study, we identified some examples of important questions in the high-priority policy issues that a redesigned NHDS could answer using the selected variables.

Many of the questions described below include a component of cost of care. The redesign tested in the feasibility study collected only hospital charges, not actual costs (e.g., what the hospital pays for personnel, supplies, etc., to deliver the service). Discussions with stakeholders confirmed our impression that hospital-cost data are not consistently and reliably collected. Hospitals are required to submit cost reports to Medicare. They prepare global and sometimes cost-center-specific cost reports, which allow costs of care to be approximated through cost-to-charge ratios. As cost-accounting systems improve, the NHDS may be able to incorporate actual costs in future years. Therefore, when "costs" are discussed in the examples, they refer to approximations of costs by applying appropriate cost-to-charge ratios to hospital charges.

Examples of Questions That Could Be Answered with a Redesigned Survey

Cost Shifting (Related Policy Issue: Cost of Care)

Illustrative question: To what extent do some patients and insurance companies subsidize the care of others? Hospitals and health policy experts have long recognized that some patients and their insurance carriers have been subsidizing care provided to the uninsured and underinsured. Existing surveys capture information about charges, payers, and patient diagnoses and procedures. Reimbursement information has not been available from a national patient sample. Therefore, the redesigned survey was designed to collect charges for hospital services that can be used to approximate costs using cost-to-charge ratios, as well as actual and expected reimbursement. For each patient and payer type, therefore, an approximation of profit (or loss) could be determined and would provide explicit information on the extent to which cost shifting occurs in America's hospitals and how those shifts are changing over time.

Use of High-Acuity Services on Patient Outcomes (Related Policy Issue: Quality of Care)

Illustrative question: Does an extended hospital stay or longer stay at a critical-care level improve long-term outcomes? Pressures exist to quickly triage patients from critical (intensive)-care services to general acute care, both because of

the need for hospitals to improve efficiency and patient throughput, and because of overcrowding in many facilities. Questions exist regarding whether these efforts increase efficiency at the expense of quality and outcomes of care. National publicly available surveys currently collect information about overall lengths of stay, discharge disposition, and procedures performed (which are coded using ICD-9-CM). The proposed redesign was intended to specifically capture information about the duration of emergency department, observation, critical care, and general acute care services throughout the patient stay. Information would also be collected regarding use of medications and ancillary services. Tracking readmissions, stability at discharge (laboratory values, vital signs, and functional status), and mortality (beyond hospital mortality) provide basic information on outcomes of care. These are elements in the new survey not available in any nationally representative database.

Aggressiveness of Care at the End of Life (Related Policy Issue: Quality of Care)

Illustrative question: What is the relationship between "do not resuscitate" orders, their timing, and outcomes of care? Early DNR orders tend not to affect inpatient mortality rates, but have effects on aggressiveness of care while in the hospital. Late DNR orders are usually indicators that a patient has become too sick to benefit from further aggressive hospital care. We have included the presence of DNR orders and their timing. This information may help explain issues related to both utilization and quality of care at the end of life. By linking with the Facility Questionnaire, it will be possible to examine differences in facility characteristics that might impact the aggressiveness of end-of-life care (e.g., academic and community hospitals, urban and rural facilities).

Patient Safety (Related Policy Issue: Quality of Care)

Illustrative question: To what extent do patients with a given condition receive appropriate interventions? Identification of trends in the safety of care delivered to patients depends on having adequate detail by which to judge quality and appropriateness of care. For example, it is important to stratify patients with post-operative hemorrhage by the type of surgery they have received in order to accurately evaluate appropriateness of care (AHRQ, 2006). Increased specificity, such as that proposed for the redesigned NHDS, would provide additional clinical detail, offering the ability to improve both accuracy and precision when studying patient safety using public databases.

Care Migration (Related Policy Issue: Care Migration Away from Inpatient Settings)

Illustrative question: To what extent are uncomplicated short-stay procedures migrating from the inpatient setting to the outpatient setting? Hospitals are witnessing a migration of some types of care, particularly for certain payer types (e.g., Medicare), from the inpatient setting to the outpatient setting, even though the services these patients receive are still provided in the hospital (e.g., observation status). With the exception of the MEDPAR and proprietary databases, current hospital surveys and databases show that the number of patients receiving certain

services is decreasing, possibly with increased average hospital lengths of stay and case-mix severity. However, this shift represents an artifact of payment policies in that these patients are still being treated in hospitals, although they are identified, for billing purposes, as outpatients rather than inpatients. The proposed redesign is intended to capture, for the first time, patients receiving care as observation patients, in effect reconstituting a sizable portion of the patients who originally were inpatients and therefore were included in earlier NHDS years. As previously acknowledged, care delivered in other ambulatory settings, such as ambulatory surgery centers and physician offices, is not proposed for inclusion, as they are part of other NCHS survey instruments.

The proposed survey data elements would permit analysis of differences in costs and reimbursement for care provided in these two different statuses. Because the same clinical and outcome information (e.g., functional status, laboratory measures, vital signs, readmissions within 30 days, long-term mortality) would be collected for all patients, analyses would be able to address whether severity and quality differences exist for patients with similar presenting and treatment situations that are dependent on patient-admission status.

Patient Stability at Discharge (Related Policy Issue: Continuity of Care)

Illustrative question: Does staying in the hospital longer improve long-term outcomes and reduce readmission? Increased financial pressures, including decreased reimbursement and uncompensated care, combined with incentives to triage less-stable patients to lower levels of care (e.g., rehabilitation, skilled nursing, home care), raise questions regarding whether these efforts increase efficiency and patient throughput at the expense of quality and outcomes of care. National publicly available surveys currently collect information about overall lengths of stay, discharge disposition, and procedures performed (which are coded using ICD-9-CM). The redesigned survey would allow for greater specificity about the intensity of services provided to the hospitalized patient while collecting measures to assess stability at discharge (laboratory values, vital signs, functional status). The more-detailed discharge disposition information would provide additional levels of information regarding the acuity of the facility or services the patient will receive when leaving the hospital. Insight regarding 30-day readmission and extended mortality could also be informative in determining the effect of early and late discharge on ultimate patient outcome.

Access to Care (Related Policy Issue: Disparities and Access)

Illustrative question: Does hospital care for patients of lower socioeconomic status differ from that for the rest of the population? Current surveys use zip code, race, and ethnicity to categorize and define population subgroups. However, this information is generally sufficiently limited so that only a superficial understanding of variations in patients' care is possible. For example, not only are the currently used categories of race/ethnicity too broad to assess care and outcomes for patients from particularly vulnerable racial/ethnic subgroups, but other potentially useful information for understanding true variation, such as address, education, language proficiency, and occupation, is generally not included. These elements, which were added to the proposed survey, and the ability to utilize

GeoAccess and blockgroup analyses would enhance the nation's understanding about access, cost, and outcomes for vulnerable populations.

Specialty Types Providing Care (Related Policy Issues: Mix and Use of Labor and Use of Resources)

Illustrative question: Are there differences in costs or patient outcomes when similar services are provided by individuals with different training and experience? The issue of which specialties should or should not be privileged to perform certain procedures has been the source of considerable debate among hospitals and medical staffs. For example, peripheral angioplasty is often performed both by interventional radiologists and by vascular surgeons. Information from existing surveys is unable to directly answer this question, because individual practitioners are not identified in national samples. Through the redesign, the individuals actually performing procedures would be captured by their National Provider Identifier (NPI, effective in 2007, and by their Unique Physician Identification Number [UPIN] before that time).

The NHDS would be able to identify provider experience and training by linking to the NPI database, which identifies provider specialty and experience. Using cost and outcome data, the NHDS would be able to inform discussions regarding privileging of individuals from different disciplines wishing to perform common procedures.

Concluding Thoughts on the Conceptual Framework

This part of the report has provided the rationale behind the conceptual framework for the redesign of the NHDS and the specific variables to be further considered for inclusion in the redesigned survey. The process we undertook in developing the conceptual framework and selecting variables for the feasibility study reaffirmed the initial premise stated by NCHS: that the redesigned survey maintain its national scope and ability to examine trends while adapting to changing hospital practice.

The variables tested in the feasibility study would provide opportunities for NCHS to begin to address in greater depth critical questions raised by current and future stakeholders that are not currently addressed by any existing survey, including resource use and cost of care, the details of care delivered within hospitals, disparities and access, and outcomes.

In the following chapters of this report, we will discuss the results of the feasibility study and the statistical analyses. In the concluding chapter, we will return to the questions raised in the current chapter, to reassess the potential of the redesigned survey to address these and other key issues.

Part Two:

Feasibility Study

6. Methods Used to Conduct the Feasibility Study

We now turn to a discussion of the feasibility study. The feasibility study, conducted from October 2006 through January 2007 included the following eight steps:

1. Institutional Review Board Approval (NCHS – ERB and Hospital – IRB)
2. Hospital Selection
3. Hospital Recruitment
4. Hospital Induction
5. Training
6. Completion of the Facility Questionnaire
7. Patient Record Sampling and Abstraction
8. Assessment of Abstraction Process and Debriefing of Hospital Personnel.

RAND's original workplan, consistent with the NCHS Task Order, allocated the period from March 1, 2006, to October 15, 2006, to sequentially screen, recruit, and schedule hospitals, thereby maximizing the effectiveness of the recruitment process and the efficiency of training and abstraction. However, the NCHS's Ethics Review Board (ERB), which functions as its IRB, did not permit any contact with hospitals until after formal approval, which occurred as scheduled at the end of September. This timeline compression required many of the feasibility steps to occur in parallel.

The methods for each of these steps are discussed below.

Step 1: Institutional Review Board Approval

This study collected data about human subjects, requiring Institutional Review Board approval. RAND has an existing agreement with the Centers for Disease Control and Prevention (CDC) that permits RAND, when serving as a subcontractor to the CDC, to defer its IRB requirements to the CDC's ERB. RAND submitted a data-use agreement, frequently asked questions, Patient Abstract Form, Hospital Induction Form, facility introductory letter, and details about the feasibility-study plan to the NCHS ERB on August 18, 2006. Full approval was received by the NCHS ERB on September 29, 2006.

Protected health information was collected as part of the abstraction process, but it would not be removed from the hospitals because analysis and linking of data to other data sources was not part of the feasibility study. However, hospitals were asked to carry out the abstraction as if PHI would be removed and to proceed with their IRB processes and requirements under that assumption. To facilitate IRB decisions and processes, hospitals were provided with two NCHS-ERB letters that

approved the study and granted a waiver of informed consent from patients under 45 CFR 46.116(d). Hospitals were also provided with a reprint of a May 2, 2003, *Morbidity and Mortality Weekly Report (MMWR)* item, "HIPAA Privacy Rule and Public Health, Guidance from CDC and the U.S. Department of Health and Human Services." These documents can be found in the *Field Manual* (Hilborne, Meili, Berry, et al., 2007). The reprint explains the CDC's rights and responsibilities under the Privacy Rule regarding collection of PHI. During the introductory call to and visit with each of the hospitals, RAND staff raised the issue of both PHI and record privacy and confidentiality generally. Hospitals were asked to describe and take whatever steps were necessary to ensure the privacy and confidentiality of the data associated with this study, irrespective of the CDC's rights as a public health agency.

Step 2: Hospital Selection

As defined by the NCHS project task order, the feasibility study was to be conducted in nine hospitals (eight were recruited and seven ultimately were able to complete the abstraction process). For logistical simplicity, NCHS requested that the hospital facilities be geographically close to RAND's Santa Monica, California, office and NCHS's Hyattsville, Maryland, office.

RAND structured a set of criteria (Table 6.1) that were used to filter the American Hospital Association's American Hospital Directory database to provide a targeted list of hospitals within the potential sampling frame.

Table 6.1
Criteria Used for Selecting Hospitals for Inclusion in the Feasibility Study

Hospital Characteristics	
Outpatient surgery	Required
Emergency department	Required
Surgeries	Over 500 annually
Outpatient visits	Over 3,000 annually
Births	Over 25 annually
Distribution Criteria	
Ownership	25% for-profit 75% nonprofit Exclude public health service, Department of Defense, and federal hospitals
Teaching	20% Council of Teaching Hospitals (COTH) 80% non-COTH
Location	67% Urban 33% Rural
Bed size	20% 50-99 beds 40% 100-350 beds 40% Over 350 beds

We initially identified 25 hospitals in each of the two geographic areas. Using the criteria in Table 6.1 as a guide, and considering the short recruitment time frame, we selected a convenience sample, using personal contacts at hospitals whenever possible. The distribution of hospitals was as follows:

- two academic medical centers or major teaching hospitals

- three community hospitals of 150-400 beds
- four community hospitals of approximately 100 or fewer beds.

If an initially selected hospital was unable or unwilling to participate, we attempted to recruit an alternate similar hospital during the recruitment time window. We began recruitment on October 2, 2006, and concluded our recruitment on November 9, 2006.

During the planning phase of the project, RAND and NCHS agreed on a sequential recruitment strategy. This process required RAND to focus first on recruiting the nine hospitals selected, using the Table 6.1 criteria, then to identify and attempt to recruit additional hospitals, as needed, only after any of the nine initially selected hospitals declined. However, toward the end of October 2006, NCHS asked RAND to recruit multiple hospitals for each potential study site simultaneously. This process meant that we would contact more hospitals than needed for the study in anticipation that some would be nonresponsive or unable to participate.

Step 3: Hospital Recruitment

Validating Hospital Contact Information

Where we did not have personal contacts, we identified initial hospital contacts through the AHA database. We called hospital operators to validate the correct name of the hospital, the current Chief Executive Officer (CEO), address, and phone and fax numbers. Recognizing that it might also prove useful to send information to the director of Medical Records, we also sought this contact information.

Introductory Letter from the CDC

RAND sent an introductory letter on CDC letterhead to the hospital CEO from Dr. Edward Sondik, Director, National Center for Health Statistics. The letter introduced the project and invited the hospital to participate. The letter was sent by overnight mail and included a study description and a list of frequently asked questions. All documents, including a copy of the Data Use Agreement between NCHS and NHDS participating hospitals, can be found in the *Field Manual* (Hilborne, Meili, Berry, et al., 2007).

Telephone Follow-Up

Allowing three to five days for the solicitation letter to arrive and be reviewed, we then called the office of the CEO. When we were unable to reach the CEO after approximately three attempts, we tried to ensure a timely response by adjusting the original protocol by directly contacting either the Medical Records Director or another designated person to whom the CEO had forwarded the information. The goal of the telephone inquiry was to set up an introductory call with the RAND principal investigators and the CEO and/or other relevant parties. We tracked calls and other contacts using contact tracking sheets (see Appendix H).

Introductory Call

The RAND principal investigators held 30-minute conversations with each hospital, with the goal of accomplishing five objectives:

- Explain the study and its intended goals and purposes.
- Solicit interest in participating in the feasibility study.
- Discuss the hospital-induction process and, if the hospital expressed interest, set up a face-to-face meeting to conduct the hospital induction.
- Identify a principal point of contact at the hospital.
- Advise the hospital about the Hospital Facility Form and obtain an email address to which it could be sent electronically.

Introductory Packet from RAND

Immediately following the call, RAND staff sent a letter thanking the hospital for taking our call and confirming the date or willingness to host RAND for an introductory visit. The letter was addressed to the hospital's principal point of contact, with a copy to the hospital CEO if the CEO was not that contact. The letter suggested a meeting of personnel who would be participating in the introductory visit, confirmed the date and time of the visit if they had been set, and outlined the visit agenda. It also included a packet of materials that RAND suggested would be helpful for the hospital to review in advance of the meeting, including the following, which are also included in the *Field Manual*:

- A Description of Study
- Frequently Asked Questions (FAQs)
- The NCHS ERB approval letter
- An *MMWR* reprint regarding participation in surveys with the CDC (CDC, 2003)
- The Facility Questionnaire
- The Draft Patient Abstract Form
- A Sampling Plan.

Many hospitals requested that we also send the materials electronically, because the materials were easier to distribute to the parties who would be participating in the introductory visit.

Step 4. Hospital Induction

Scheduling the induction visit usually required multiple follow-up phone calls and/or emails with the principal point of contact. Hospital introductory visits (called

"induction visits" by NCHS) were conducted in person by the co-principal investigators, who traveled to the hospital sites. NCHS staff also joined RAND on seven of eight site visits. The induction visits, which lasted from 1.5 to 2 hours, were intended to offer a more detailed discussion of the information covered in the introductory call. Hospitals that agreed to the induction visit still had the opportunity to decline participation after additional discussion at the visit. The individuals we asked to attend the induction visit included representatives from Administration (the CEO or designee), Finance, Information Technology, Medical Records/Health Information Management, Pharmacy, and the Privacy Office, as well as the person responsible for the abstraction and our primary contact, if not among the above representatives. Some hospitals also later consulted with the nursing staff when Nursing was not present at the meeting.

Materials brought to the induction visit and referenced during the discussion included:

- copies of the introductory packet for all attendees
- two copies of the *Field Manual*
- an example of NCHS publications using the NHDS data
- a CD-ROM containing multiple years of NHDS data.

The induction-visit discussion focused on:

- a description of NCHS and the role of the NHDS in the NCHS portfolio of surveys
- the purpose of the feasibility study
- requirements of hospitals agreeing to participate
- a review of HIPAA requirements and public health exemptions
- discussion of the month to sample for abstraction
- discussion of how hospitals would link clinical and financial information
- the protocol for completing the study
  - review of the Patient Abstract Form
  - review of the sampling plan
- identification of principal contacts for the study
- involvement of Information Technology staff in potentially providing some components of the abstraction electronically.

RAND investigators used the Facility Induction Form to guide the discussion (Appendix I).

The two copies of the *Field Manual* provided to the hospital were for the principal point of contact and the administrative staff person responsible for the study.

RAND followed the introductory visit with an email thank-you message and attached to it a Key Contacts List (see Appendix J) to confirm RAND's principal contact and other personnel with whom we might interact.

Step 5. Training

Given both the accelerated time frame and the nature of the recruitment process (during which hospitals were concurrently in different stages of recruitment and participation), it was not feasible to hold a single training session with participating hospitals, as had originally been planned. Instead, training consisted of individual conference calls with the primary contact and others, at the discretion of the contact, using the *Field Manual* as the guide for training. RAND recommended that those responsible for sampling and gathering the records for the feasibility study (including all ancillary systems) participate in the call.

Step 6: Completion of Facility Questionnaire

A hard copy of the questionnaire was provided in the Introductory Packet and discussed during the induction visit. RAND also sent an electronic copy of the questionnaire upon acceptance of participation. To facilitate hospital completion, the form was divided into four sections:

1. Hospital contact information
2. AHA submission information
3. Information from the AHA submission, but requiring additional information (volume of services provided)
4. Finance, staffing, HIT, and other general questions.

The original intent was for hospitals to complete the questionnaire two weeks after receipt of the document, irrespective of the timing of the hospital induction visit. RAND abstractors were asked to collect the completed survey during their visit if the completed questionnaire had not already been received.

Step 7: Patient Record Sampling and Abstraction

Sampling

The sampling strategy was designed specifically for the feasibility study, to test the hospital's ability to identify and abstract a diverse set of records. The sampling process had two goals: (1) to determine how difficult it would be for facilities to pull a stratified random sample of cases, and (2) to select specific case types to test both the general and special module data-collection forms.

The Sample Period. The sample period for record selection was confirmed during the induction visits. During discussion with the participating hospitals, we asked Medical Records and Financial Services staff to identify the length of time from the point at which patients are discharged and the point at which month-end volume statistics are complete and financial records for the month are at least 90 percent complete. For the feasibility study, records from the most recent 90-percent-complete month(s) were selected for sampling.

Selection of the Sample. To minimize the burden of data collection for the feasibility study, hospitals were asked to select only discharges with a length of stay of ten or fewer days. Because these general acute care hospitals have average lengths of stay of approximately three to five days, most records would be included in the sampling strategy. To confirm this, we conducted an analysis of community hospitals affiliated with academic centers and found that approximately 10 percent of hospital stays exceeded ten days (University HealthSystem Consortium Clinical Database, 2006).

Hospitals were asked to identify a sufficient number of medical records to facilitate abstraction of 20 records across seven different groups (Table 6.2).

Table 6.2
Allocation of Record Types for Feasibility Study

Type of Case	Number of Cases
A. Observation Cases	5
B. Normal Newborns	1
C. Pediatrics	2
D. Acute Myocardial Infarction (AMI)/ Acute Coronary Syndrome (ACS)	2
E. Asthma	2
F. Psychiatric	2
G. All Other Patients	6
Total	20

Hospitals were asked to account for the possibility of any missing records and to select the next randomly sampled record in each group as a replacement if records were missing. Historically, the NHDS has noted and sampled the missing records in subsequent months.

Within each group, hospitals were instructed to identify a random sample of records in one of three ways:

1. At the facility, using a computer algorithm available from the hospital's business systems (e.g., Medical Records, Decision Support).

2. Using the instructions included in the Sample Listing Sheet prepared by RAND and included in the *Field Manual*.

3. Manually, with randomization assistance from RAND, by ordering the records, sending RAND the total number of records (without any patient information) within each category, and then selecting the specific cases,

by number, that RAND recommended. The *Field Manual* included a fax form for RAND assistance.

When a hospital did not have patients within any particular group, it was instructed to reallocate the records from the empty group to the "all other patients" group to maintain the integrity of the 20-patient sample.

The specific algorithm for selecting patients for this feasibility study was as follows:

Group A: Observation or 24-Hour Short-Stay Patients

1. Primary payer may be Medicare or any other payer that reimburses for patients in this status.
2. Exclude "extended recovery" patients from outpatient or ambulatory surgery.

Group B: Normal Newborns

1. Primary ICD-9-CM diagnosis codes V27.0, V27.2, V27.5, or DRG 391.

Group C: Eligible Pediatric Discharges

1. Patient age less than or equal to 15 years.
2. Exclude normal newborns: Primary ICD-9-CM diagnosis codes V27.0, V27.2, V27.5, or DRG 391.
3. Exclude Asthma Patients: Primary ICD-9-CM diagnosis codes 493.00-493.92.

Group D: AMI/Acute Coronary Syndrome Discharges

1. ICD-9-CM primary diagnosis codes 410.x0, 410.x1, or 411.1.

Group E: Asthma Discharges

1. ICD-9-CM primary diagnosis codes 493.00-493.92.

Group F: Psychiatric Discharges

1. Exclude patients age less than or equal to 15 years.
2. ICD-9-CM primary diagnosis codes 290.0-299.91.

Group G: All Other Patients (Discharges)

1. Exclude patients age less than or equal to 15 years.
2. Exclude asthma patients: Primary ICD-9-CM diagnosis codes 493.00-493.92.
3. Exclude ICD-9-CM primary diagnosis codes 410.x0, 410.x1, or 411.1.
4. Exclude ICD-9-CM primary diagnosis codes 290.0-299.91.

Recording the Sample. Hospitals were asked to record their sample by group on the Sample Listing Sheets (SLSs) provided in the *Field Manual*. The SLSs request that hospitals record the total number of cases in each group to allow for estimating to a national sample. In addition, the form indicates the cases that have been selected for abstraction in each group.

Patient-Record Abstraction

Abstraction of the 20 patient records was planned in two phases: (1) by hospital staff and (2) by RAND staff after hospital staff had completed their abstraction of the same 20 records. The intent of this two-phase approach was to test the differences between hospital staff and RAND staff in identifying data elements. This comparison was intended to facilitate understanding of those areas in which hospital staff experienced difficulty with definitions of particular data elements and the availability of elements. During the hospital-record-abstraction period, RAND-trained abstractors were available to hospital personnel by mail or by telephone to answer questions.

Two very experienced RAND registered nurse abstractors visited each hospital for 1.5 days (a total of 13 hours at the hospital site) to abstract records and conduct an on-site debriefing with the hospital personnel. RAND nurse abstractors spoke with and emailed the hospital staff before their visit to review the time and date of arrival and to discuss any hospital-specific special needs or requirements. This discussion was confirmed by email and included topics customized by site, such as the following:

- The arrival time of the RAND abstractors
- A request that the records for abstraction and any printed materials used for the data collection (i.e., data sources other than the chart) be available
- Allocation of work space at the hospital
- Availability of the Sample Listing Sheets to guide abstraction order
- Acknowledgement that abstraction may involve both paper charts and some use of online documentation. It was also noted that the RAND abstraction would begin with an orientation to the site's records and documentation system and would conclude with abstraction from the paper records and printed documentation. The RAND abstractors requested that they be able to work evening hours during one of the visit days.
- RAND's plan to return the next morning (time to be determined) and work until the staff debriefing
- Availability of staff involved in the sampling, accessing, and/or abstracting for the debriefing for approximately one hour on the final day
- Notification that, upon departure, RAND researchers would take copies of completed abstraction and feasibility forms. Hospitals were asked to prepare the following copies in advance: 20 completed abstraction forms,

including any printouts from electronic data. Any PHI was removed from the documentation by RAND abstractors before taking documentation from the site.

Step 8: Assessment of Abstraction Process and Debriefing of Hospital Personnel

To evaluate the ability of the hospitals to successfully complete the requirements for the feasibility study, we constructed four assessment instruments and conducted three debriefing sessions with the hospital staff. The details of this evaluation process are noted below. The results from the evaluation are incorporated into the findings and discussion sections to which they apply. The three feasibility assessment forms used by the facility are included in the *Field Manual*. RAND's on-site debriefing questions are included in Appendix K.

RAND worked closely with participating hospitals to understand their challenges and concerns as they completed the feasibility-study protocol. Hospital staff, abstractors, NCHS, and RAND principal investigators (PIs) collectively participated in the evaluation process, which had five components (Table 6.3).

Table 6.3
Feasibility Assessment Steps

No.	Step	Completed by
1	Completion of the feasibility assessment forms	Facility
2	Debriefing on-site following abstraction	Facility and RAND abstractors
3	Reconciliation of facility and RAND abstraction of records	RAND abstractors
4	Telephone debriefing to discuss the Facility Questionnaire	Facility and RAND PIs
5	Joint hospital debriefing	Facility, RAND team, and NCHS

Completion of the Feasibility Assessment Forms

During the record identification and abstraction, participants completed three specific feasibility assessment forms: Sample Selection Assessment Form, Record Abstractor General Assessment Form, and Record Abstractor Record Assessment Form.

1. The *Sample Selection Assessment Form* was used to describe issues associated with identifying and retrieving the required records. RAND requested that one form be completed by the individual most responsible for identifying the records required for abstraction. This form had five specific questions and one general question. The five specific questions inquired whether individuals were given appropriate background and instructions to perform the task, the individual's job title, and his/her normal job duties, whether the task fit within the individual's normal duties, and who else was involved in performing the task. Additional

space was provided to solicit any suggestions or recommendations to guide future redesign efforts.

2. The *Record Abstractor General Assessment Form* was used to describe overall issues associated with record abstraction. Each hospital abstractor was asked to complete one form after all abstractions had been completed. The six questions outlined above were tailored for the abstraction component of the study.

3. The *Record Abstractor Record Assessment Form* was used to describe challenges associated with obtaining required information from individual records. Abstractors were asked to complete one form for each record abstracted, using the RAND ID number to identify the case. The form was divided into two sections: process questions and specific questions.

Process Questions

1. We asked whether abstractors completed the record all at once before going on to the next record or whether they "batched" certain sections (e.g., clinical, administrative, financial). If the abstractors "batched" sections of the form, we asked them to describe their approach to completing the abstraction.

2. We requested that abstractors record the total amount of time it took to complete each abstraction. If they completed the abstract over multiple sittings, or in sections, we asked that they note the time required for each sitting and then report the aggregate amount of time to complete the record on the abstraction form.

Specific Questions

This section divided the abstraction form into groups of questions:

- Identification numbers
- Type/timing of care
- Demographics
- Clinical data
- Admission and discharge information
- Providers of care
- Medical coding
- Financial and billing
- Previous/subsequent care
- Medications
- Clinical module (if appropriate).

We asked abstractors to document any challenges encountered as they completed individual questions or groups of questions. Specific data elements under each group were identified and numbered to match the abstraction form. We recommended that abstractors note only those areas that were problematic.

On-Site Debriefing Following Abstraction

At the end of the two days that RAND abstractors spent at the facility, RAND abstractors conducted a one-hour on-site debriefing session with hospital staff to review the process, problems, issues, concerns, and suggestions for improvement. RAND abstractors recommended that staff involved in the sampling, accessing, and abstracting be available for the debriefing, but they suggested that staff may attend or send feedback via other attendees. RAND followed a semistructured interview protocol (Appendix K). We anticipated that, because RAND staff had not had the opportunity to compare their abstractions with those completed by hospital staff at the time of the debriefing, some questions might have been deferred to follow-up phone calls or email correspondence, but this proved to be minimal.

Reconciliation of Abstraction Records (Facility and RAND Abstractors)

RAND abstractors and study leaders reviewed the feasibility-assessment forms. They compared the RAND record abstraction forms with those completed by the hospital to identify differences in the data gathered and the location from which the data were obtained.

Debriefing on Facility Questionnaire

RAND scheduled 15- to 30-minute conversations with the facilities to review the completed Facility Questionnaires. The discussion included the following questions:

- Who filled out the questionnaire?
- How long did it take each person?
- What questions were particularly difficult or time-consuming?
- Are there data elements on this form that are not collected by the facility?

Regarding the ongoing use of the instrument and any general comments or recommendations, RAND also solicited feedback that would be useful for NCHS to consider.

Joint Hospital Debriefing

To identify major issues and concerns, following completion of abstraction at the feasibility study sites, RAND aggregated the findings from the record reconciliation, the on-site debriefings, a review of the assessment forms completed by the hospitals, and the feedback on the Facility Questionnaire. The consolidation of the findings was reviewed with the hospital sites on a joint conference call in which facilities were identified by the RAND ID number assigned to their facility in order to

retain anonymity. RAND investigators shared their proposed revisions based on site input and solicited additional feedback.

The feasibility study provided valuable information to help guide subsequent phases of the redesign. The primary aims of the feasibility study were achieved, including the demonstration that complex record sampling by hospitals is possible and detailed patient and facility information can be collected. However, the timeline compression noted above imposed limitations that constrained testing of recruitment, training, hospital IRB considerations, hospital planning for collection and provision of all necessary supporting materials, and hospital abstraction, which should be considered in planning for Phase II. The results of the feasibility study are discussed in Chapters 7 and 8.

7. Findings: Procedures Used to Recruit, Induct, and Train Hospitals for Participation in the Feasibility Study

In this chapter, we discuss findings with relation to the recruitment, induction, and training of hospitals to participate in the feasibility study. Findings from the Facility Questionnaire and from the sampling and abstraction processes are discussed in Chapter 8. Issues and lessons learned from the feasibility study are incorporated into Chapters 9 and 11.

Institutional Review Board Approval

Two key issues were relevant to Institutional Review Board approval: (1) hospitals' understanding of their responsibilities regarding managing protected health information, and (2) hospitals' procedures for either accepting the NCHS ERB approval or conducting their own internal review.

To review hospitals' individual responsibilities regarding participation in the study, during the introductory call and visit RAND staff introduced the issue of PHI. Hospitals acknowledged their responsibilities to advise their IRB or other relevant officials about the study and retain an information-disclosure record as required under the Health Insurance Portability and Accountability Act (HIPAA).

All but one hospital accepted the NCHS ERB approval and waiver without further official review, although all hospitals indicated that they would advise their IRBs of the study. The IRB in the one hospital that formally submitted the project for review required only an expedited review, which took approximately one month from hospital IRB submission to approval, although the process occurred over a holiday period. The hospital's IRB required submission of the documents provided in the introductory packet: RAND introductory letter, study description, FAQs, NCHS ERB approval letters, Patient Abstract Form, and sampling plan.

One hospital contacted the CDC three months following initial contact, after the study was completed. It requested that a CDC representative participate in an upcoming IRB meeting if the study was to be ongoing. Because the study concluded, this did not occur.

We inquired about hospitals' IRB processes during the introductory visit. IRB meeting schedules vary considerably. Community hospitals that do not customarily participate in studies indicated that their IRBs meet quarterly or less frequently, although they can be convened when needed. Local IRBs often require an on-site principal investigator, although a site point of contact in some cases may be sufficient.

Hospital Selection

Recognizing that this was a convenience sample, we were interested in identifying whether hospital size, location, or ownership influenced the hospitals' willingness to participate in the study or our ability to work with the hospitals.

Given this small sample, we did not find any difference between large and small or urban and rural hospitals, or among hospitals under different forms of ownership. All hospitals were familiar with abstracting records, partly because of participation in the Hospital Quality Alliance and partly because of many other pay-for-performance or certification requirements. We did note, however, some concern among smaller hospitals about the time commitment required for participation. Smaller hospitals agreed to participate primarily because they knew the commitment was for only 20 charts and a few days of labor. Small hospitals tend to be more constrained in staffing, although the hospitals that gave staffing constraints as a reason for declining to participate in this survey did not fall into this category.

These findings may not be generalizable because our hospital selection was based on a convenience sample rather than on a more rigorous sampling strategy.

Hospital Recruitment and Induction

The recruitment and induction process involved multiple activities, ranging from making the initial telephone contact with hospital personnel to an on-site induction visit to discuss the requirements for participation with key hospital personnel. We highlight findings in several areas. Overall, clear written communication was effective to introduce the project and set expectations, but personal communication through phone calls and visits was required in order to address hospital questions and concerns.

Validation of Hospital Contact Information

We found that, although the AHA database is usually accurate, it is not always current. For example, we needed to confirm the name of the current hospital administrator and, in some cases, the current hospital name, as well as other information, such as address, phone, and fax numbers.

Two especially useful pieces of information obtained early in discussions with hospitals were the email addresses of key hospital contacts and the name and contact information for the hospital administrator's assistant (to facilitate follow-up contact with the administrator and his or her staff).

Overall Effectiveness of Communications with Hospitals

As noted in Chapter 6 on methods for the feasibility study, RAND provided several written communications to hospitals during the induction process, including an introductory letter from the CDC and an introductory packet of materials. The recruitment process also involved a 30-minute introductory telephone call with key hospital personnel and an induction visit.

Most hospitals indicated that they preferred to handle most written communications by email. More than 50 percent of RAND's scheduling (phone calls and visits) was conducted via email.

Written Materials. Most hospitals noted the usefulness of the written materials in their consideration of participation, many indicating that the introductory letter clearly stated the purpose of both our follow-up call and the study. Hospitals mentioned that the introductory packet was used in their decisionmaking. Only one hospital requested a copy of the NCHS Data Use Agreement.

We did note a few issues with the transmission of written materials. For example, although using overnight mail to deliver the introductory letter was effective, at least half of the hospitals required a second copy of the letter. We sent this copy by either fax or email. We also found that the introductory packet was typically not widely distributed among hospital personnel before RAND's arrival at the hospital. In fact, few people other than our principal contact had seen the introductory materials before we arrived. This lack of circulation was generally not a problem, although the questions that were raised and the introductory session were more robust if relevant personnel had been able to review the written materials in advance.

Introductory Phone Call. The introductory phone call with hospitals was useful, particularly as a means of discussing study-related HIPAA issues and the hospital's obligations in performing the study. All facilities raised questions about HIPAA compliance during the call. Calls tended to be brief, never exceeding 30 minutes. An average of 2.5 weeks (range: 1 to 5 weeks) was required between the time of the first hospital contact and the introductory call.

Induction Visit. The induction visit was a critical means of communicating during the recruitment and induction process. Although hospitals agreeing to an induction visit had the opportunity to decline participation, for a hospital to agree to our visit indicated that at least some staff agreed that they wished to participate and were interested in obtaining more details. Four of the eight recruited hospitals required follow-up before making their final decision, however.

The induction visit was a useful means of reviewing the Patient Abstract Form and sampling plan with hospital personnel, providing the hospital with a grounding for the study. RAND staff used the Facility Induction Form to guide the discussion. Although the form was useful overall, after the induction process was complete, we concluded that the form could be simplified, primarily regarding the details on how to obtain and aggregate financial information by patient encounter.

We were particularly interested in ascertaining how facilities would link together financial and clinical data and how identification of inpatient and short-stay, or observation stay (outpatient), records would differ. In all facilities, the medical record number was the unique patient identifier, and an encounter or visit number identified the index visit and all activities and charges associated with that visit for both inpatient and observation cases.

Scheduling of Introductory Call and Induction Visit

Multiple contacts were required to schedule the introductory telephone call and the induction visit. On average, 6.25 contacts (whether by phone, email, or fax) were required before an introductory call was completed. Time required for scheduling varied considerably. In one case, the solicitation and introductory calls with the CEO, who was a personal acquaintance, were completed simultaneously; at the other extreme, one hospital required eight weeks and nine contacts before an introductory call was scheduled.

Before hospitals were willing to schedule an introductory call, they frequently asked about the study timing and the amount of staff time required. One-third also asked to see the Patient Abstract Form to better understand what was being asked of them. The Patient Abstract Form was sent electronically, in addition to being included later in the introductory packet. Two hospitals, both of which RAND staff had personal contacts at, asked about compensation for their efforts.

From introductory letter to induction took an average of 8.75 formal contacts, and the scheduling following the introductory call required an average of five weeks. In addition, there were multiple short emails or calls confirming attendees, location, time, materials, etc., while the introductory visit was being scheduled. RAND abstractors were able to visit the sites on average 6 weeks after the induction visit. RAND visits were scheduled as closely as possible to hospitals' completion of the abstraction. It should be noted that this scheduling occurred during the 2006 holiday season, which introduced some delay in the process.

Factors Involved in the Successful Recruiting of Hospitals

Table 7.1 provides information on the 15 hospitals that RAND attempted to recruit. Table 7.2 summarizes the time required from the introductory letter to the RAND abstractors' visit. Overall, we received eight positive responses from 14 contacts and on average it took 3 months to complete the process. One contact had responsibility for two sites that considered, but ultimately declined, participation.

Five of the eight hospitals that agreed to participate included key staff personally known to RAND or NCHS. During the induction visits, hospitals indicated that the personal relationship was a key positive factor in influencing the hospital's decision to participate. However, two of the seven hospitals that declined were also among those with whom we had personal contacts.

Two hospitals were dropped from the list of potential study sites after eight or more phone or email contacts (excluding fax or introductory letter). In both cases, we had direct contact with hospital personnel and sent the introductory package twice. Although both sites scheduled introductory calls, neither was available at the appointed time. Multiple follow-up attempts occurred, but we were ultimately unable to set up an introductory call at either hospital.

Sites declined to participate in the study for the following non-mutually exclusive reasons:

- Competing priorities (4)

- Staffing constraints (3)
- Requested compensation (2)
- Changing personnel (1)
- Insufficient lead time (1).

One hospital that declined estimated it would require approximately 65 hours to complete the required work for this small sample.

Table 7.1
Hospital Recruitment Summary

Characteristics	Status	Invitation Letter Sent	Introductory Call	Induction Visit	RAND Abstraction Visit
General Community Hospital District (Gov't) Rural	*Recruited* Personal relationship	10/5/2006	10/18/2006	11/08/2006	1/4-5/2007
General community Not-for-profit Rural	*Recruited* No personal contacts	10/5/2006	10/16/2006	10/24/2006	12/12-13/2006
General community Semi-district Not-for-profit Urban	*Recruited* No personal contacts	10/5/2006	10/13/2006	10/24/2006	12/13-14/2006
Teaching hospital Not-for-profit Urban	*Recruited* Personal relationship	10/5/2006	10/26/2006	11/09/2006	1/17-18/2007
General community Not-for-profit Rural	*Recruited* Personal relationship	10/8/2006	11/17/2006	12/08/2006	1/15-16/2007
Teaching hospital For-profit Urban	*Recruited* Personal relationship	10/17/2006	10/31/2006	11/28/2006	Unable to complete
General community Academic affiliation Urban	*Recruited* No personal contacts	10/19/2006	11/16/2006	11/29/2006	1/23-24/2007
General community Not-for-profit Rural	*Recruited* Personal relationship	10/27/2006 Conversation w/ CEO	10/27/06	11/08/2006	12/18-19/2006
General community Church-operated Urban	*Declined* No personal contacts Competing priorities Changing personnel	10/5/2006	NA	NA	NA
General community Not-for-profit Urban	*Declined* No personal contacts Competing priorities Staffing constraints	10/12/2006	NA	NA	NA
General community Church-operated Urban	*Declined* Personal relationship Competing priorities Staffing constraints Requested compensation Insufficient lead time	10/18/06 Email and personal call	NA	NA	NA
2 facilities General community Church-operated Urban	*Declined* Personal relationship Competing priorities Staffing constraints Requested compensation	10/30/2006 Conversation w/ CMO	10/30/2006 11/3/2006 declined	NA	NA

NA= not applicable.

Table 7.2
Timeline from Recruitment to Abstraction in Feasibility Study

Step in Feasibility Study	Days		
	Minimum	Maximum	Average
From Introductory letter to Introductory Call	1	39	16
From Introductory call to Induction Visit	8	28	16
From Completion of Hospital Abstraction to RAND Abstraction	19	69	45
Total days required	*28*	*136*	*77*

Training

The training that RAND provided to hospitals appeared to be sufficient to prepare hospitals for participation in the study. However, the training was more informal and ad hoc than originally planned; in essence, it constituted a second, more-detailed review of the steps and procedures for sampling and abstraction outlined in the *Field Manual*, and of issues that had been discussed briefly during the induction visit. The training sessions were conducted by telephone, with the duration of the calls ranging from 15 to 45 minutes. The principal hospital contact was always on the call; some facilities included other individuals with responsibilities for record selection or abstraction.

Hospitals had few questions regarding the procedures or the materials provided. They indicated that the protocols they used for case selection were similar to those that they use for other types of quality-improvement projects. Participants noted that they were comfortable with the Patient Abstract Form, knew either where to find the required elements or to whom they would turn for assistance. Many data elements were familiar to hospitals, given their participation in other quality-improvement projects, such as the Hospital Quality Alliance and the Joint Commission's ORYX program.

However, the question-agreement rate of the hospitals' responses with RAND abstractors regarding Stability at Discharge (item 40 on the Patient Abstract Form) in particular pointed out the need for more-rigorous training. Although relatively straightforward in terms of data elements requested, Stability at Discharge is a concept that has been used primarily in research settings because of its correlation to outcomes. Because it has not been used in more-general applications, abstractors are not familiar with its intent; it requires training to familiarize abstractors with the concept it addresses.

8. Findings: Facility Questionnaire, Sampling, and Abstraction

Those findings related to the processes for which hospitals had primary responsibility—the Facility Questionnaire, and the sampling and abstraction processes—are the focus of this chapter.

We will discuss the Facility Questionnaire and Patient Abstract Form findings at the conclusion of this chapter. A detailed analysis of the variable-by-variable findings from use of the Facility Questionnaire and Patient Abstract Form is found in Tables 8.2 and 8.3.

Completion of the Facility Questionnaire

In a 15-30-minute telephone interview, RAND asked the four hospitals that completed the form a series of unstructured questions that were aimed at determining

- How was the form completed and how long did that take?
- Was the connection to the AHA data helpful? And right?
- What took the most time? How long was that?
- What was particularly difficult to collect?
- Are there particular variables that they recommend not attempting to collect?
- Are there questions others are asking that could be obtained from elsewhere?
- Are there questions the hospitals would recommend be asked?

Hospitals reported that, overall, completion of the form was time-consuming and burdensome. Responsibility for the questionnaire could not easily be assigned to one or two people; in fact, hospitals had to distribute the form to between seven and 20 people so that all sections could be completed. Individuals who provided input required between 1 and 4 hours to complete their sections, and the principal contact required as much as 12 hours to compile responses. Very little of the requested information is readily available from routinely produced reports; therefore, manual analysis and assembly was required. Hospitals reported that it took approximately two days in total to complete the form, an amount of time that annually would be too onerous to request hospitals to voluntarily commit.

Below, we discuss the results of the four hospitals that completed the Questionnaire. The discussion focuses on Sections II-IV; Section I contained demographic and contact information for the facility.

Section II: Information Available from AHA Submission

Questions 3 through 6 requested information identical to the AHA Survey (i.e., utilization, accreditation and certification, ownership and affiliations, and hospital type). Hospitals were instructed to provide their most recent AHA Survey in lieu of completing this section. Three hospitals manually completed this section: two that also provided their AHA submission and another because it had not completed the most recent AHA Survey. One hospital provided only its AHA Survey.

Section III: Questions Related to AHA Submission

Questions 7 and 8 are structured similarly to the AHA Survey, but they request additional information on capacity and volume by hospital bed type and service area. All four hospitals do not collect volume or statistics by hospital bed type (question 7) or clinical service area (question 8) and therefore left these questions blank.

Section IV: Additional Questions

Financial Information (question 9). Information about payer mix and the distribution of revenue by insurer type (e.g., Medicare, Medicaid, Commercial [question 9a]) was available, but only two of four hospitals were able to identify the financial mix by payer type (e.g., fee-for-service, HMO, PPO [question 9b]). In one of these two hospitals, revenue by HMO and PPO payer type is collapsed into one category.

Emergency Department, Observation/Outpatient Beds, Operating Suites. When asked about emergency department bed capacity, two of four hospitals incorrectly provided their total acute care bed capacity. But all completed the monthly emergency department volume statistics (question 10).

All hospitals completed the hospital observation/outpatient accommodations section (question 11), although only one noted dedicated outpatient bed accommodations and one noted monthly observation statistics.

All hospitals completed the section on number of operating rooms (question 12). They did not provide an inpatient/outpatient breakdown as requested, but three of four provided the number, by type, of operating rooms (e.g., general, special procedure, obstetrics, endoscopy).

Facility Staffing. Hospitals required their Medical Staff, Graduate Medical Education, and Nursing Offices to complete relevant sections of this question (question 13). These items were particularly time-consuming. In the physician staffing section (question 13a.ii.), one hospital suggested that we separate teleprofessionals and locum tenens to gain further insight regarding staffing shortages and trends. In the “other hospital staff” section (question 13c), all hospitals noted they do not differentiate between general medical and surgical personnel.

Other Comments. The only remaining question hospitals found difficult was annualized median and maximum per-patient coded diagnoses and procedures (question 16b). Median and maximum number of diagnoses and procedures per

patient was not accurately calculated in one hospital and too difficult for a second to calculate.

Translation services and ethics consultation services (questions 18 and 19) are Joint Commission requirements; therefore, questions are always answered affirmatively by hospitals.

Patient Record Sampling

Despite the complexity of the sampling plan, none of the hospitals considered sampling to be a difficult task, and the RAND-provided instructions were generally considered to be clear. Only one smaller facility requested RAND's assistance with sampling. A number of hospitals used the Web site www.random.org to assist them in randomly selecting cases. In some cases, the assistance of the hospital's Information Technology (IT) department was required, and many participants said that, if they were going to conduct the study on an ongoing basis, they would ask their IT staff to program the sampling requirements.

Because of a miscommunication, one hospital pulled a simple random sample, rather than a stratified sample. Upon review and discussion, this hospital confirmed that creating a stratified sample was readily achievable at their facility.

Very few errors were found in the sampling. Of those hospitals that sampled correctly, only four errors were identified in the sampling (one admission was longer than ten days, and two acute myocardial infarction patients and one asthma patient were included among other cases). The decision to limit the sample to stays less than ten days was done for the convenience of the feasibility study and would not be appropriate for the pilot or actual survey. Further, the decision to select the next randomly sampled record in each group as a replacement if records were missing will need to be revisited for the pilot.

Table 8.1 provides examples of the total number of cases available in study facilities for sampling. Not all facilities completed Sample Listing Sheets; instead, they provided RAND abstractors with just the cases selected. Hospitals that did not provide the total number of cases by group missed this data item on the SLS, but had to derive the sample from a group of cases and would be able to provide the totals by case type if the survey was conducted on an ongoing basis.

Table 8.1
Facility Case Availability for Sampling

Case Type	Sample Size	Hospital							
		I	II	III	IV	V	VI	VII	VIII
A. Observation	5	Total cases not available	Total cases not available	6	0	86	Hospital did not complete study	Total cases not available	0
B. Normal newborn	1			101		422			75
C. Pediatrics	2			43		342			22
D. AMI/coronary	2			11	2	29			5
E. Asthma	2			5	3	23			6
F. Psychiatric	2			3	0	95			0
G. All others	6			546		3,083			374
Total patients[a]	20				446				
Sample period (months)		1	1	1	6	1	NA	1	2

[a] With lengths of stay under ten days.

Record Abstraction

Abstraction Process

Hospitals were able to abstract the majority of the elements included as part of the Patient Abstract Form. Abstractors generally had limited need for the *Field Manual*, because they thought the questions as stated in the abstraction form were self-explanatory. When the *Field Manual* was used, the abstractors found the instructions helpful. However, some felt that the manual contained "too much information" and included many details that were not needed unless there was a specific question about a particular element.

Conducting the Abstraction. Although RAND and NCHS provided guidelines for selecting abstractors, hospitals were free to decide which person or persons in their facility would be best suited to carrying out this task.

Five of the seven facilities used just one or two individuals to conduct the abstraction. In three sites, abstraction was done entirely by nonclinical personnel (e.g., Medical Records director and/or a data analyst). The other four sites included as abstractors an RN and/or other designated clinical staff (e.g., cardiac nurse specialist, respiratory therapist, psychiatric clinical staff). Agreement between RAND abstractors and facility abstractors, particularly on clinical data elements (vital signs, pain, activities of daily living, and stability at discharge), was greater in facilities in which abstraction was completed by clinical personnel.

Two sites subdivided the abstraction process among six people, intending that each person would assume responsibility for the accuracy of his/her individual content. Neither site designated a person to look at each case in its entirety. In one case, laboratory values were not assigned to anyone for abstraction.

Hospitals approached this as a one-time study rather than as an ongoing data-collection effort. They all agreed that if this was an ongoing task they would engage in programming of their systems that would allow them to sample and more easily provide and abstract many of the data elements (e.g., financial information, hospital care 30 days pre- and post-discharge, medications, laboratory values). They would also give increased consideration to how they would staff the effort.

All hospitals had some form of a computer-and-paper ("hybrid") record. Diagnoses, procedures, and financial information were consistently provided through printed summaries of electronic data or, in one case, financial information was downloaded to a CD. One hospital provided the majority of data through printouts of data captured electronically in its system. Two hospitals provided online access to some of their data.

Abstraction Time. Abstraction time for the survey used in the feasibility study averaged approximately 45 minutes for facility personnel. There is considerable variability in that number: Normal newborns required 15 minutes or less, normal maternity cases requiring approximately 30 minutes, and cases with substantial documentation required more than 1 hour.

There is evidence to suggest that, if implemented in its current form, the survey would require even more time to abstract than was seen in the feasibility study:

- Records from hospital stays exceeding ten days were excluded from the sample to expedite the feasibility study. Analysis suggests that these longer, more-detailed records account for approximately 10 percent of hospital stays in most hospitals.

- In-hospital medications were not abstracted completely. Facilities were instructed to provide a list of medications from their medication administration records (MARs) or other sources. Most photocopied or printed the patients' MARs but did not fully abstract the medication information. RAND abstractors abstracted medications on a sample of records. They estimated that full completion of the Hospital Medication section would add an additional 5 to 10 minutes to the abstraction time.

- For purposes of the feasibility study, hospitals chose the types of documents they used to provide information about billing and reimbursement. Some hospitals provided copies of itemized patient bills; others provided rolled-up charges by revenue center, either on an actual UB-92 or as a printout; and one hospital provided information on a disk. Only two sites abstracted these data onto the Patient Abstract Form. For consistency, future studies should specify the type of documents requested. Although itemized bills provide considerably more detail than a rollup by cost center, collection of this information is only feasible if the data are provided electronically, using a standard protocol. Aggregate data by revenue center should offer sufficient depth for the general survey. More-detailed data might be appropriate for focused studies.

Classes of Variables

On the whole, hospitals were successful in abstracting most data elements. Referring to Tables 4.3, 4.4, and 4.5, we see that variables included on the current NHDS are readily accessible, only three variables we suggested as likely to be included proved to be difficult, and most of the variables that we expected to be challenging to abstract were in fact difficult to obtain. English proficiency and mother's medical-record number for newborns could be reliably collected even though we initially anticipated them to be difficult.

Issues arose surrounding some variable classes, and refinement or definitional clarity was required for others. Note that the shortened hospital recruitment and participation window may account for some of the difficulties that hospital staff experienced. Some of these difficulties may have been lessened had there been time for formal testing and training of hospital personnel, as originally planned.

We focus here on key issues that arose for each variable class during the abstraction process. Variable-by-variable findings and recommendations for inclusion in the final Patient Abstract Form are summarized in Table 8.2 at the end of this chapter.

Protected Health Information. Abstractors had no difficulty obtaining or providing protected health information from the medical record and billing forms. The NCHS ERB approval and CDC public health exemption were critical considerations for the hospitals with regard to PHI disclosure. Important for future consideration, some sensitive personal information, such as Social Security numbers, has been removed from the face sheets of patient records but is available from "back-end" systems (e.g., billing systems, admission/discharge and transfer [ADT] systems).

Observation Care. Observation care is a relatively new concept introduced with the Balanced Budget Act of 1997 for Medicare patients. Patients are considered candidates for observation status when they present with an unclear diagnosis (e.g., rule out myocardial infarction) or they have a condition that is likely to resolve over a short period of time (e.g., congestive heart failure requiring modest diuresis). Although observation status was adopted for Medicare patients, other payers apply different rules to short-stay hospitalizations. Observation status is driven by payment policy and is unrelated to the clinical care provided. Because observation patients are classified as outpatients (e.g., billed under Medicare Part B), they are not included among patients discharged from the acute care facility. Observation is payer-dependent and requires appropriate physician documentation; consequently, correctly assigning patients has proven exceptionally challenging. Not surprising, then, accurately capturing data on patients as they transition from the emergency department to observation and from observation to acute inpatient was uniquely challenging. Billing records were not helpful in identifying observation patients that transitioned to inpatient care because billing rules dictate that any observation and emergency care associated with a subsequent inpatient admission be rolled into that admission.

Dates and Times. Dates, and especially specific times, were extremely problematic, for both hospital and RAND abstractors. The abstraction form asked abstractors to identify admission and discharge times, as well as times when patients transitioned from the emergency department to observation status or acute admission and from observation to acute admission. Charts often contained multiple, conflicting times for these events, and times in the hospital information systems generally did not agree with the specifics documented by health care practitioners in the record. Furthermore, handwritten physician notes and orders were often dated but not did not note a specific time. Hospital systems may not necessarily record times when patients transition from observation to acute inpatient status because billing protocols incorporate observation services and charges into the acute admission bill when such transitions occur.

Demographics. Some of the demographic information requested on the abstraction form was not readily available. For example, information about a patient's occupation was not consistently available, although sometimes this information was noted in the social history by either the physician or allied health care providers. The face sheet typically identified an employer (for the guarantor), but not the patient's occupation. Information about the patient's education level was also not typically available. Five of seven hospitals that completed our study did not regularly collect this information.

Hospitals had no problem abstracting other demographic items. For example, although occupation was not regularly recorded, employment status was

generally available. Consistent with patient's-rights requirements specified by the Joint Commission, English proficiency was noted by nurses during their initial assessment; however, when patients were not English-proficient, their preferred language was not always stated.

Clinical Variables. The clinical variables were available from all hospitals. However, the entries made by hospital abstractors and RAND abstractors did not always agree. This lack of agreement appears to have occurred most often when a variable required calculation (e.g., feet to inches or meters to centimeters, weight to pounds and ounces or grams, daily smoking use to pack years). In such cases, some hospital abstractors either simply copied what they found in the chart without recalculation (e.g., height in feet and inches, smoking history in terms of daily use), or had difficulty consistently making the calculations. Agreement between hospital and RAND abstractors was more likely when the hospital staff abstracting the records had a clinical background.

Some clinical data were not consistently available. Three sites did not collect data to allow for assessment of activities of daily living, and at other facilities there was inconsistent documentation. For those facilities that had data on activities of daily living (ADLs), documentation of ADLs at admission was typically better than that at discharge.

Provider Identification. Hospitals easily obtained data on the attending physician and operating physician, both of which were available on the UB-92. However, the abstraction form also asked hospitals to provide the UPIN for each provider who provided any service. Although in most cases hospitals could identify providers, the UPINs were not part of the billing or medical record. Some hospitals realized that the information was available from their medical and professional staff offices, but the compressed time frame did not allow for retrieval of this element to be a priority.

Diagnoses and Procedures. All hospitals provided discharge abstracts listing coded diagnoses and procedures as paper printouts, but they did not abstract this information onto the abstraction form, as requested. Consistent with coding practices nationally, less significant diagnoses (e.g., no contributory chronic conditions), procedures (e.g., radiology procedures, minor surgical procedures), and external causes of injury (i.e., E-codes) were infrequently recorded.

Some information was not readily available. For example, the Procedure section of the form asked for type of anesthesia used, if applicable, for each procedure. This element was not abstracted because hospitals provided copies of their discharge abstracts, and this element is not a required element of that form. Determining whether a condition was present on admission was easy for those participating facilities located in California, where present-on-admission is already required for statewide reporting. Facilities in Maryland found collecting this variable to be more challenging.

Medications. Admission and discharge medications were available from most records. The Joint Commission's new requirements for medication reconciliation have led hospitals to develop new, easier ways to record this information.

Information on medications received during hospitalization, when available, was not in a form that could easily be transferred to the abstraction form. Usually, facilities provided paper copies of the MAR but did not edit or extract the contents to the abstraction form. Handwritten forms are difficult to read, and information can be crowded into very small spaces on forms. One hospital with an electronic health record provided a printout of all medications given during the hospitalization, including dose and time of administration, but did not specify route. MARs did not always include medications provided either in the emergency department or by respiratory therapy. Medications are frequently misspelled, and the same medication is listed on the MAR with both generic and brand names requiring clinical and/or pharmaceutical knowledge.

The Patient Abstract Form requested the first administration of a medication. Patients usually receive a mix of generic and brand-name drugs; understanding the names of medications and whether a brand or generic name indicates the same drug requires clinical expertise, often that of a pharmacist.

Financial Information. Most hospitals were able to provide the requested information in hard-copy printout form directly from their financial systems, without difficulty. However, only two sites transferred this information onto the abstraction form.

There were differences in the type of financial information provided. All hospitals provided information on charges, whereas four of seven provided expected and actual payment information. It was not possible to determine expected and actual payment from one hospital, although in discussions it noted that it was available; for another hospital, the information varied by patient. A third hospital did not have information on expected payment, and it declined to provide information on actual reimbursement; because of the short time frame and limited nature of the study, we did not have time to revisit this initial reaction with this facility, but expect the objection could be overcome. As noted previously, detailed charges by revenue center were reported differently by different facilities. Given the information received, and in discussing what was provided with facilities, detailed instructions would improve the consistency of data.

Newborns. Most of the clinical data either were not applicable to newborns (e.g., cigarette smoking, first pain assessment) or required calculations (e.g., weight in pounds and ounces converted to kilograms and grams), which were not always done accurately.

Clinical Modules. Hospitals were able to abstract clinical modules, but often the primary abstractor, most frequently one without a clinical background, would call on a colleague with discipline-specific clinical expertise to complete the clinical module. Testing clinical modules added approximately 10 minutes to the abstraction time.

Tables 8.2 and 8.3 provide a more detailed look at the findings from the feasibility study regarding the Patient Abstract Form and the Facility Questionnaire. Recommendations for both will be discussed in more detail in Chapter 9.

Table 8.2 provides an element-by-element analysis of the findings from the feasibility study and RAND's recommendations for inclusion on the future Patient Abstract Form. It is designed to guide the reader, by variable, from the content

contained on the initial abstraction form, through the feasibility study, to the elements on the final abstraction form. The first two columns in the table list the variable number and name as they were used during the feasibility study (Appendix G). The third column highlights any significant findings or difficulties either encountered during that time by the hospital staff abstracting records or discovered by RAND's trained nurse abstractors during their site visits. Based on the findings, any recommendations for a change to the variable, along with a brief rationale, are shown in column 4. Recognizing that coinciding with the publication of this report, the UB-04 will be adopted for hospital discharges, we indicate in column 5 whether or not the UB-04 contains a field that maps to the variable. If such a field exists on the UB-04 and is complete and accurate, these variables will not require manual abstraction. Lastly, because the order of some questions changed to accommodate the recommendations, variables were reassigned to different locations on the abstraction form. The final column details the new variable numbers that correspond to those in the final abstraction form (Appendix A).

Table 8.3 provides an element-by-element analysis of the findings from the feasibility study and RAND's recommendations for inclusion on the future Facility Questionnaire. It is designed to guide the reader, by variable, from the content contained on the initial abstraction form, through the feasibility study, to the elements on the final abstraction form. The first two columns in the table list the variable number and name as they were used in the feasibility study *Field Manual* (Hilborne, Meili, Berry, et al., 2007). The third column highlights significant findings or difficulties either encountered, by the hospital staff abstracting records or discussed during our telephone discussion with the hospital specifically about the Facility Questionnaire. Based on the findings, any recommendations for change to the variable, along with a brief rationale, are shown in column four. Column five indicates where these data may be available from the annual AHA Survey because this survey would be an efficient means to obtain this information. Lastly, because the order of some questions changed to accommodate the recommendations, variables were reassigned to different locations on the abstraction form. The final column details the new variable numbers that correspond to those in the final abstraction form (Appendix A). We discuss some of these findings in detail in the text below.

Table 8.2
Summary of Findings and Recommendations, by Variable in Patient Abstract Form

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
1	AHA Hospital Number	Same as current NHDS	No changes	No	1
2	HDS Hospital Number	Same as current NHDS	No changes	No	2
3	HIC Number	Available on face sheet when appropriate	Will be specified on UB-04 when appropriate. Should be collected directly from UB-04 claim.	Yes	11
4	Patient Name	Available on face sheet	Last, first, and middle initial are on UB-04. Collect directly from UB-04.	Yes	3
5	Medical Record Number	Available on face sheet	Collect from face sheet.	No	20
5a	Mother's Medical Record Number	When present, available from the birth record	Collect from birth record. Moved to newborn section of the form.	No	45
6	Billing Number	Hospitals use billing number as the encounter or visit number	Delete – Will be captured as the encounter/visit number.	No	N/A
7	Encounter/Visit Number	Available on the face sheet or from the case list	Abstract variable from medical record or case list.	No	20a
8	Birth Date	Available on face sheet	Will be specified on UB-04. Should be collected directly from UB-04 claim. Specification for age is added if no birth date is given. The age specification follows the current NHDS.	Yes	8
9	Social Security Number	Often the complete SSN was not included on medical records (e.g., face sheet) because of patient-privacy concerns	Location to abstract variable will depend on facility. The SSN will most likely come from ADT or financial systems.	No	48

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
10	Patient Street Address	Available on face sheet	Will be specified on UB-04. Should be collected directly from UB-04 claim, although UB-04 permits PO Box or RFD.	Yes	4
11	Zip Code	Available on face sheet	Will be specified on UB-04. Should be collected directly from UB-04 claim.	Yes	5
12-14, 16-17	Admission/Discharge Dates and Times	Information on times (and, to a lesser extent, dates) was particularly problematic. Documentation was inconsistent and conflicting among all hospitals or there were inconsistencies between documented times on the paper record and the face sheet. Overall: • 20% of records were missing parts of these data (mostly from two hospitals) • There was only 54% agreement between RAND abstractors and on-site abstractors for these variables.	(See individual variables below)		

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
12	Emergency Department Presentation Information	See above	Revise variable: Was this patient seen in this hospital's **Emergency Department**? Response: Yes or No Presentation date and time remain Add data about date and time of first order for transition of care and type of care ordered *Although UB-04 may not explicitly collect ED presentation, ED-specific charges are likely to be included if a patient received service in the ED.	No*	31

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
13	Observation Status Information	See above	Revise variable and combine with original variable 14: Collect one of three statuses (observation only, observation converted to acute inpatient, acute inpatient only). Requires physician order for observation status, not just "admit for observation." Rationale: One admission date should be available in the record, along with the admission time (on the UB-04, but not required). We did not find this variable to be collected reliably. A clear recommendation for time must be made; we recommend that "time" be the time that care in the hospital (not ED) is first documented in the record or the physician order for observation, if the patient was first seen in the ED.	Yes Not Req	32

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
14	Acute Inpatient Status Information	See above	Revise variable and combine with original variable 13: Collect one of three statuses (observation only, observation converted to acute inpatient, acute inpatient only). Requires physician order for observation status, not just "admit for observation." Rationale: One admission date should be available in the record, along with the admission time (on the UB-04, but not required). We did not find this variable to be collected reliably. A clear recommendation for time must be made; we recommend that "time" be the time that care in the hospital (not ED) is first documented in the record or the physician order for the inpatient admission, if the patient was first seen in the ED.	Yes Not Req	32
15	If Acute Admission, Identify Type	Consistently available on face sheet	Revise variable to be consistent with UB-04 categories: Emergent Newborn Urgent Trauma Elective Unable to tell Not applicable	Yes	10

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
16	Critical Care Bed	Information on times (and to a lesser extent, dates) was particularly problematic. The feasibility study had limited numbers of patients in critical care beds (12 patients over 5 sites; 2 sites had none).	Revise variable: Collect only month and day (year not necessary, given that this is a single admission that maps to the day of admission) of admission and discharge from the unit and total number of admissions. Ask only if there were multiple critical care stays, not the number. If more information is desired, a focused study may be appropriate. *Although UB-04 may not explicitly collect critical care services directly, critical care-specific charges are likely to be included if a patient received those services.	No*	33

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
17	Date and Time of Final Discharge	Information on times (and, to a lesser extent, dates) was particularly problematic. Documentation was inconsistent and conflicting among all hospitals, or there were inconsistencies between documented times on the paper record and those on the face sheet. The time gap between order and execution for transitions in care was variable. Overall: • 20% of records were missing parts of these data mostly from two hospitals • There was only 54% agreement between RAND abstractors and on-site abstractors for these variables.	Revise variable: Collect date and hour of discharge, to be consistent with the information collected on the UB-04 (although hour is not required).	Yes Not Req	35
18	City of Residence	Consistently available on face sheet	Will be specified on UB-04. Should be collected directly from UB-04 claim.	Yes	6
19	State of Residence	Consistently available on face sheet	Will be specified on UB-04. Should be collected directly from UB-04 claim.	Yes	7
20	Patient Age	Collected from the face sheet (or birth date, or both)	Birth date is specified on the UB-04. This question was moved to be incorporated with birth date (question 8).	Yes	See question 8
21	Sex	Consistently available on face sheet	Will be specified on UB-04. Should be collected directly from UB-04 claim.	Yes	9

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
22	Marital Status	Generally indicated or coded on the face sheet. When coded, the codes may be limited (e.g., single, married, divorced). Some staff were unable to decipher their hospital's codes for marital status.	Abstract this variable from the face sheet. It will not be included on the UB-04.	No	23
23	Living Situation at Admission	When available, this was recorded either in the social history or in the nursing assessment. However, it was not consistently documented, particularly with respect to whether the patient lived alone or with others.	The UB-04 does collect source of admission, and there is overlap between this question and admission source (question 12). The purpose of this variable is to assess home support, so categories are simplified. Revise variable: – Private residence, shared – Private residence, alone – Private residence, unknown if alone/ shared – Psychiatric facility – Other institution or facility (not psychiatric) – Homeless – Other /not stated	No	29
24	Race	Generally available, but codes may be limited. "Hispanic" may be included in race code. Coded race may not match provider documentation.	Abstract this variable from the face sheet. It will not be included on the UB-04. How hospitals map their codes to Census codes should be documented during the Induction Visit.	No	21

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
25	Ethnicity	Generally available but codes may be limited. "Hispanic" may be included in race code. Ethnicity not available to abstractors in all locations. Coded ethnicity may not match provider documentation. Some facilities embed ethnicity within race.	Abstract this variable from the face sheet. It will not be included on the UB-04.	No	22
26	Mode of Arrival	Available, in part, from medical records documentation. From records, it was possible to discriminate between ambulance arrival and others. Hospital records could not discriminate the detail captured in NAMCS.	Revise variable: Ambulance (air/ground) Walk-in Unknown	No	28
27	Source of admission	Discussion regarding the source of admission was included in the record, although the coding of the source was not consistent with the choices presented in the abstraction form.	Revise variable to be consistent with UB-04 categories: Physician referral – Clinic referral – Managed care plan referral – Acute-to-acute transfer (from a different facility) – Transfer from an SNF – Transfer from another health care facility – Emergency room (this facility) – Court / law enforcement – Other transfer – Unknown	Yes	12

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
28	Education	Not collected in five of seven sites. The two sites that collected the data do not categorize as specified in the abstraction form.	Delete variable	No	N/A
29	Occupation	Generally on the face sheet as free text. The item is addressed only for guarantor and sometimes lists the employer but not the occupation. The status (employed, retired, unemployed) is generally coded.	Revise variable, rename: Employment status Collect this for the individual and, for those under 18, for the guarantor. Amend categories to expand the list based on feedback from abstraction: – Employed – Student – Homemaker – Retired – Unemployed – Unknown	No	24
30	English Proficiency	Collected at all sites, usually by the nursing department. The language, if not English, is not always stated. Some sites coded this on the face sheet.	Revise variable: Collect this for the patient, for patients at least 13 years of age. For those under 13, collect for the parent or caregiver. Specific variable options remain unchanged.	No	25

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
31	Vital Signs at First Presentation	Generally, this information was retrievable from the record. The agreement rate with RAND abstractors varied by the type of on-site abstractor. Agreement Rate Variable / Analyst / Nurse BP 58% 78% HR 54% 81% RR 62% 86% Temp 68% 88% O2 Sat 71% 86% Height 92% 89% Weight 86% 88%	Revise variable(s). Formatting to facilitate better reporting. Make not applicable to newborns.	No	36
32	Clinical Laboratory Results at First Presentation	Generally, this information was retrievable from the record. Nurses agreed with RAND abstractors slightly more often than did analysts. However, analysts correctly identified laboratory values 74-81% of the time, whereas nurses identified the correct laboratory values 82% of the time. One site overlooked abstracting these values.	Revise order of laboratory results to be consistent with order commonly reported. Make not applicable to newborns.	No	37
33	Activities of Daily Living	For three sites, no data were available. For others, collecting these data was difficult due to inconsistent documentation. Data were better in some facilities for ADLs at admission than at discharge.	Given the difficulty and inconsistency of these data elements, delete this variable at this time.	No	N/A

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
34	Pain Assessment Within 24 Hours	There was agreement between the on-site abstractors and RAND abstractors 58% of the time. One site did not assess severity. Those that did generally used a 5- or 10-point scale. The greatest difficulty leading to inconsistency is that pain is assessed frequently, making it difficult to identify clearly the first entry.	Modify variable: 1. Specify the first value within the first 24 hours. 2. Add option for "none" to allow for no pain. Make not applicable to newborns.	No	38
35	ASA Classification for Surgical Patients	This variable is routinely noted on the anesthesia assessment	Abstract as provided in feasibility study. Make not applicable to newborns.	No	42
36	Drug Allergies	Routinely assessed on admission and noted on the MAR	Abstract as provided in feasibility study NOTE: Emphasize that this refers to drug allergies at the time of admission. Make not applicable to newborns.	No	39

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
37	Tobacco Use	Tobacco use is routinely addressed on admission assessment and on the history and physical. Often the record only says "Tobacco: no." The duration or amount smoked is often documented, but not both. Reference is generally only to cigarettes.	Modify variable: Restrict to cigarette smoking only. Add option for no data. Add option for documentation that patient is not smoking but no further information is provided. Limit the question to patients age 10 and older.	No	40
38	Pack Years	Tobacco use is routinely addressed on admission assessment and on the history and physical. Comments are generally limited to current use. The duration or amount smoked is often documented, but not both. Pack years are not generally noted.	Revise to ask packs per day and duration separately, in addition to pack years. Limit the question to patients age 10 and older.	No	41

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
39	DNR Order for This Admission	Records included reference to DNR status without evidence of DNR orders. This element applied to very few cases among those reviewed.	Revise variable: ☐ No ☐ Yes, date of 1st order: MM ___ ___ DD ___ ___ ☐ Yes, order present, not dated ☐ Documentation of DNR but no order Allow for possibility of an order with no date. A number of charts documented that the patient was DNR, but there was no physician order. Because the aggressiveness of treatment in DNR patients, even in the absence of a DNR order, may be different, we have accommodated this variation in record documentation.	No	34

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
40	Stability at Discharge	This was a difficult concept for non-clinical abstractors. The original design made it impossible to distinguish between missing data and no instability. Data are limited, but two sites using analysts did not understand the concept. Three other sites using analysts were in agreement 80% of the time. One site completing this section using a nurse abstractor was in agreement 95% of the time.	Modify variable; rename to "vital signs": 1. Include an option for "none of the above" in bold. 2. Make it clear this applies only to lengths of stay of three days or longer. Limit the question to patients age 16 and older. The rationale for the limitation is that the values reported are not appropriate for younger children. When performed using an electronic survey tool, age-specific questions can and should be asked.	No	43

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
41	Status/Disposition of the Patient at Discharge	These data were generally easy to collect from the medical record. Regarding follow-up care, if patient was discharged to home, a notation routinely existed that the patient was instructed to contact the physician for follow up without an indication of a patient discussion. Only one hospital consistently documented specific follow-up appointments. If patients are on IV medications, then home health will be part of the discharge plan (status 06). There were insufficient cases to test the reliability of location of in-hospital deaths.	Modify to make variable consistent with UB-04: 01 Discharge to home or self-care 02 Discharge/transferred to short-term inpatient 03 Discharge/transfer to SNF 04 Discharge/transfer to intermediate care facility 05 Discharge/transfer to another institution 06 Discharge home with home health 07 Left against medical advice 20 Expired 43 Discharge/transfer to federal facility 50 Discharge/transfer to home hospice 51 Discharge/transfer to hospice facility 61 Discharge/transfer to within-facility swing bed 62 Discharge/transfer to acute rehabilitation 63 Discharge/transfer to long-term care 64 Discharge/transfer to Medicaid facility 65 Discharge/transfer to psychiatric facility 66 Discharge/transfer to critical access hosp	Yes	13

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
41	continued		This modification will eliminate two elements: (1) home follow-up (IV meds, patient instructed to call MD, follow-up appointment) and (2) location of in-hospital death. We believe that the effort to collect these elements at present is not worth the added manual data-collection effort. If desired, focused study could be conducted to understand these issues.		
42	Palliative/Terminal Care Arranged at Discharge	These data were generally easy to collect from the medical record.	Incorporated into discharge status. (See above, question 41, statuses 50 and 51). Delete this variable.	Yes	See question 13
43	Attending Physician UPIN or NPI	This was difficult to obtain for abstractors. To get the information during the abstraction process requires contacting the Medical Staff Office.	Will be specified on UB-04. Should be collected directly from UB-04 claim for the types of services covered by the NHDS.	Yes	14

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
44	DRG Assigned to the Admission	This was generally not a difficult variable to obtain. It was available from the billing printouts from the hospitals.	Recommend deleting this variable. There are a number of different DRG severity-adjustment schemes (e.g., CMS, 3M, Solucient, Ingenix, HSS), and this variable would capture only the CMS DRG. CMS is currently examining the system they use, so DRG comparisons at a future time would be difficult. All the data needed to determine the DRG exist (e.g., diagnoses, procedures, age) and can be determined by using the relevant and current DRG grouper.	No	N/A
45	Admitting Diagnosis	This was generally not a difficult variable to obtain from the billing printouts from the hospitals.	Will be specified on UB-04. Should be collected directly from UB-04 claim.	Yes	16
46	Final Diagnoses	This was generally not a difficult variable to obtain from the billing printouts from the hospitals. Present-on-admission flag is required in California, but was more difficult for Maryland hospitals. It will be required with the UB-04 starting March 2007.	The paper UB-04 has 18 spots for submitting diagnoses; however, the electronic form, which is submitted by virtually all hospitals except when performing special billing, has the provision for 25 diagnoses. The Patient Abstract Form has the provision for 18 diagnoses if a hospital is providing this information for manual abstraction, but we envision diagnoses will always be obtained from the electronic form.	Yes	18

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
47	Surgical and Diagnostic Procedures	Coded procedures were generally not a difficult variable to obtain from the billing printouts from the hospitals. The description may or may not be available in full or abbreviated form. Procedure date was available for major procedures. UPIN was difficult to obtain for abstractors. To get UPINs during the abstraction process requires contacting the Medical Staff Office. Evaluating the type of anesthesia associated with procedures was not clear, particularly for non-clinical abstractors.	Eliminate the year from the procedure date. Delete provider UPIN and Anesthesia type. The paper UB-04 has only six spots for submitting procedures; however, the electronic form, which is submitted by virtually all hospitals, except when performing special billing, has the provision for 25 procedures. The abstraction form has the provision for six procedures, but we envision this will always be obtained from the electronic form.	Yes	17
48	Expected Source of Payment	This was generally not a difficult variable to obtain from the face sheet or from billing printouts from the hospitals.	Abstract as provided in feasibility study. Part of this can be derived from the UB-04, based on the payer to whom claims were submitted.	No	26
49	Payer Type for Primary Insurance	This was generally not a difficult variable to obtain from the face sheet or from billing printouts from the hospitals. This variable will require detailed training to ensure accuracy.	Abstract as provided in feasibility study.	No	27

<table>
<tr><th>Original Patient Abstract Variable No.</th><th>Variable Name</th><th>Findings</th><th>Recommendations</th><th>On UB-04</th><th>New Patient Abstract Variable No.</th></tr>
<tr><td>50</td><td>Charges, Expected Reimbursement, and Actual Payment</td><td>All facilities provided charge information from their financial systems. Expected reimbursement was consistently available in 3 of 7 facilities. One organization declined to provide actual reimbursement due to time constraints (see table of facility responses below).

<table>
<tr><th>Facil</th><th>Charges</th><th>Expected Reimb</th><th>Actual Reimb</th></tr>
<tr><td>I</td><td>Yes</td><td>Incomp</td><td>Incomp</td></tr>
<tr><td>II</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>III</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>IV</td><td>Yes</td><td>Avail</td><td>Yes</td></tr>
<tr><td>V</td><td>Yes</td><td>Incomp</td><td>Incomp</td></tr>
<tr><td>VI</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>VII</td><td>Yes</td><td>No</td><td>Declined</td></tr>
<tr><td>VIII</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
</table></td><td>Abstract as provided in feasibility study.

Only part of this information is collected for the UB-04.

Providing expected and actual reimbursement was not an issue in Maryland, given the unique nature of Maryland’s hospital reimbursement. Because actual payment is the result of contract negotiations between hospitals and payers in most states, concerns regarding disclosure of this information may limit data availability, even given the confidential nature of the survey.

Data were not always complete, and varying data formats complicated interpretation of data provided. However, hospitals in general indicated their financial systems contained these data and they could provide it.</td><td>No</td><td>47</td></tr>
</table>

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
51	Charges Allocated by Revenue Center ID	All but one facility supplied charges by revenue center ID. One facility provided the information in electronic form; the remaining facilities provided individual printouts rolled up either by revenue center or by individual charges. Charge dates but not times were captured.	Modify request: Request charges aggregated by revenue center ID, except for room and board charges. Collecting specifics within room and board will provide information on the intensity of services. If data will continue to be provided as a printout, staff will be needed to input the findings. The next pilot should work with hospitals to request these data in electronic form, using a standard format that can be read directly into the database. *UB-04 will provide some degree of charge breakdown, although usually by revenue code, not by individual service.	Yes*	19
52	Care at This Facility 30 Days Before and After This Hospital Stay	All hospitals were able to retrieve these elements from their billing systems.	Abstract as provided in feasibility study.	No	49
53	Medications at Admission and Discharge	This variable was obtainable with moderate difficulty. Medication-reconciliation procedures now required by the Joint Commission make this easier to obtain.	Abstract as provided in feasibility study. Add that newborn admission medication is not relevant.	No	46

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
54	Medications Received During This Admission	Hospitals provided copies of the MARs but did not abstract the data. Accurately obtaining those data and coding them will be very difficult.	Delete this variable. Specific medications can (and should) be included in relevant focus studies.	No	N/A
47	Operating Physician UPIN/NPI	We have recommended deletion of the physician associated with each procedure code, while retaining the attending and operating physician as specified in the UB-04.	The UB-04 requires this field be completed when a surgical procedure code is listed on the claim, identifying the individual with primary responsibility for performing the procedure. Consideration may be given to incorporating the two other provider identifier fields permitted on the UB-04, although the definitions of these fields vary. The fields are used for another operating physician when a secondary surgical procedure is performed or a second surgeon assists the operating physician. For outpatient claims, the fields are used for the referring physician.	Yes	17
--	Transfer from Another Emergency Department	This information was available. However, the source of admission (question 13) was changed to reflect the coding on the UB-04.	Add this variable. It will be coded on the “source of admission” as transfer from another health care facility, although that response is not adequate to specifically identify transfers from EDs for a higher level of care.	No	30

Original Patient Abstract Variable No.	Variable Name	Findings	Recommendations	On UB-04	New Patient Abstract Variable No.
--	Birth Statistics	These were not explicitly collected during the feasibility study. Weight and height were collected. This section has values appropriate to newborn patients.	Add this variable specifically for newborns and eliminate the collection of other clinical variables for newborn patients: Birth Length Birth Weight Apgar Scores Estimated Gestation Age Or Estimated Date of Confinement (EDC)	No	44

NOTES: Not Req= not required; RFD= Rural Free Delivery; BP= blood pressure; HR= heart rate; RR= respiration rate; 02 Sat= oxygen saturation.

Table 8.3
Summary of Findings and Recommendations, by Variable in Facility Questionnaire

Original Facility Questionnaire Variable No.	Variable Name	Findings	Recommendations	In AHA Database	New Facility Questionnaire Variable No.
1	Hospital Information	Same as current NHDS	Obtain from AHA	Yes	1
2	Person Completing This Form (Key Contact)	Available	Obtain from AHA	Yes	2
3	Aggregate Hospital Utilization Statistics for Calendar Year 20XX	Same as current NHDS	Obtain from AHA Moved number of operating rooms to this section Removed median length of stay	Yes	3
4	Accreditation and Certification	Same as current NHDS	Obtain from AHA	Yes	4
5	Hospital Ownership and Affiliations	Same as current NHDS	Obtain from AHA	Yes	5
6	Services Offered by Your Hospital	Same as current NHDS	Obtain from AHA	Yes	6
7	Hospital / Bed Capacity- Hospital Inpatient – No. licensed, staffed, non-teaching beds; No. discharges/month by bed type; average length of stay (ALOS) by bed type	Volume and ALOS not collected by hospitals at the level of bed type	Obtain from AHA – hospital-staffed beds by bed type	Yes	7
8	Clinical Capabilities and Services – annual usage/patient	Usage and patient volume not collected by hospitals at the level of clinical service	Obtain from AHA – clinical services provided by hospital or hospital network	Yes	8

Original Facility Questionnaire Variable No.	Variable Name	Findings	Recommendations	In AHA Database	New Facility Questionnaire Variable No.
	volume		Retain Neonatal Intensive Care Unit level of care	No	13
9a	Financial Information – Patient Insurance	Two of four completed	Test for availability in pilot	No	9a
9b	Financial Information – Payer Type	May be difficult to collect consistently	Test for availability in pilot	No	9b
10	Emergency Department – availability	Available	Retain	No	12
10a	Emergency Department Volume	Volume not available by Adult, Pediatric, Psychiatric	Retain beds/bays by adult, pediatric, psychiatric. Volume only overall.	No	12a
10b	Trauma level of Emergency Department and Hospital	Available	Retain	Yes	12b
11	Hospital Observation/ Outpatient Accommodations and Volume	Completed generally with 0 as answer. Combining accommodations and volume confusing.	Retain, but test in pilot for value of information. Break out questions.	No	14 – Accommodations 15 – Volume
12	Operating Rooms	Supplied by detailed type of operating room, not IP / OP	Obtain from AHA	Yes	3
13a.i	Facility Staffing – Total Medical Staff	Available	Obtain from AHA	Yes	16a.i
13a.ii	Facility Staffing – Medical Specialty Staffing	Available; reported as time-consuming to obtain. Expand to reflect flexible workforce	Retain and added columns for Tele-Licensed Independent Practitioners and Locum Tenens	No	16a.ii
13b.i	Hospitalists – Employed (yes/no)	Available	Retain	No	16b.i

Original Facility Questionnaire Variable No.	Variable Name	Findings	Recommendations	In AHA Database	New Facility Questionnaire Variable No.
13b.ii	Hospitalists – Avg. monthly number by hospitals service	Available	Retain	No	16b.ii
13c	Other Hospital Staff	Available; reported as very time-consuming	Retain	No	16c
13c.i	Number Certified Registered Nurse Anesthetists	Available	Retain	No	16c.i
13c.ii	Number nursing full time equivalent (FTE) positions recruiting	Available	Retain	No	16c.ii
13d	Unionization	Available	Retain	No	16d
13e.i	Trainees – Avg. No. Students by Discipline	Available	Retain – change to average monthly to more accurately reflect volume	No	16e.i
13e.ii	Residents	Available	Remove detail regarding average monthly volume by service and if primary teaching site or residency program. Residency programs available from Medicare cost reports.	No	16e.ii
14a	Health Information Technology (HIT) by hospital functionality	Available	Retain	No	17a
14b	International Standards Used in HIT	Available	Delete – standards being determined by national-standards bodies and systems will likely be certified when survey enters field	No	---
14c	Linking of HIT between patient care settings	Available	Retain	No	17b

Original Facility Questionnaire Variable No.	Variable Name	Findings	Recommendations	In AHA Database	New Facility Questionnaire Variable No.
15	Medicaid Disproportionate Share Funding	Available	Retain – combine with other financial questions	No	10
16a	Medical Coding software	Available	Retain	No	18a
16b	Avg, Median, Maximum diagnoses and procedures per patient	Median and Maximum difficult for hospitals	Retain. Element likely obtainable if billing systems are coded to provide data.	No	18b
17	Capital Investment	Available	Retain – combine with other financial questions	No	11
18	Translation Services	Available	Delete – required by Joint Commission	No	--
19	Ethics Consultation Services	Available	Delete – required by Joint Commission	No	--

9. Discussion and Recommendations: Feasibility Study

The Facility Questionnaire and Patient Abstract Form that were tested in the feasibility study are new for the NHDS in two important, but different, ways. First, they contain new content (new variables) that has not been included in previous surveys. Second, they require new processes, such as complex sampling by facilities and extensive primary patient and facility data collection. The feasibility study tested both areas and reinforced the expectation that patient-level clinical data and facility-level characteristics that address the policy issues prioritized by the Workgroup can be reliably collected.

In this chapter, we review some of the key findings from our feasibility study and provide our recommendations for improvement. We first discuss findings and recommendations related to identifying, recruiting, and training hospitals for participation in the survey; we then focus on the Facility Questionnaire and the sampling and abstraction process. We conclude with recommended adjustments to complexity and data definitions that will improve the reliability of data collection.

Procedures Used to Identify, Recruit, and Train Hospitals

Institutional Review Board Approval

The IRB approval process functioned smoothly in many respects. All but one hospital accepted the NCHS ERB approval and waiver without further official review. The hospital that submitted the project for review to its own IRB received approval within one month.

Some issues did arise, however, in relation to the management of protected health information. As discussed in Chapter 8, some hospitals had not completely removed all sensitive personal information (e.g., SSNs) from the patient records. The presence of such data ultimately did not pose a serious problem for the feasibility study because either the records stayed in the hospital or additional documentation was de-identified by the RAND abstractors prior to leaving the facility. However, during normal administration of the survey, when the abstracting organization would physically remove the files from the hospital site, such data would pose a problem.

During the feasibility study, we instructed facilities to approach their IRBs as if PHI would be physically removed by RAND abstractors. However, because of the limited nature of the study and because hospitals knew that these data would not actually be removed, they may not have approached the issue of PHI as cautiously as they might have had PHI actually been removed from the premises.

Removing PHI often requires the study team's active intervention with each hospital's IRB. RAND's experience, as well as that of other studies (Green et al., 2005), indicates that there is wide variability across IRBs in facilitating this process.

One recent RAND study that required removal of abstracted clinical data from facilities took, on average, three to four months to get hospitals' IRB approval.

Although the CDC's public health exemption and ERB approval provided hospitals with a level of comfort regarding use and removal of PHI from their premises that would not be present in other external studies, we do not feel that this feasibility study provided NCHS with an adequate test of hospitals' IRB processes, requirements, and timelines that should be considered in the structure of the pilot test. These issues will require further study.

Hospital Selection

Going into the study, we were interested in understanding whether the characteristics, location, or ownership structure of different hospitals would influence the hospital's willingness to participate or ability to carry out the abstraction. We were particularly concerned about whether the abstraction process might place a greater burden on smaller hospitals.

We did not find any significant differences in the willingness or ability of different types of hospitals (e.g., large or small, urban or rural, for-profit or not-for-profit) to participate in the feasibility study. However, it is possible that regular participation in an ongoing survey could prove burdensome, particularly for smaller hospitals, which typically have limited staff and resources.

Depending on how NCHS chooses to structure who will be responsible for sampling and data collection in the ongoing survey, it might be worth considering rotating smaller hospitals through the sample more frequently than larger hospitals in order to minimize this potential burden of participation.

Hospital Recruitment and Induction

Overall, the recruitment and induction process progressed satisfactorily, although the process was time-intensive. While hospitals found written materials useful in laying the initial groundwork for participation, personal communications through phone calls and visits were even more important in moving the process forward, and especially in answering hospitals' questions and addressing their concerns. The in-person induction visit was also crucial.

We achieved a 50-percent recruitment success rate for the feasibility study, similar to other NCHS feasibility studies. However, given that we contacted many facilities at which we had personal contacts, one could anticipate that the pilot is likely to achieve a lower success rate. Consent to participate will depend on how much is asked of the facilities, the time frame, and the direct benefit that participating hospitals will receive (in terms of remuneration or data).

We estimate that, when using a paper-based abstraction process, it will take at least three months to complete the process from initial contact to hospital abstraction. This estimate assumes that sufficient resources are available to contact facilities around 20 times, and that there are no IRB issues or delays.

More time might be needed, depending on the nature of the final survey. Decreasing the intensity of contact (frequency and number) would lengthen the period between initial contact and abstraction. Additional time would be required if the goal is to refine the electronic-data queries performed by the hospital. Hospitals indicated that they would desire an additional three months to queue up IT requests and perform the necessary programming. RAND was unable to test this estimate because of the one-time nature of the survey.

We recommend that future estimates and planning should allow 5 hours of recruitment time per hospital to complete the induction-visit stage, not including travel time. This 5 hours includes 30 minutes per introductory call and approximately 30 minutes to schedule the introductory call (8.75 contacts), and 1.5-2 hours per introductory visit, allowing one-half day per introductory visit.

Although the Induction Form used for the feasibility study worked well, we simplified the form slightly to reflect our revised understanding, primarily of hospital-encounter-tracking processes. The revised Induction Form can be found in Appendix A.

Facility Questionnaire

The Facility Questionnaire adds a robust dimension about facility characteristics, capabilities, and capacities to patient-level analyses not currently available in any survey. Collecting these data regularly will provide the ability to link general processes and cost of care to hospital size, teaching status, general levels of staffing, and payer mix and type, among many other characteristics. It will provide the only nationally representative sample of the level of diffusion of health information technology in the United States.[6] Understanding coding practices (i.e., number of codes reported) will provide insight into the variation that exists in coded data. This is particularly relevant information, given that so many analyses are derived from these data. Annually completing this questionnaire may prove too burdensome for hospitals. NCHS should explore the optimal frequency.

Our limited sample does not provide an adequate analysis of what information is possible to collect using the Facility Questionnaire. Therefore, we were reluctant to remove some very important variables that hospitals reported were difficult to collect (e.g., median and maximum per-patient diagnoses and procedure volume). However, it is clear that a form that requires two or more days for hospitals to voluntarily complete is not reasonable.

We revised the Facility Questionnaire (Appendix A) to reduce the time and resources necessary for completion. We separated and consolidated the AHA questions and deleted the following:

- For each hospital-bed type: number of licensed beds, number of nonteaching beds, number of discharges per month, average length of

[6] HIMSS-Dorenfest Database provides data on most community hospitals in the United States (approximately 4,000 hospitals); it excludes hospitals with fewer than 100 beds and that are not members of health care systems.

stay (question 7) because hospitals were not able to provide this information

- For each clinical service: annual usage or patient volume (question 8) because hospitals were not able to provide this information
- Residency training programs and number of residents (question 13e.ii) because this information is available from other sources
- International standards and protocols for health information technology (question 14b) because this information is highly variable and rapidly changing
- Translation and ethics consultation services (questions 18 and 19) because this is required by the Joint Commission and not useful to collect.

At the suggestion of one rural hospital, we added a question about tele-professionals and locum tenens to the Licensed Independent Practitioner section. We agree that this question reflects shifting workforce demands and solutions. For example, although telemedicine is now common for radiology, it is expanding to other image-based specialties, and systems exist to remotely provide evaluation and management services, including critical care (Rosenfeld, Dorman, Breslow, et al., 2000).

We recommend that NCHS pursue a consolidation of this questionnaire with the AHA, through discussions about linking to and perhaps enhancing the annual AHA Survey. Other relevant hospital information, such as residency training programs, can be obtained through Medicare Cost Reports and other means.

The Veterans' Administration Clinical Practice Survey, Chief of Staff Module, might provide another useful source of questions for the Facility Questionnaire. It contains some interesting quality and leadership questions that highly correlate with clinical outcomes (personal correspondence with Elizabeth Yano).[7]

Training

During the individual hospital training sessions, hospital personnel appeared to have a clear understanding of procedures and instructions; however, subsequent RAND abstraction and debriefing sessions indicated that there were opportunities to improve the structure and process of hospital training. This is not surprising, given that RAND's original intent was to secure participation from all participating facilities in advance of the training and then conduct a more formal, group training for all sites. The compressed time frame required that training occur as soon as possible following induction. Scheduling needed to be sensitive to local hospital time constraints, conflicting priorities (e.g., accreditation surveys), vacation schedules, and the proximity to winter holidays. To allow the RAND abstractors sufficient time

[7] For further information, contact the principal investigator, Elizabeth Yano, Ph.D., at Elizabeth.Yano@va.gov.

to schedule visits to all hospitals for reabstraction, it was necessary for some hospitals to complete abstraction before induction visits had occurred at other hospitals.

RAND recommends that, for the pilot and regular surveys, sufficient time be allocated to ensure that the individuals sampling, retrieving, and abstracting records fully understand their project roles and responsibilities. If, in the future, the intent is for hospital personnel to abstract records, a comprehensive training program should be instituted. Because of the time required for training (and abstraction), compensating hospitals for their staff time would be reasonable. Hospitals commented, however, that even with compensation it may be difficult to free up sufficient time, given full schedules and limited staffing. Alternatively, if abstraction will be performed by future contractors, either directly or through subcontracts, a formalized training program should similarly be incorporated.

In the end, individuals participating in the project should complete a training program and be certified as a participating trained abstractor. Training updates should be offered when changes are made to the abstraction process, data elements are added or deleted, or different temporary modules are incorporated.

The field manual used by abstractors should be simple and should contain only those elements that are relevant for abstraction. This simplification can be facilitated by having the entire field manual available to the participating site coordinator but providing only relevant sections to abstraction personnel.

Sampling and Abstraction

Patient Record Sampling

Although most hospitals were able to complete sampling independently, future studies must be able to accommodate the needs of organizations for which such a review would be a potential obstacle. Based on our findings, the backup methods that RAND provided (Chapter 6, Step 7) should adequately meet the needs of facilities for assistance.

Record Abstraction

Hospitals were generally able to complete the records requested. Specific recommendations for changes to variables are included in Table 8.2. Also included are recommendations for deletion of some variables for the pilot study, because they are not routinely recorded in a manner to facilitate data collection or consistency in analysis. We recognized at the same time that documentation patterns are changing and that hospitals are adopting electronic health records that may, in the near future, facilitate collection of these elements. Elements included in the original abstraction form, even those that RAND recommends deleting at this time, map to areas that the Workgroup and health care leaders identified as priority areas, as described in the conceptual framework. A summary of deleted and added elements is included in Table 9.1. It does not include areas in which we recommended that data elements be modified to facilitate more-consistent data collection.

RAND believes that the data-abstraction time required for the abstraction form used in this feasibility study is too long. The length of the form, depending on the strategy selected for data abstraction and collection (i.e., by facilities or by NCHS contract staff), may discourage some organizations from participating on an ongoing basis. Participating hospitals and NCHS colleagues validated this impression.

Table 9.1
Summary of Data-Element Deletion and Addition Recommendations

Recommended Deletions	Workgroup Priority Issue
Billing number	Not applicable
Time of presentation to ED and observation status	Resource use
Education	Disparities / access
Occupation	Disparities / access
Activities of daily living at admission and discharge	Quality of care (risk adjustment) / outcomes
Home follow-up (IV meds, patient instructed to call MD, MD appointment)	Continuity of care / transitions (MD follow-up) Quality of care (extent of illness at discharge)
Location of in-hospital death	Quality of care
Palliative / terminal care at discharge	Continuity of care / transitions
DRG	Derive from collected data
Medications received during admission	Resource use
Physician UPIN/NPI for each procedure (keep surgical procedures)	Mix and use of labor
Recommended Additions	**Workgroup Priority Issue**
Transfer from another emergency department	Resource use
Birth statistics for newborns	Quality of care (risk adjustment for newborns)

With this in mind, we redesigned the abstraction form to incorporate data elements, whenever possible, that were specified as part of the UB-04, which will be used by hospitals beginning March 2007. For example, RAND reworded the status/disposition of the patient at discharge to be consistent with UB-04 reporting specifications, and the UB-04 requires hospitals to identify whether a condition was present on admission.

Although the UB-04 paper form has space for 18 diagnoses and six procedures, almost all hospitals use the electronic equivalent of the UB, which has space for up to 25 diagnoses and 25 procedures. Local coding policies, and reimbursement and reporting requirements, generally dictate the depth to which facilities code their hospital discharges. However, it is important to recognize that the CMS and other payers are exploring strategies to better risk-adjust for patient severity within facilities. These schemes are likely to encourage hospitals to expand the depth of their clinical coding, because hospitals will receive higher reimbursement for more complete coding. Although a considerable degree of coding variation in clinical practice exists, it would be unrealistic for NCHS to recruit exceptionally skilled coders to manually recode the records from all patients included in the NHDS sample.

As hospitals adopt the UB-04, it will be important to validate the reliability of the data elements it contains and the validity of our recommendations to rely heavily on it for many data elements.

This feasibility study was limited by the constraints of a paper abstraction form. Adoption of a computer-assisted abstraction tool will allow for incorporation of more-complex skip patterns that would facilitate the possibility of collecting elements that are not otherwise practical. For example, a pediatric patient's discharge vital signs could be collected by age-specific standards.

Migrating to a computer-assisted data-collection tool offers the ability to ask for more-detailed clinical information that is appropriate for a given patient type on a selective basis. Clinical-variable selection may be driven, in part, by specific diagnoses, such as cardiac conditions. The collection of markers of coronary ischemia could be prompted only for those patients presenting with cardiac conditions. Blood gases and pulmonary function tests may be prompted for when the patient presents with chronic obstructive pulmonary disease (COPD). Vital signs at discharge could be age-adjusted. With time, many of the conditions that might at present be explored through special modules could be adapted to the routine survey through computer-adapted data abstraction.

A computer-assisted tool may also provide NCHS with the ability to more readily obtain data electronically from facilities as the adoption of electronic health records based on national transmission and nomenclature standards improves.

The revised Patient Abstract Form and instructions for completing the Patient Abstract Form can be found in Appendix A.

Part Three:

Statistical Analysis

10. Design and Statistical Considerations

The NHDS has great value as a national probability sample of discharges, but it must adapt to a changing environment in order to continue to offer value to potential users. The greatest potential for NHDS to increase its utility is to achieve greater clinical depth of elements, allowing more-sophisticated health services and health policy analyses than are currently possible. To accommodate the increased cost associated with obtaining clinical depth, the current NHDS size of 300,000 discharges annually would probably have to be reduced. Our analyses of 16 sample designs suggest that, with a less disproportionate 2-stage sampling approach, as few as 50,000 discharges annually, if drawn from 500 hospitals, might provide appealing measurement precision that would support many such analyses ("good" measurement precision for most scenarios and "acceptable" for others). If resources are very constrained, then 250 hospitals and 50 discharges per hospital should probably be considered minimum targets, but there would be considerable loss of precision. The NHDS can also substantially improve precision by dropping a third tier of sampling hospitals within primary sampling units (PSUs) and may realize some additional gains by reducing disproportionate weighting. This is described further below.

We also note that the changing environment for the NHDS includes the National Inpatient Sample (NIS), the largest all-payer inpatient database in the United States. Currently, the NIS and the NHDS collect similar information based on the UB-92 form. The NIS contains 100 percent of records from a sample of 1,004 hospitals in 37 states (2004) for a total of approximately 8 million discharges each year, or from 10 to 20 percent of discharges annually (Agency for Healthcare Research and Quality, 2006). The sample consists of 20 percent of all hospitals in each stratum defined by region, urban/rural, number of beds, teaching status, and ownership/control. In contrast, the number of annual discharges included in NHDS between 1988 and 1997 ranged from 233,493 to 300,464, or about 1 percent of the 30.9 million discharges in the United States in 1997. The range of hospitals between 1988 and 1997 was 408 to 494. Thus, currently, researchers have a choice of which data source to use, and Workshop participants raised the question of why the NHDS was needed at all if the NIS is collecting the same data on so many more hospitals and patients.

To highlight the contrast, the NHDS is considered to be geographically representative of the United States and thus yields generally unbiased national estimates, and, of course, NHDS is the only data source for hospitals and patients in geographic areas in which NIS does not collect data. However, while NIS is a biased estimator of the national population (due to incomplete coverage), NIS produces more-precise estimates than NHDS as a function of having nearly twice as many participating hospitals and more than 20 times as many discharges and, therefore, smaller variance.

Perhaps the best measure of the trade-off between bias and variance is mean standard error (MSE), which considers both bias and variance. It is an empirical question whether NHDS or NIS currently provides the most accurate estimates for a given measure in terms of MSE, but our calculations indicate that it would take very little frame bias in NIS for its precision (variance) advantages over

NHDS to be overwhelmed, and it is likely that NHDS is actually more accurate for a variety of measures. With some statistical design improvements that we suggest below, the NHDS, even at current sample sizes and perhaps even at reduced sample sizes, would probably have greater statistical accuracy than the NIS for the common data items, and it will be important for NCHS to educate its potential users about the situations in which the NHDS outperforms other surveys with larger sample sizes. However, our main focus is on an enhanced design with greater clinical depth. Below, we describe the current statistical design of the NHDS, as background, and our thinking about a revised statistical design.

Current NHDS Statistical Design

A key feature of the current NHDS structure is its 3-stage sample design. The original NHDS had a 2-stage sample design—first, hospitals were sampled; then, within each hospital, records were sampled. In 1988, the NHDS moved to a 3-stage sample design, which introduced selection of geographic PSUs used in the 1985-1994 National Health Interview Survey (NHIS). The NHIS is a cross-sectional household-interview survey used to monitor the health of the U.S. population. Currently, the design is as follows: After selection of PSUs, large hospitals are selected with certainty and supplemented with a random sample of noncertainty hospitals selected from sample PSUs with probabilities proportional to their annual number of discharges (Dennison and Pokras, 2000). On average, four or five hospitals are sampled and participating per PSU. To maximize the potential for automated data collection and representativeness across PSUs, noncertainty hospitals were stratified by region, PSU, and, in the 12 largest PSUs, by data-collection type (i.e., whether a hospital subscribes to a commercial abstracting service). Within strata, hospitals were ordered by PSU, whether the hospital was in the 1987 NHDS, hospital size class and specialty class, abstracting service status (in noncertainty areas), specialty, and annual discharges. Within specialty, hospitals were arrayed by annual discharges. Sampling rates were set so that at least three hospitals were selected from each PSU; if the PSU had fewer than three hospitals, all hospitals in the PSU were selected.

At any given time, there are nearly 500 respondent hospitals in the sample (representing about 10 percent of all eligible hospitals). The range of hospitals between 1988 and 1997 was 408 to 494, and the response rate ranged from 77.6 percent to 96.1 percent (Dennison and Pokras, 2000, Table B). In 2004, the response rate was 92 percent (DeFrances, Lees, Kozak, Hall, and Pokras, 2006). Most respondent hospitals remain in the panel once they are in. In addition, NCHS attempts to recruit eligible non-responding hospitals in subsequent years. The sample is refreshed every three years: Hospitals that no longer meet eligibility criteria are removed (mostly because of a change in average length of stay), and a "birth panel" of hospitals based on all new hospitals is incorporated.

The third stage of sampling involves discharges within hospitals. As summarized in Table 10.1, for hospitals with manual record systems, the number of annual discharges sampled is roughly equivalent to that for hospitals with automated systems, regardless of total number of hospital discharges.

Table 10.1
Third-Stage NHDS Sampling (Annual), by Hospital Size and Type of Record System

	Hospital size		
	Certainty Hospital	Noncertainty Hospital ≥4,000 Discharges	Noncertainty Hospital <4,000 Discharges
Automated records	5% all records	2,000 records	250 records
Manual records	1% all records	250 records	250 records

For hospitals with automated record systems, NCHS purchases computerized data tapes from the abstracting-service organizations, state data systems, or hospitals (Dennison and Pokras, 2000). Each of the small noncertainty hospitals with automated records provides about 250 records, and approximately 2,000 records are sampled from each large noncertainty hospital. Among certainty hospitals, 5 percent of all records is sampled for hospitals with automated systems and 1 percent of all records is sampled for hospitals with manual systems. The number of annual discharges included in NHDS between 1988 and 1997 ranged from 233,493 to 300,464, or about 1 percent of 30.9 million of the discharges in the United States in 1997.

Statistical Properties of the Current NHDS Design

By design, the NHDS is unbiased but not especially precise for all measures. The NHDS has three sources of design effects (DEFF): (1) clustering of patients within hospitals, (2) clustering of hospitals within PSUs, and (3) weighting for departures from proportionate sampling, with probability proportionate to size (e.g., undersampling of manual records, some variations in sampling probabilities by hospital size). The greatest correctable source of inefficiency is at the stage of sampling discharges within hospitals. In the following subsections, we describe each of the DEFFs in turn.

Clustering of Patients Within Hospitals. At the end of this chapter, in the "Summaries of Measurement Precision" section, we discuss in detail design effects as a function of the number of cases sampled per hospital. In that section, we consider 80 scenarios for a dichotomous (yes/no) outcome based on the prevalence of the outcome, the size of the subgroup involved, and the intraclass correlation coefficient of the measure between hospitals. As detailed later, the design effect from the clustering of cases within a hospital ranges from 1.29 to 180.70 over these scenarios in the current design, with the median design effect of 12.83 and a mean of 34.34.

Clustering of Hospitals Within PSUs. Although most of the design effects can be attributed to sampling of discharges within hospitals, improvements to efficiencies may be achieved by addressing the other two contributors to design effect. The effect of clustering of hospitals within PSUs is nontrivial. Shimizu (1990) reported relative standard errors (RSEs) for the 3-stage design of 3 to 17 percent, which correspond to upper confidence limits that are 1.125 to 2 times as large as the lower confidence limit in the corresponding 95-percent confidence intervals. Dropping PSUs would reduce relative standard errors by 3 to 5 percentage points

(Shimizu and Cole, 1991). For the measure *all discharges*, these RSE increases suggest that dropping PSUs would divide design effects and multiply effective sample size (ESS) by 7.34. For the measure *all procedures*, effective sample size would be multiplied by a factor of 4.54, and for specific procedures this factor would range from 1.04 to 1.90. For the *days of care* measure, effective sample size would decrease in some cases and increase in others.

Combining these two sources of design effects suggests that total design effects from clustering for the current design might be as large as 25 or 30 in a median scenario and might be as large as 100-500 under some circumstances. Some of these large design effects may be addressed by the elimination of PSUs, which is under consideration by NCHS. The design effect contributed by collecting more records per hospital than is necessary for common conditions may, in fact, contribute importantly to precision for rarer conditions. Where cost per record becomes a consideration, such as in the redesign, it may be more important to limit the number of discharges per hospital to maximize efficiency, which we discuss in greater depth. For additional detail on design effects from clustering and weighting and the role of intraclass correlation coefficients, see Biemer (1983), Chromy (1987), Kish (1985), Folson, Potter, and Williams, (1987), Gabler, Haeder, and Lahiri (1999), and Kish (1965, 1974).

Weighting for Departures from Optimum Sampling Fraction. The overall design effect due to weighting is a small part of the story (personal communication, Iris Shimizu), and any such design effects are uniform across all outcomes. Nonetheless, small improvements could also be made by optimizing on the relative cost of manual versus electronic data collection and not allowing hospital size to directly affect the inclusion probability for discharges, after conditioning on electronic versus manual data collection. Such optimization really refers to identifying the optimum sampling fraction; given the effects of clustering, this fraction is similar to but not exactly the same as proportionate to size sampling.

Synthesizing weighting and clustering effects on design suggests that a design effect of 30 or more is likely to apply to many applications under the current design, before considering that design effects are from weights for nonresponse, which will further increase design effects.

More-uniform discharge-selection probabilities may decrease design effects somewhat; however, such an approach could increase nonsampling errors in several ways. It is an empirical question whether the former savings would exceed the latter losses. Nonsampling error may be especially important with manual data collection. For example, at the largest hospitals, the capacity and willingness to abstract discharges may not be fully proportionate to volume, which could lead some large hospitals to perceive response burden as excessive. Such a prescription could, in turn, increase the risk of hospital nonresponse. Similarly, a sudden increase in discharge volume at a given hospital would generate a corresponding sudden increase in burden, for which a hospital may not be prepared. Sudden drops in hospital discharge volume could make visits to that hospital inefficient under a constant-probability scheme, although it should be noted that undersampling large hospitals is a much bigger contributor to design effects than oversampling small ones.

Potential Modifications to Save Cost or Enhance Statistical Efficiency

In light of the recommendation to improve clinical depth in data collection, the RAND team assessed the statistical implications of the NHDS redesign to inform the discussion regarding trade-offs between statistical power and the burden of data collection. For the purposes of this section, we will assume that a future design of the NHDS will eliminate sampling at the PSU level and will attempt to minimize design effects from weighting when possible. As such, we will for the most part not consider design effects from these sources. We will focus on the consequences of the number of hospitals, the number of cases per hospital, and the properties of the research questions. If these assumptions do not hold, the patterns described in this section will be similar, except that precision will be uniformly poorer to an extent described in the preceding sections. We draw attention to those values that represent the current (high) specification for sampling and present them in relation to reduced values, for comparison.

Sixteen Sample Designs

In this subsection, we consider 16 different designs: all possible combinations of four possible numbers of participating hospitals (125, 250, 500, or 1,000) and four possible numbers of annual discharges abstracted per hospital (25, 50, 100, or the current 600). Table 10.2 illustrates these 16 possibilities, which range from 3,125 to 600,000 total discharges. The cell with 500 hospitals and 600 discharges per hospital approximates the current design.

In particular, in the current sample design, discharges per hospital vary substantially (as described in Table 10.1), but they average just under 600 discharges per hospital in about 500 hospitals (NCHS, 2007). Although the variance properties differ somewhat for a constant number of discharges per hospital, they are a rough approximation of a variable number of discharges per hospital with the same average.

Table 10.2
Total Discharges in Each of 16 Designs (See Appendix L). Shaded cell represents the average.

Annual Discharges Abstracted per Hospital	Number of Hospitals			
	125	250	500	1,000
25	3,125 (Table A.1.1)	6,250 (Table A.2.1)	12,500 (Table A.3.1)	25,000 (Table A.4.1)
50	6,250 (Table A.1.2)	12,500 (Table A.2.2)	25,000 (Table A.3.2)	50,000 (Table A.4.2)
100	12,500 (Table A.1.3)	25,000 (Table A.2.3)	50,000 (Table A.3.3)	100,000 (Table A.4.3)
600	75,000 (Table A.1.4)	150,000 (Table A.2.4)	**300,000 (Table A.3.4)**	600,000 (Table A.4.4)

Eighty Outcome[8] Scenarios

The analysis presented here focuses on discharge-level rather than hospital-level outcomes.[9] For simplicity, we consider only dichotomous outcomes in this exercise: those that estimate a percentage, a probability, or a count of events that can occur, at most, once per discharge. These types of outcomes are the most frequently discussed in exploring the properties of the NHDS (e.g., Shimizu, 1990), because they are typically the limiting cases. In other words, any design with adequate precision for dichotomous outcomes is likely to have adequate precision for continuous outcomes.

We consider three characteristics of dichotomous outcomes: (1) the prevalence of that outcome, (2) the size of the subgroup to which the outcome is applicable, and (3) the intraclass correlation coefficient for that outcome in that subgroup.

The *prevalence of the outcome* is the proportion of applicable cases in which the outcome occurs. Because every dichotomous event with prevalence *p* has a probability of *1-p* of not occurring, one must find a consistent way of labeling which is the event and which is the nonevent. Here, we characterize the prevalence of an outcome as being the smaller of *p* and *1-p*. We explore five values of prevalence that span the following range: 0.50, 0.25, 0.10, 0.05, and 0.01. If one were interested in an event with prevalence *p* greater than 0.50, one would simply refer to the properties of *1-p* in the tables that follow. For example, for an outcome with 0.75 prevalence, one would refer to our row with 0.25 prevalence. This convention, which is the most commonly used by NCHS and others, will be important when we calculate relative standard errors.

We consider four possible sizes of the applicable subgroup. A value of 1 means that the outcome in question applies to all discharges. A value of 0.50 means that the outcome applies to one-half of all discharges (e.g., males). A value of 0.20 means that the outcome applies to 20 percent of all discharges (e.g., minors), and a value of 0.05 means that the outcome applies to a 5-percent subgroup (e.g., those receiving a specific procedure). Table 10.3 gives examples of low, 5-percent prevalence, and high-prevalence dichotomous outcomes in small and large applicable subgroups.

The final characteristic of an outcome is its intraclass correlation coefficient. The ICC is a measure of the extent to which the outcome varies between hospitals, relative to the amount that it varies within hospitals. A value of 0 means that patients in the same hospital are no more similar on this outcome than are patients in different hospitals. For dichotomous outcomes, if the prevalence did not vary by hospitals, the ICC would be 0. The maximum possible value for an ICC is 1; negative values are possible, but they are very rarely observed. In most

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[8] These measures are not clinical outcomes per se, but are important NHDS measures and are used as outcomes in statistical models to explore the statistical properties of the NHDS (e.g., Shimizu, 1990).

[9] The precision of hospital-level statistics would be a function of (1) the number of hospitals if the PSUs are eliminated, assuming no sampling error at the hospital-level and (2) the number of records per hospital (assuming one is interested in hospital-level averages derived from discharges).

applications, an ICC of 0.01 is small, indicating little heterogeneity by a higher-level unit (in this instance, a hospital), and a value of 0.20 is high, indicating substantial heterogeneity. Values larger than 0.50 are uncommon.

Table 10.3
Examples of Outcome Prevalence and Size of Applicable Subgroup

	Small Applicable Subgroup	Large Applicable Subgroup
Low-prevalence dichotomous outcome	In-hospital infections for appendicitis	In-hospital mortality for women
High-prevalence dichotomous outcome	Six-month readmission after congestive heart failure	Received appropriate care for AMI

ICCs are of great importance, because the effective sample size per hospital can never exceed the inverse of the ICC (1/ICC), and the marginal returns from additional discharges per hospital are small beyond about 3/ICC discharges per hospital, the point at which an ESS of 0.75/ICC is achieved. For example, if an outcome has an ICC of 0.01, the maximum possible effective sample size is 1/0.01 = 100 and one achieves 75 percent of that maximum (i.e., ESS of 75 per hospital) at 300 discharges per hospital. If the ICC equals 0.25, the maximum ESS per hospital is 1/0.25 = 4 and one achieves 75 percent of that potential (i.e., an ESS of 3 discharges per hospital) at a mere 12 discharges per hospital. Note that ICC varies by outcome; to a lesser extent, it may vary for the same outcome by applicable subgroup. Finally, note that in multivariate applications (e.g., multivariate logistic regressions), the ICCs of interest apply to the residuals of the parameters of interest. Such ICCs are often lower than those for the unadjusted dichotomous outcomes themselves, but this is not necessarily the case.

To get a sense of the range of ICCs in the NHDS and a sense of the typical heterogeneity of discharges by hospital, we computed ICCs for seven dichotomous characteristics in the 2004 NHDS. Table 10.4 reports these ICCs. Although not traditional health services outcomes, the seven measures are typical of measures studied by NCHS to understand variation by hospital. They include four conditions (acute myocardial infarction, asthma, psychiatric diagnoses, and newborn birth) and three demographic indicators (patient is female age 20-44 years, patient is black, and patient is age 14 or younger). These ICCs range from 0.008 to 0.462, with a median of 0.158. The rate of AMI and asthma (as a proportion of all discharges) varies little by hospital; the proportion of young adult females varies to a small to moderate extent, the proportion of black patients and the proportion of psychiatric patients varies substantially, and the newborn and youth proportions vary markedly by hospital. The most variable measures are likely to reflect either the hospitals' tendency to specialize in the care of certain subgroups or the demographics of the population they serve.

Given these results and the range of ICCs typically observed, we consider four levels of ICC that span the likely range of values: 0.01 (small), 0.05 (small-moderate), 0.15 (moderate-large), and ≥0.30 (very large). The proposed new NHDS data elements may have ICCs that differ from the examples examined here; however, the broad range of ICCs examined should include many of these and other unspecified outcomes.

Note that these ICCs do not account for stratification by variables, such as bed size; true variances are likely to be slightly lower. On the other hand, not directly accounting for nonresponse weighting, as noted earlier, will have a somewhat compensatory effect.

Table 10.4
Intraclass Correlation Coefficients for Seven Dichotomous Measures - 2004 NHDS

Discharges that are:	ICC
Acute myocardial infarction (AMI)	0.008
Asthma (ICD-9-CM 493.X)	0.022
Patient is female age 20-44 years	0.059
Patient is black	0.158
Any psychiatric diagnosis (ICD-9-CM 290.X-319.X)	0.173
Newborn births	0.322
Patient is age 14 or younger	0.462

In exploring the statistical properties of each of the 16 designs (combinations of number of hospitals and number of discharges per hospital), we consider a total of 80 outcome scenarios, for a total of 16 x 80 = 1,280 assessments. The 80 outcome scenarios represent all possible combinations of five different outcome prevalences, four different sizes of the applicable subgroup, and four different values of the ICC. These scenarios just consider design effects of clustering of discharges within hospitals; they do not consider the design effects due to weighting or PSUs, neither of which varies much from design to design. Appendix L contains 16 tables that summarize these 1,280 assessments, one for each of the 16 designs. See Table 10.2 for a description of how tables correspond to designs.

Evaluating the Designs and Scenarios

The first three columns of the appendix tables label the described outcome scenario in terms of the prevalence, applicable subgroup size, and ICC. The remaining eight columns report statistics that are a consequence of the design and outcome scenario.

Design Effects and Effective Sample Sizes. Column 4 is the number of applicable cases per hospital. It is the product of the number of discharges per hospital and the proportion of discharges to which the outcome is applicable. For example, if the design involved 50 discharges per hospital and the outcome scenario was applicable to a 5-percent subgroup, the number of applicable discharges per hospital would be 50 x 0.05 = 2.5. Column 5 is the design effect from clustering. As described in Kish (1985), the design effect from the clustering of discharges within hospitals will be approximately $1+(B - 1)r$, where B is the number of applicable discharges per hospital and r is the ICC.

Table 10.5 summarizes the design effect observed from clustering of discharges within hospitals across the set of 80 outcome scenarios for each of the

four numbers of sampled discharges per hospital. This information is a summary of the design effects that appear as Column 5 in the Appendix L tables. Note that this design effect does not depend upon the number of hospitals. The second column of Table 10.5 shows that the scenario with a minimum design effect results in a very low design effect in all four designs. With 25 sampled discharges per hospital, the design effect is essentially 1.00, indicating no variance inflation from clustering. Even with 600 sampled discharges per hospital, one outcome scenario has a design effect of only 1.29. This best case will correspond to the smallest ICC and the smallest applicable subgroup. The third column of Table 10.5 corresponds to the worst scenario for a design effect: Ranging from 8.20 for 25 discharges per hospital to 180.70 for 600 discharges per hospital, these design effects apply to outcomes that are applicable to all discharges and that have the largest ICC.

The fourth and fifth columns, corresponding to the median and mean design effects, respectively, give a sense of what design effects are typical. Median design effects from clustering are reasonably small (1.41-2.20) for designs with 25-100 discharges per hospital, but are large (12.83) for 600 discharges per hospital.

Table 10.5
Design Effects from Clustering Discharges Within Hospitals, by Discharges per Hospital, Summarized Across 80 Outcome Scenarios

Sampled Discharges per Hospitals	Minimum	Maximum	Median	Mean	Standard Deviation
600	1.29	180.70	12.83	34.34	47.42
100	1.04	30.70	2.20	6.39	7.82
50	1.02	15.70	1.85	3.66	3.89
25	1.00	8.20	1.41	2.27	1.91

Summaries of Measurement Precision

Column 6 of the Appendix L tables is the effective sample size (ESS) per hospital, which is the applicable discharges per hospital divided by design effect. For example, with 50 discharges per hospital and an outcome applicable to 5 percent of discharges that had a 0.05 ICC, the design effect would be 1+(2.5 - 1)0.05 = 1.075, and the effective sample size per hospital would be 2.5/1.075 = 2.326.

Column 7 is the total effective sample size (ESS), which is the product of the effective sample size per hospital and the number of hospitals. If the last example came from a design involving 250 hospitals, the total effective sample size would be 250 x 2.326 = 581.4, which means that the precision of the estimate for that outcome (based on 12,500 discharges, 625 of which were applicable from 250 hospitals) would be equivalent to the precision obtained from a simple random sample of approximately 581 applicable cases.

Relative Standard Errors. Column 8 contains the standard error (SE) for the dichotomous outcome. It is computed by the standard binomial formula SQRT($p(1 - p)/n$), where p is the outcome prevalence and n is the total effective

sample size. For example, if p = 0.10 and the total effective sample size is 1,600, the standard error is SQRT((0.10)0.90)/1600) = 0.0075. Under the normal approximation to the binomial, estimates should lie within one standard error of their true value approximately 68 percent of the time. The standard error can also be interpreted as the approximate average expected absolute distance of the estimate from its true value under the same approximation. Thus, under the hypothetical scenario described above, the expected error for the 10-percent prevalence outcome is 0.75 percent.

NCHS often characterizes measurement precision in terms of the relative standard error. The RSE for a dichotomous outcome with prevalence p and standard error SE is defined as $SE/min(p, 1 - p)$. In other words, it is the ratio of the standard error to the prevalence, if the prevalence is 0.50 or lower; and the ratio of the standard error to the complement of the prevalence, if the prevalence is greater than 0.50. In the previous hypothetical example, the RSE would be 0.0075/0.10 = 0.075. RSEs less than 0.10 are generally considered "good," and they usually indicate sufficient precision for meaningful cross-tabulation and multivariate modeling. RSEs between 0.10 and 0.30 are considered "acceptable" and usually indicate insufficient precision for cross-tabulation or modeling but sufficient precision for usable prevalence estimates. RSEs greater than 0.30 are generally considered "unacceptable," and they typically indicate precision that is too poor to be useful for prevalence estimates. Column 9 contains the RSE. Columns 10 and 11 contain indicators of whether the RSE exceeds 0.30 (indicating *unacceptable* precision) or exceeds 0.10 (indicating that precision is not *good*), respectively.

Figures 10.1 through 10.4 summarize the proportion of scenarios with good measurement precision (RSE<0.10), acceptable measurement precision (0.10≤RSE<0.30), and unacceptable measurement precision (RSE≥0.30) in each of the 16 sample designs, corresponding to 125 hospitals, 250 hospitals, 500 hospitals, and 1,000 hospitals, respectively. The four columns within each figure correspond to 25, 50, 100, and 600 discharges per hospital. In the smallest design (a total of 3,125 discharges from 125 hospitals), measurement precision is good for about 40 percent of scenarios, acceptable for about 40 percent of scenarios, and unacceptable for about 20 percent of scenarios. In the largest design (a total of 600,000 discharges from 1,000 hospitals), measurement precision is good for about 90 percent of scenarios and is acceptable for the remaining 10 percent. For reference, the design that most closely resembles the current NHDS (300,000 discharges from 500 hospitals) has good measurement precision for 80 percent of scenarios and acceptable precision for 20 percent of scenarios if we assume that PSUs have been eliminated, as well as design effects from unequal weighting, an assumption made throughout this section.

For a given number of total discharges, measurement precision is generally better with more hospitals and fewer discharges per hospital. For example, 12,500 total discharges from 125 hospitals yields good measurement precision for about 50 percent of scenarios, acceptable for about 40 percent, and unacceptable for about 10 percent. A total of 12,500 discharges from 500 hospitals yields good measurement precision for about 65 percent of scenarios, acceptable for about 30 percent, and unacceptable for about 5 percent.

On the other hand, a fixed number of discharges is generally more expensive when gathered from a larger number of hospitals. Within a fixed number of hospitals, measurement quality improves with the number of sampled discharges per hospital, although the gain is a bit slower with 1,000 hospitals. These gains from more discharges per hospital will occur mainly for outcomes applying to small subgroups or to low-prevalence outcomes with low ICCs. The gains from increasing the number of hospitals are more uniform, although these gains result in changes in our measurement categories least frequently when there are 600 discharges per hospital. The improvement in the distribution of measurement precision is especially apparent when increasing the number of hospitals from 125 to 250, with 100 or fewer discharges per hospital.

Figures 10.1 through 10.4 summarize across the 80 outcome scenarios, but they do not necessarily describe *which* outcome scenarios have what degree of measurement precision.

Figure 10.1
Summary of Measurement Precision for 80 Outcome Scenarios–
125 Hospitals

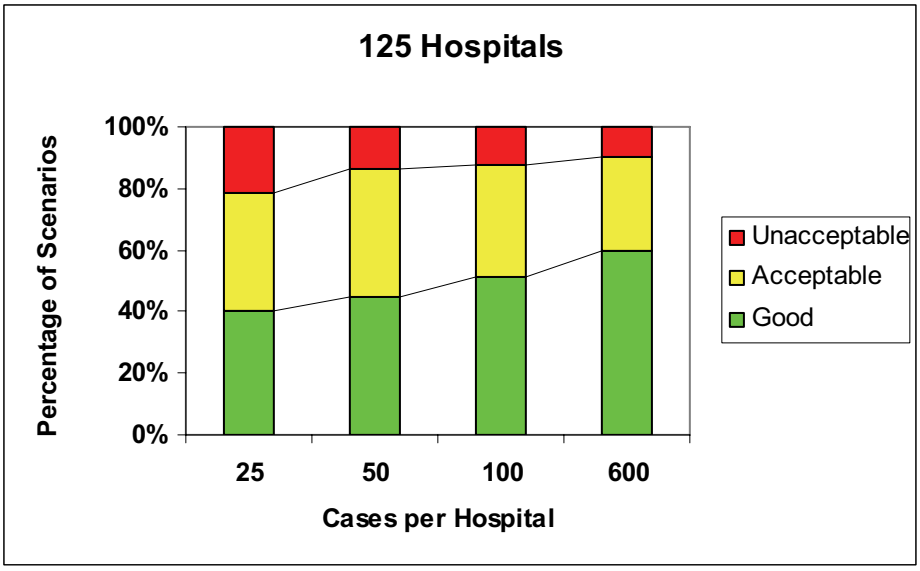


Figure 10.2
Summary of Measurement Precision for 80 Outcome Scenarios–250 Hospitals

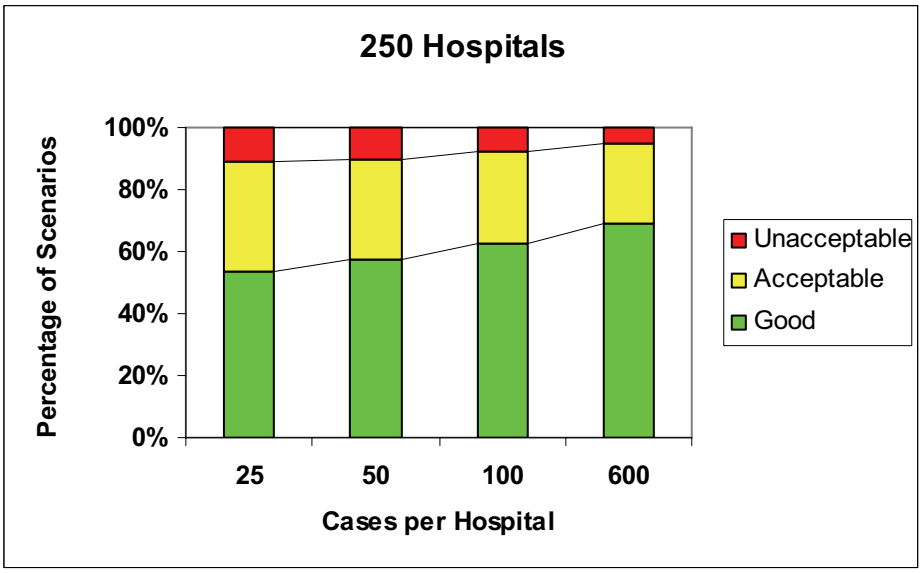


Figure 10.3
Summary of Measurement Precision for 80 Outcome Scenarios–500 Hospitals

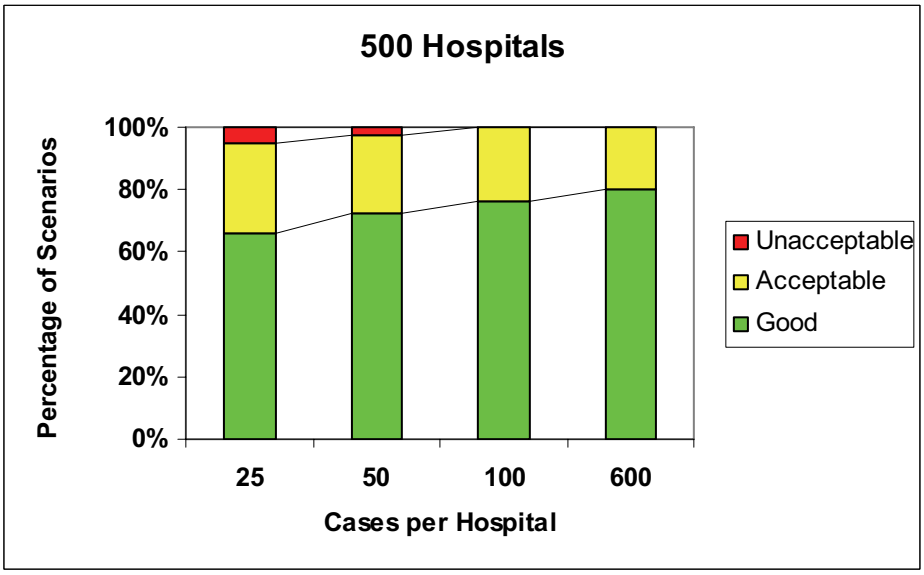
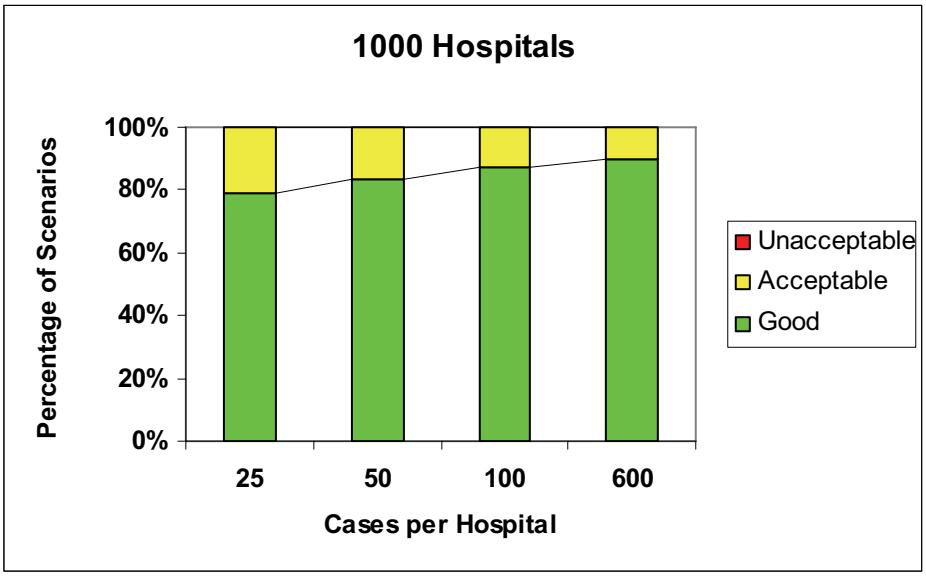


Figure 10.4
Summary of Measurement Precision for 80 Outcome Scenarios–1000 Hospitals



Although the full details are contained in the 16 Appendix L tables, Table 10.6 below provides additional detail for six key designs: 25 and 100 discharges per hospital at each of the three most feasible options for number of hospitals.

Table 10.6
Measurement-Precision Details for Six Design Scenarios

Number of Hospitals	Discharges per Hospital	
	25	100
125	50% prevalence outcome precision is always good 25% prevalence outcome precision is good in most cases; acceptable in 5% subgroup 10% prevalence outcome has acceptable precision always 5% prevalence outcome precision is acceptable in larger subgroups; unacceptable in 5% and small subgroups 1% prevalence outcome generally has unacceptable precision	50% prevalence outcome precision is always good 25% prevalence outcome precision is almost always good 10% prevalence outcome precision is good when ICC≤ 0.05 or less; otherwise, acceptable 5% prevalence outcome precision is good when ICC≤0.01; otherwise, acceptable 1% prevalence outcome acceptable when ICC≤0.05; otherwise, unacceptable

Table 10.6, Cont.

Number of Hospitals	Discharges per Hospital 25	100
250	50% and 25% prevalence outcome precision nearly always good 10% prevalence outcome is good, except in small subgroups or when ICCs are very high 5% prevalence outcome is good when ICC≤0.05; otherwise, acceptable 1% prevalence outcome is acceptable, except in small to medium subgroups and with larger ICCs, for which precision is unacceptable	50% and 25% prevalence outcome precision is always good 10% prevalence outcome precision is good, except when ICCs are very high 5% prevalence outcome is good when ICC≤0.05; otherwise, acceptable 1% prevalence outcome is acceptable, except at highest ICCs,
500	50% and 25% prevalence outcome precision is always good 10% prevalence outcome is good, except for smallest subgroups, for which precision is acceptable 5% prevalence outcome is good when ICC≤0.05; otherwise, acceptable 1% prevalence outcome is acceptable, except in smallest subgroups	50% and 25% prevalence outcome precision is always good 10% prevalence outcome precision is always good 5% prevalence outcome is good, except for highest ICCs, when it is acceptable 1% prevalence outcome is acceptable across the board

Conclusions and Recommendations

The NHDS can substantially improve precision by dropping a third tier of sampling hospitals within PSUs and may realize some additional gains by reducing disproportionate weighting. Such an improved NHDS, even at current sample sizes, would probably be more accurate than the NIS for the items that are similar in both surveys. However, the greatest potential for the NHDS to increase its utility is to achieve greater clinical depth of elements, allowing more-sophisticated health services and health policy analyses than are currently possible. Such an expansion of depth would be more costly per sample size, so that the current NHDS size of 300,000 discharges annually would probably have to be reduced.

We consider a variety of estimation problems that might be of interest in a redesigned NHDS, using a necessarily simplified model of outcome and variance structures. Analyses of 16 sample designs suggest that, with a less disproportionate 2-stage sampling approach, as few as 50,000 discharges annually, if they came from 500 hospitals, might provide appealing measurement precision that would support many such analyses ("good" measurement precision for most scenarios and "acceptable" for others). At an average paper-record-abstraction time of 45 minutes

per record and an average personnel cost of $40/hour,[10] the labor costs for abstraction alone will be a minimum of $1.5 million. This does not include costs for project management, hospital induction, quality control, or data processing, which could be equal to the actual abstract costs. The minimum target level of 250 hospitals and 50 discharges per hospital, for a total of 12,500 records, would cost a minimum of $375,000 but would provide significantly reduced precision, good for only about half the measures and unacceptable for 10 percent of them.

For the NHDS, NCHS might wish to consider sampling discharges to minimize the design effect due to clustering of prevalent outcomes through within-hospital stratification of discharges, undersampling the most prevalent outcomes in favor of rarer outcomes. Carrying out this sampling approach, however, might be unduly burdensome to hospitals and abstractors. Finally, the NHDS currently does not try to replace uncooperative hospitals (although contact is made with them annually to try to recruit them), and the NHDS may want to consider doing so.

As a further option, NCHS may wish to consider forming a group of National Statistical Hospitals, a representative set of hospitals where patients would consent at the time of admission to have data collected and reported to NCHS about their care, including pre- and post-hospital stays. Patients who "opted out" would, of course, not be included. This might be accomplished by recruiting the group of hospitals selected for the enhanced design to become the first set of National Statistical Hospitals. Having hospitals get consent from their patients for participation in NCHS data collection at admission might overcome hospitals' concerns, if any, about providing identifiable patient information needed to track long-term outcomes, such as names and Social Security numbers. These hospitals could also become a laboratory for experimentation with means of electronic data collection or could provide NCHS with a census of discharges thereby allowing for complex and ad hoc sampling to flexibly meet new-client analysis requests. However, negotiating this level of participation might make hospital induction more costly and complicated. Moreover, having hospitals so designated might make it difficult to refresh the hospital panel by dropping hospitals that are no longer eligible. Finally, having patients able to "opt out" of participating would make the sample less representative than it is now, since, currently, patient-level nonresponse comes only from missing records.

[10] Based on a consultant/vendor annual salary of $84,383, according to an American Health Information Management Association (AHIMA) 2006 survey of coders (http://www.ahima.org/membership/member_profile_data.asp; accessed March 16).

Part Four:

Conclusions

11. Conclusions

NCHS leadership is taking a bold step by undertaking the first fundamental redesign of the NHDS since its inception over 40 years ago. Although the proposed redesign is clearly ambitious, its implementation offers an opportunity for the survey to continue to be invaluable to the health policy and research communities in the decades to come. The redesigned survey also provides a framework that is flexible enough to incorporate more-complex data in the future to answer an increasing repertoire of questions about our health system, particularly as the sophistication of America's health information technology advances to facilitate data collection without the need for manual chart abstraction. Ambitious as the redesign may be, the feasibility study suggests that it is achievable with careful planning and execution.

The NHDS was designed as a general-purpose survey, a property that RAND believes is essential to maintain as the redesign efforts continue. We have demonstrated, however, that it is possible to incorporate depth and breadth into the survey without compromising the basic premise on which the NHDS was founded.

The proposed redesign introduces new classes of variables that, in combination, will allow researchers to address a broad range of policy and research questions that will be important to guide health and health care policy decisions in the future. It also offers opportunities to better inform current research by providing greater depth than is currently available from existing surveys. Not only does the redesigned survey include a range of new variables (e.g., reimbursement, laboratory values, present-on-admission flag), it provides a structure for incorporating modules that can focus in detail on selected issues of interest (e.g., appropriateness of care, management of HIV, detailed costs for treating patients needing hip replacement), which may not lend themselves to incorporation in the general-purpose survey. The proposed redesign includes not only a new Patient Abstract Form but also a Facility Questionnaire; combining hospital and patient data will offer insight into differences in clinical care based on the type of hospital organization in which that care was provided.

Research and Policy Questions That Can Be Examined Through Redesigned Survey

The redesigned survey will allow for a range of new research and policy questions to be explored. In the following paragraphs, we highlight ways in which the survey can be used to address questions related to the five high-priority policy issues identified by the Workgroup.

Cost of Care and Resource Use

The redesign introduces, for the first time, new variables related to reimbursement for care. These variables will supplement information already available on costs of care, which are approximated through charges submitted on hospital bills. The addition of variables on reimbursement will allow for examination of more-complex

issues, such as cost shifting among different payers and patients, and the relationship among costs, charges, and actual reimbursement.

Stakeholders expressed interest in better understanding the allocation of resources and the need for greater transparency in cost and pricing. The redesign addresses these needs by introducing information on both expected and actual reimbursement. For example, data from the Facility Questionnaire could be used to identify hospitals with different payer mixes (e.g., high or low proportion of Medicaid patients or self-pay patients), while patient data could then be used to determine whether individual patient encounters are profitable (i.e., reimbursement exceeds cost) or unprofitable (i.e., cost exceeds hospital reimbursement). These findings might be analyzed for the entire patient mix in participating hospitals or for specific diagnoses and procedures captured through ICD-9-CM codes. Data on differences between actual and expected reimbursement might also be used to examine the consequences of external case management and utilization review by third-party payers. This will be the first time a nationally representative set of data will be available to address potential gaps between cost of care and reimbursement for services.

The NHDS dataset can also be used to generate models to predict expected costs. When applied to subsequent NHDS discharges, the new survey can then be used to identify facility characteristics (based on the Facility Questionnaire) that result in higher or lower costs and lengths of stay than expected, based on the risk-adjusted model. The depth of clinical information provided by the redesigned survey offers the ability to develop a significantly more robust risk-adjustment model than is currently possible.

Collecting data on medications used during the patient's stay is important for understanding both costs of care and quality. Unfortunately, this variable proved to be too time-consuming to incorporate into a redesigned manual survey. Medication administration records varied considerably across organizations, with some being electronic and some manual. Abstraction was also challenging due to differences in medications ordered, dispensed, and administered. Medication names were frequently misspelled, and both brand and generic names were used.

However, because of the importance of collecting information on inpatient medications and because such data are absent from current public databases, RAND recommends that NCHS continue to explore strategies for collecting this information electronically. If these data remain difficult to collect in the pilot study, modules might be considered to examine medication use through special studies, as discussed below.

The general survey will not have sufficient depth to answer very focused questions related to cost of care (e.g., the cost of laboratory services for patients admitted for treatment of thyroid cancer or the resources spent on services tangential to the reason for admission, such as might occur when dental services are provided to a patient admitted for general surgery). However, special modules designed specifically for such analyses can be used to answer questions such as the number of nursing hours allocated to patients with a particular acuity or the cost of antibiotic medications for treating patients with gram-negative sepsis.

Quality of Care and Patient Safety

Quality of care and patient safety are and will continue to be critical issues in health services research. A key focus is understanding the degree to which processes of care are consistent with recognized quality standards and practice guidelines. Drawing meaningful inferences regarding quality of care requires a clinical context in which that care is provided. The proposed redesign dramatically expands the survey's clinical information by incorporating laboratory data, vital signs, medications on admission and discharge, ASA classification, and other clinically relevant variables. The redesign also captures whether diagnoses existed on admission, an important determinant in differentiating between adverse situations that led to hospitalization and complications that resulted from the care provided.

The redesigned survey begins to define variables that will link structure, process, and outcomes of care. Structural information (i.e., information on the facility and environment in which care is received) provided on the Facility Questionnaire can be linked with clinical care processes (e.g., surgeries, medications at discharge, lengths of stay) to understand outcomes of care (e.g., 30-day readmission, mortality). For example, patients and families have come to expect shorter lengths of stay, with patients leaving the hospital for home or intermediate care with higher acuity than in previous years. Data from the survey can be used to examine the extent to which earlier discharge places a patient at risk for unanticipated (i.e., non-elective) readmission to the hospital. Using clinical variables at discharge contained in the redesigned survey, it will be possible to adjust for patient acuity at discharge and adjust for the discharge location. By relating findings to facility characteristics, researchers can assess whether facility-specific determinants (e.g., teaching status, rural versus urban, profitability) influence acuity at time of discharge. Two parameters that have already been shown to improve risk adjustment of hospital mortality are present-on-admission and key numerical laboratory values (Pine, Jordan, Elixhauser, et al., 2007).

There is considerable interest, within both the government and the private sector, in better adjusting for patient severity in order to estimate quality performance and reimbursement (Centers for Medicare and Medicaid Services, 2006). The current focus is on extracting more information from administrative data sources (i.e., primarily diagnosis and procedure codes). The richness of the data contained in the redesigned survey could facilitate policy analyses to determine strategies for incorporating additional, non-administrative variables that better adjust for patient severity. Once selected, variables could then be tested to determine their value in quality reporting (and pay-for-performance) programs.

The NHDS also provides the opportunity to retrospectively examine adoption trends for new procedures and types of care to assess their effect on quality and outcomes. For example, the current NHDS has been valuable in studying disparities in the adoption of cardioverter defibrillators. (Stanley, DeLia, and Cantors, 2007) The redesigned NHDS offers the opportunity to look beyond the hospital care received to evaluate the mortality impact of the care through linkage to the National Death Index.

Another important quality issue relates to the training and experience of those providing care. The proposed survey captures the attending and operating physicians' National Provider Identifiers (NPIs) as part of the discharge abstract,

offering the ability to link the individual patient's care with the specialty of the providers from whom care was received. Information linking provider identifiers to their characteristics (e.g., specialty, provider age) is publicly available. To maintain provider confidentiality, NCHS will need to create a database of NHDS data containing key provider characteristics (e.g., specialty, provider age) in a de-identified publicly available file.

RAND evaluated the possibility of collecting a provider identifier for the individual associated with each coded procedure, which would have provided more information regarding the types of specialists (e.g., general surgeons, intensivists, family physicians) treating patients in America's hospitals. However, such collection proved to be extremely challenging and usually required manual linkage between procedure notes and identifiers that abstractors must obtain from hospitals' Medical Staff Offices. RAND believes that, at this time, the optimal degree of specificity that can reasonably be obtained on providers is limited to the admitting and, when appropriate, the operating physician. However, for hospital-level studies, the Facility Questionnaire provides data on the levels and types of licensed independent practitioners in the facility and the ways in which hospital units are staffed. An additional layer of depth can be provided if linkages can be established to provide residency staffing. Moreover, with increasing sophistication of electronic health records, the ability to collect data on additional providers at the patient level will be enhanced.

Another high priority for the government and health care organizations is better understanding of safe practices in the hospital. Our discussions with national patient safety leaders suggest that the additional proposed clinical variables will facilitate strategies to improve the specificity of AHRQ's Patient Safety Indicators (AHRQ, 2006). For example, death in low-mortality DRGs (defined as expected mortality under 0.5%) is more likely to represent a health care error than a natural event. To increase specificity, the indicator already excludes trauma patients, patients who are immunosuppressed, and patients with cancer. Increased clinical detail, provided through such variables as vital signs and laboratory values on admission, offers the opportunity to increase the specificity of the indicator by further excluding patients who present with very high acuity, even though their condition maps to a low-mortality DRG. Similar adjustments for confounding conditions could be made to study many patient safety indicators now being used while providing a basis to explore the incorporation of indicators that were initially rejected because administrative data could not distinguish consequences of care from clinically expected events.

The general survey lacks sufficient detail to adequately address issues related to appropriateness of care or to fully respond to the wide range of quality indicators either being used or being developed. For example, the assessment of appropriateness of coronary artery bypass surgery (CABG) requires patient findings to be related to established, procedure-specific appropriateness criteria (Fitch et al., 2001). Because appropriateness criteria are specific to patient condition and procedure, this type of assessment is uniquely amenable to focused modules related to care for patients with known coronary artery disease.

Care Delivered Throughout the Hospital

By incorporating data on patients with "observation" status, the redesigned survey provides a more complete picture of care delivered throughout the hospital than has been possible in recent years, as more and more patients receiving services were treated as "outpatients" and therefore not captured among inpatient discharges. By design, the survey includes patients receiving short-stay or observation services in hospital settings and who are coded and billed as outpatients. Incorporating these "outpatients" into the NHDS will help to reconstitute the patient composition of the survey of previous decades, thereby making possible, for the first time, an understanding of the effect this practice shift has had on the services, intensity of care, costs, reimbursement, and outcomes. For example, the redesigned survey will make it possible to determine whether care differences (e.g., intensity of service and quality of care) exist for patients with similar presenting and treatment situations based on patient admission status. The feasibility study focused on "observation" patients using CMS's definition. However, assignment to observation status is inconsistent both within organizations, where it varies by payer, and between organizations that struggle to accurately assign patient status. Future studies may wish to explore whether all patients occupying hospital beds, either observation patients or simply outpatients, should be included in the NHDS.

Continuity of Care and Transitions

Continuity of care, particularly as patients transition from the hospital environment to lower levels of care (e.g., home, assisted living, hospice, intermediate care), is frequently cited by patients as a major weakness. Health policy experts also frequently noted the lack of longitudinal data. Although practical considerations limited the extent to which longitudinal data could be included in the redesigned survey, the redesign will allow for examination of the effect of patients' discharge arrangements on their use of hospital services (e.g., using variables such as discharge location, length of stay, and 30-day readmission or emergency department visits). For example, patients recovering from acute brain injury may be discharged home, to acute rehabilitation, or to a long-term care facility. After partially adjusting for stability at discharge using vital signs and coded diagnoses, it may be possible to examine the implications of discharge location on mortality and hospital readmission within 30 days. Discharge medication information specifically inquires about whether patients left the hospitals with IV medications, which when present signifies a situation requiring more-intensive patient post-discharge management. This redesign only begins to look at longitudinal issues. Future revisions, and perhaps focused modules, should examine opportunities to further explore the care patients receive over the course of an illness or period of time.

Disparities and Access

The Institute of Medicine has included equity among the six key properties or domains of quality. Equitable treatment of patients requires that each individual receive health care of equal quality, irrespective of personal characteristics other than their clinical condition and preferences for care. The redesigned survey will facilitate studies of equity in care by providing additional detail by which to identify patient personal characteristics unrelated to their clinical condition. For example, the

survey will, for the first time, provide a national sample of patients' English proficiency, which can be linked to processes and outcomes of care. A better understanding of patient socioeconomic status will be possible, because the inclusion of the address variable in addition to zip code will facilitate sophisticated geocoding, thus allowing for better estimates of patient and family income, race and ethnicity, and education. This detailed patient information, of course, must be de-identified by the NHDS to be available for public use. Data from the redesign can also be used to address whether longer lengths of stay occur for some patients with lower SES who cannot be triaged to an appropriate lower level of care. Relating patient SES to insurance status and hospital type (e.g., rural or urban), particularly after adjusting for acuity at discharge, will offer insight regarding the extent of differences in care that patients of different SES receive.

Other Issues

In the discussion above, we elected to focus on those five policy issues that the Workgroup ranked as the most important. The survey, however, offers both the depth and flexibility to address components of almost all of the issues that the Workgroup affirmed were important for NCHS to consider for the redesign. For example, the survey can help inform discussions on the role and value of the electronic health record. The Facility Questionnaire will provide data on the extent to which electronic health records have been adopted within a facility, and this information can then be linked to the efficiency and quality of care provided, using the cost and quality metrics discussed above.

Similarly, the redesigned NHDS should continue to be an extremely valuable public health resource by providing trended data on hospital use, including diagnoses and procedures of particular interest (e.g., Cesarean section rates, use of coronary stents). The inclusion of observation care and potentially other outpatient care when patients occupy hospital beds will facilitate comparison of services provided by America's hospitals over time.

Costs of Data Collection

Adding a requirement for primary data collection does not come without a substantial increase in per-record cost. RAND acknowledges this reality; however, we strongly believe the additional investment in this survey will give it the ability to address policy and research questions that will ensure that future health care investments–-which are orders of magnitude more costly than the added cost of the survey–are well spent. The actual cost of the survey will vary depending on the number of participating hospitals, their geographic dispersion, the number of records abstracted per facility, and the number of data elements abstracted per record. We describe here some considerations that can be used by NCHS to inform the pilot study.

Number of Participating Hospitals

Adding additional hospitals increases the fixed cost of data collection because each facility must be inducted into the survey and NHCS staff must work with hospital officials and employees to consistently obtain data in the desired format. The

amount of effort required to train hospital staff depends on their role relative to NCHS staff or contractors. Even if NCHS should elect to centralize or outsource data abstraction, hospitals must still retrieve relevant records and prepare them for submission.

Geographic Dispersion

As discussed in Chapter 10, the NHDS currently samples hospitals by PSU, which was motivated by analytic goals that are no longer applicable. Such an approach always has costs in statistical efficiency, but in the case of NHDS, corresponding cost savings in data collection were not realized. Eliminating this third level of sampling increases the effective sample size of the survey but may not affect costs. An all-manual data collection might make working with unclustered hospitals somewhat more costly than clustered hospitals, particularly if data abstraction is decentralized.

Number of Records Abstracted per Facility

The Design and Statistical Considerations chapter discusses the implications of altering the number of records abstracted per facility. It may be possible to reduce the number of records per facility if facilities are directly sampled rather than clustering them geographically. However, it is important to maintain collection of a sufficient number of records at each facility to ensure that the facility makes a substantive contribution to the survey. Abstracting a sufficient number of records per facility increases incentives to develop electronic approaches to data collection; this positions the organization to more easily add additional elements that NCHS may propose in the future.

Number of Data Elements Abstracted per Record

We anticipate that the current abstraction form will require an average of 45 minutes per record to complete. However, observed abstraction time decreased with experience; therefore, if hospitals will be abstracting their own records in the future, we expect that those who agree to an ongoing relationship with the NHDS can anticipate shorter abstraction times as the duration of their participation increases. Additional hospital costs include computer programmer time, record-pulling time, and facility form completion. If NCHS maintains responsibility for record abstraction, abstraction costs, calculated at $40 per hour, would alone total $1.5 million for 50,000 records. Shortening the abstraction by one-third through efficiencies and use of the UB-04 data when available would reduce the marginal cost of data collection by approximately the same amount. If abstraction is centralized by NCHS or outsourced to a contractor, anticipated copying and shipping costs could add $1 million, assuming the current per-page contract rate that CMS pays hospitals when submitting records for review.

The redesign offers several strategies for minimizing the cost burden of the survey, both on participating hospitals and on the NCHS. First, the introduction of focused modules minimizes the nonproductive collection of data elements that results when static survey designs cannot restrict data collection to those patients for whom specific elements are relevant. Second, the statistical analysis presented in

Chapter 10 offers redesign considerations that minimize the number of records required with minimal loss of statistical power to draw significant observations.

Use of Health Information Technology

Lastly, RAND acknowledges that this study comes at a time of transition for most health care organizations. As the field of health information technology matures and facilities adopt increasingly robust electronic health records, the potential exists to harness additional depth beyond that which is financially or technically practical today. The ability to leverage the adoption of health information technology is dependent on increased data standardization, something that is of key interest to and a substantial focus of the federal government, vendors, providers, and policymakers as represented by the work of the American Health Information Community (AHIC) and the Certification Commission for Health Information Technology (CCHIT). In this context, RAND believes that the proposed redesign of the NHDS actually represents the beginning of an ongoing expansion of the richness of the NHDS and that NCHS leadership must continually monitor the state of information technology adoption and incorporate new developments as they reach sufficient maturity. The Workgroup also emphasized, and RAND agrees, that NCHS should not only react to developments as they occur but also take an active leadership role in shaping the data infrastructure of tomorrow.

Although beyond the scope of this project, RAND repeatedly heard from researchers, policymakers, the Workgroup, and our reviewers that the Department of Health and Human Services should actively examine strategies to harmonize at least the federal surveys of hospital care in the United States, and potentially other surveys as well.

Increasing Awareness of NHDS's Advantages

Discussions with health care leaders and hospital database users revealed that many are not aware of the unique advantages that even today the NHDS offers over other surveys. Most notably, researchers and policymakers turn to larger databases because of the increased precision that comes from larger sample sizes. Although the relationship between sample size and precision is well recognized, the influence of potential bias goes largely unappreciated. For many research questions, the error introduced by bias from not using a nationally representative sample, even when that bias is relatively small, may overwhelm the statistical advantage that comes with better precision from large samples. NCHS thus has an opportunity to educate potential users regarding the advantages that the current NHDS, through its sampling design, offers.

Future Considerations

In moving forward with the pilot study, NCHS should also keep other considerations in mind:

Abstraction Tools

Future pilots using computerized data-abstraction tools should have the ability to better incorporate skip patterns and contextually relevant questions (e.g., disease- and age-specific branching logic). This ability will both expedite data collection by minimizing irrelevant data abstraction and allow the survey to be used to probe more-detailed questions when clinically relevant (e.g., cardiac enzymes in the context of chest pain or myocardial infarction). Computerized abstraction tools could also decrease abstraction time by allowing hospitals to provide electronic submission of their data (e.g., discharge abstract, laboratory values). Increasing standardization of clinical vocabulary and transmission standards could permit the integration of medications during hospitalization and other items too tedious to collect in a paper-based environment.

Creating Files for Public Use

NCHS has a long history of respecting the confidentiality of its participants. The proposed redesign survey collects additional patient-identifiable data that must be deleted before survey files are made available for public use. The NHDS will require the infrastructure to create necessary linkages to external files (e.g., Social Security number and the National Death Index, National Provider Identifier and provider type), obtain the requisite demographic and other data, and then delete sensitive information before public release.

National Statistical Hospitals

The Workgroup recommended that NCHS focus on identifying and developing a network of National Statistical Hospitals through which could explore alternative data-collection strategies. Strategies discussed in this document could streamline data collection by, for example, prospectively incorporating patients' consent to use their PHI in their admission forms. National Statistical Hospitals would partner with NCHS to electronically collect data and perhaps extend data collection longitudinally. By collecting all patient discharges from National Statistical Hospitals, it will be possible to perform complex sampling algorithms and facilitate ad hoc analyses.

Limitations

This report discusses the findings of RAND's feasibility study. By intent, the feasibility study had a number of limitations that must be explored before the full redesigned survey reaches the field. The compression of the timeline for conducting the feasibility study in the field introduced a number of additional limitations. We discuss the following key limitations because we believe they must be addressed in order to ensure a successful redesign effort.

Response Rate

A limited hospital recruitment timeline necessitated moving to a convenience sample that included primarily facilities with which RAND or NCHS had existing relationships. Characteristics of hospitals used for the feasibility study, however,

approximated those we would have desired using a random process. We ultimately had a 50-percent response rate, not unlike that observed in other feasibility studies. However, the proposed redesign is more complex and time-consuming than other surveys. Whether randomly selected hospitals would consistently elect to participate following the induction visit, given the nature of the proposed redesign, remains untested.

Ongoing Data Collection

The feasibility study addressed primarily the issue of whether hospitals could collect the proposed data elements. The actual survey, when it reaches the field, will be dependent on ongoing data submission from participating hospitals. During induction, RAND asked hospitals to approach their work as if they would be participating in an ongoing survey or at least provide feedback as if this had been the approach. Because the feasibility was a one-time effort with an extremely compressed time frame, hospitals were unable to approach the exercise as if they would be doing so regularly. That is, the focus was on the outcome–completing the requisite facility and patient abstract forms–rather than on the process of how to best get those elements if they were to be regularly requested. Subsequent pilots should engage participating hospitals over an extended period to ensure that processes for collecting data are compatible with long-term, continual acquisition rather than a single-time effort.

Electronic Data Collection

Related to ongoing data collection, the participation time available for hospitals did not permit them to program their systems to efficiently extract requested data elements. Furthermore, a one-time study did not provide the necessary incentives to program queries to provide those elements. Our discussions with facilities suggested that, for those with electronic systems, three to six months of lead time should be anticipated, depending on competing priorities.

Obtaining Necessary Approvals

Because of the limited nature of the feasibility study, Office of Management and Budget (OMB) approval was not required. RAND anticipated that ERB approval would still be required, even if OMB clearance was not. However, the restriction that hospitals must not be contacted before final ERB approval was received was not expected. Time for ERB and OMB clearance must be factored into subsequent phases of the redesign.

Training

It is customary for RAND to conduct formalized training for abstractors when they are new to a study. The timeline made such a training program impractical. RAND elected to individually train participating hospitals by telephone, using the *Field Manual* as a guide. Although hospitals indicated they were comfortable with the study requirements, it was clear that additional training would improve participants' understanding of requirements and consistency of data reporting. On-site

abstractors with clinical experience had less difficulty abstracting variables of a clinical nature. Although clinically trained abstractors are ideal, the Clinical Data Abstraction Center (CDAC, York, PA) has successfully trained individuals with limited or no previous medical experience to abstract clinical data following six weeks of training.

RAND has completed the initial phase of the redesign of the National Hospital Discharge Survey. This report details the conceptual framework to guide the redesign and proposes, for NCHS consideration, a set of data elements to incorporate into future pilots and ultimately the redesigned NHDS when it reaches the field. The changes proposed are the first substantive revision to the NHDS in its over 40 years of existence. Although the proposed redesign will be challenging, it will ensure that the NHDS continues to be an indispensable tool for policymakers, researchers, providers, and the public.

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Appendix A

Revised Forms and Documents

Facility Induction
Facility Questionnaire
Patient Abstract
Patient Abstract Instructions

Facility Induction Form

National Hospital Discharge Survey
Facility Induction Form

Hospital Preparatory Background Information for Contract Staff

To be completed as preparatory work in advance of the visit. Some information will be redundant to the Facility Form, but will provide background and context for the surveyor before they enter the facility. This information can be validated during the interview process.

Hospital Name:			
CEO Name:			
Primary Contact:			
Phone:		E-mail:	
Fax:		Room number:	
Address:	Street:		
	City:	State	
	Zip:		

☐ Mapquest directions are attached from the hotel or most recent destination to the hospital

PLEASE OBTAIN GENERAL HOSPITAL STATISTICS FROM THE MOST CURRENT AHA GUIDE:

A. General Demographics (Year 20__ __)

Current Staffed Beds: _____ Total Admissions: _____

Births _____ Emergency Room ☐ Yes ☐ No

Teaching Hospital ☐ Yes ☐ No Primary teaching hospital for:_____

B. Type of Hospital (i.e., ownership):

☐ Government ☐ Proprietary ☐ Non-profit ☐ Church related or other religious affiliation

☐ Public Health Service ☐ Other, specify:_____

C. Primary Hospital Service:

☐ General (Excluded services):_____

☐ Children's ☐ Orthopedic ☐ Maternity ☐ Cancer

☐ Eye, ear, nose, & throat ☐ Heart ☐ Substance abuse ☐ Psychiatric

☐ Rehabilitation ☐ Other, specify: _____

D. Check list of items for contract staff to bring to the hospital:

- ☐ Introductory packet – 1 for each member of the staff present
- ☐ Feasibility Study Field Manual
- ☐ Sample products produced from the NHDS survey, e.g.,
  - o A sample report produced from NHDS data
  - o A CD-ROM containing multiple years of NHDS data
  - o Other

On Site Interview

Introduction
Thank you for arranging this meeting and taking the time to meet with us today. As you know, we are here to talk with you about participating in a feasibility study to redesign the National Hospital Discharge Survey, which we will call the NHDS. We are from RAND and are collaborating with the Centers for Disease Control and Prevention's National Center for Health Statistics in this important endeavor.

Perhaps we could all introduce ourselves before we get started. I am Name / Title / Institution, and continue through the room.

You should have received a package in the mail prior to this visit that contained the following materials:
- Introduction letters from Dr. Ed Sondick of the NCHS and RAND
- A description of the National Center for Health Statistics, the NHDS, and the feasibility test upon which we are about to embark
- Frequently Asked Questions related to this feasibility test
- CDC IRB Approval Letter
- The Patient Sampling Plan
- A Facility Questionnaire
- A Patient Abstraction Form

You may not have had the opportunity to read through the package, so we would like to discuss each of these with you or the appropriate parties during our time here today.

Background on the National Center for Health Statistics and the NHDS
Among other things, the National Center for Health Statistics (NCHS) is responsible for a family of surveys, referred to collectively as the National Health Care Survey (NHCS), which are designed to measure utilization of the health care delivery system, and are used for a variety of purposes in the public and private sector. A key component in the suite of surveys is the National Hospital Discharge Survey (NHDS). First conducted in 1965, the NHDS has been an important source of information on inpatient utilization in short-stay non-federal hospitals in the United States for many users. Although the NHDS focuses specifically on hospital inpatient care, it fits in a broader portfolio of surveys covering outpatient care, emergency room care, nursing home care, home health and hospice care, and ambulatory surgery center care. Your hospital may in fact participate in one or more of these studies, but RAND is not privy to that information.

About the Current NHDS: The current NHDS produces national estimates of the use of non-federal short-stay U.S. hospitals. The survey provides information on:
- Patient characteristics
- Lengths of stay
- Diagnoses and major surgical and diagnostic procedures
- Patterns of use of care in hospitals of different size and ownership and in various regions of the country.

These data are publicly available for researchers in federal and states government, hospitals, academia, and other institutions. The public use files do not allow identification of hospitals or patients. They are used for health services research, public health, to inform health care policy and for many other areas of study of the U.S. inpatient population.

Description and Purpose of the Study and Feasibility Test
We are here to request your assistance in testing a redesigned NHDS. RAND has been asked to collaborate with the CDC in this redesign process. In order to do so, we sought input regarding issues that our health care system will face over the foreseeable future (e.g., 20 years) from economists, clinicians, researchers, insurers, policy makers, and others - in government, academic institutions, and private business. Based on the input, RAND and NCHS determined the data elements to be included in this feasibility study and created the facility questionnaire and the patient abstraction form that we sent in the introduction package prior to our visit and that we would like to use in your hospital for the abstraction of 20 medical records.

The feasibility test will evaluate and refine the preliminary design of the framework and content of the redesigned NHDS by testing field procedures in nine hospitals, including yours. The feasibility study will gain insight into any problems or issues that need to be addressed or corrected in the final set of materials and procedures. Based on the results of the feasibility study, RAND and NCHS will develop a final well-defined set of field procedures that will allow for consistent data collection from a national sample of hospitals.

Data to be Collected
As you have seen from the survey instrument, this survey will collect data in the following categories:
- Where a patient was first admitted to the hospital
- Patient identification and demographics that contain such detailed questions as race, ethnicity, and English proficiency
- Patient clinical variables
- Discharge diagnoses and surgical and diagnostic procedures
- Charges, expected reimbursement, actual payment
- Limited disease specific modules

We recognize that all the data elements may not be available at your facility. That is part of what we want to learn from this feasibility study.

Confidentiality
We will be collecting protected health information or PHI in this survey. We recognize the hospital's legal obligations to protect PHI and would like to discuss the guarantee of confidentiality that RAND and the CDC-NCHS provide to hospitals participating in the NHDS redesign feasibility study.

First let's discuss Health Insurance Portability and Accountability Act (HIPAA) issues. HIPAA and its Privacy Rule ensure the privacy of the study participants. HIPAA permits Protected Health Information (PHI) disclosures without written patient authorization for specified public health purposes to public health authorities legally authorized to collect and receive the information for such purposes. The Centers for Disease Control and Prevention (CDC), including the National Center for Health Statistics, is an authorized public health entity. RAND, as a contractor for the NCHS is considered to be a public health authority under the Privacy Rule with respect to the activities RAND will conduct related to the feasibility study. This study has been reviewed and approved by the CDC IRB. They have particularly examined the issues of PHI and the methods RAND and the NCHS will use to protect this information. You are permitted by law to rely on a CDC IRB review and approval.

The second primary topic of interest is how patient and facility information will be used. Information on patients and facilities will be used only for statistical purposes as required by the Public Health Service Act. Published documents resulting from this feasibility test will not include any hospital or patient data. All published summaries will be presented in such a way that no individual facility or patient can be identified. The documents will focus only on the feasibility of collecting the data.

Process and Timeline

The process and timeline we will follow will consist of the following steps:

1) We will conduct a brief training session with your staff via the phone using the Field Manual as the training tool (within 1 week of this meeting) or alternatively we could do it prior to leaving the hospital today
2) You pull records according to the record sampling plan provided (within 2 week of this meeting)
3) Your staff abstracts the 20 records prior to RAND staff arrival (within 3 weeks of this meeting)
4) RAND abstractors come on site for up to 2 days to abstract the same 20 records (within 4 weeks of this meeting)
5) We debrief you while on site at the end of the 2-day RAND abstraction process
6) We will hold a follow up debrief with all sites upon completion of the feasibility study (around January).

Before we begin

Do you have any questions based on what we have talked about above?
Record Questions:

1._____

2._____

3._____

4._____

5._____

We would like now to proceed with conducting the study in your hospital.

- ❑ Hospital agrees to participate (go to page 6, question 11)
- ❑ Hospital objects to participating (go to Question 1)

The hospital may outline more than one of the following concerns. The skip pattern assumes that only one is articulated. If more than one concern is raised, please follow the questions for each concern raised by the hospital.

1. What concerns do you have about participating in this feasibility test?
   - ❑ We are concerned about collecting PHI and will need to review this with our IRB and/or privacy officer (Go to question 2)
   - ❑ Our financial situation does not permit us to dedicate time to this effort (Go to question 5)
   - ❑ We have too many other priorities at this point in time (Go to question 5)
   - ❑ Other:_____

2. How long will your internal IRB/HSPC privacy review process take?
   - ❑ Less than or equal to 2 weeks (Go to question 4)
   - ❑ More than 2 weeks (Go to question 3)

3. Given the resource and time constraints of this feasibility test, with your permission, we would still like to work with your hospital and test hospital level logistics and the collection of the majority of the data elements on the form that are non-PHI. May we do so?
   - ❑ Yes (Go to page 6, question 11)
   - ❑ No (Go to question 5)

4. Is there anything we can provide you that would make you comfortable participating in this study?
   Note to contract staff: It may not be necessary to ask all these sub-questions, please use your judgment.
   a) Would you be interested in speaking with the CDC IRB to better understand the protection they provide?
      - ❑ No
      - ❑ Yes, hospital contact person: _____

   b) Can we provide you or someone of your choice with any written documentation such as the law and its exemption provisions?
      - ❑ No
      - ❑ Yes, hospital contact person: _____

      Specify materials requested:_____

      _____

   c) Other?
      - ❑ No
      - ❑ Yes, specify:_____ _____

      _____

   d) Nothing – Go to Question 5

5. We are disappointed that we will not be able to work further with your hospital but we very much appreciate the time you spent with us today. We would like to take this opportunity to learn a little more about your IRB processes.

6. What is the process for approving research studies that are of a public health nature in your hospital?

   _____

   _____

   _____

   _____

7. Do you have your own IRB/HSPC or do you rely on an IRB/HSPC at another institution?
   - ❑ Yes, we have our own IRB/HSPC.
   - ❑ We do not have our own IRB/HSPC; we rely on an IRB/HSPC at another institution.

     Please specify the name of the other institution: _____

8. How often does the IRB/HSPC meet?
   - ❑ Weekly
   - ❑ Monthly
   - ❑ Every other month
   - ❑ As needed
   - ❑ Other frequency-- Please describe: _____

9. What is the "typical" turnaround for your hospital IRB/HSPC?
   - ❑ 2 Weeks
   - ❑ One Month
   - ❑ 6 weeks
   - ❑ Two months
   - ❑ Longer than two months

   Comments: _____

   _____

10. Does your IRB/HSPC require an in-house Principal Investigator (PI)?
    - ❑ No (Go to Closing Remarks, page 13)
    - ❑ Yes (Go to Closing Remarks, page 13)

Hospital Basics and Logistics

11. Confirm information from Page 1 above and note any changes on that page

Record Sampling and Identification

Please refer to the Record Sampling Plan provided in the introductory package

12. An important aspect of the proposed redesign is the linkage of clinical, financial, medical records, pharmacy, laboratory, radiology and other data both from the study admission and from any admissions within 30 days before admission or after discharge. We suspect that you likely do this for other studies and projects and would appreciate your discussing briefly how you link your systems and records to obtain a complete picture of any individual patient's care.

_____

_____

_____

_____

12a. If your process for gathering or compiling the information above differs for patients on observation status, please describe those differences.

_____

_____

_____

_____

13. Are your clinical records complete at the time of patient discharge (i.e., medical records, laboratory, pharmacy, radiology)?
    - ❑ Yes
    - ❑ No

    After how long do you consider these systems to accurately reflect the patient's stay? _____Days

14. After how many days do you consider a month closed in order to generate a list of discharged patients by ICD-9 code for that month?_____ Days

15. After how many days are you able to close the (financial) books for a given month? _____ Days

16. So it seems that data from all clinical and financial systems should accurately reflect patient's discharged after _____ Days. That would mean that we could use patients discharged from the month of _____.

17. Let's review the requirements for pulling the sample of 20 patient records
    Utilizing the Patient Record Selection sampling instructions from the Field Manual, the surveyor should review the sampling instructions with the responsible party by step and record any issues / concerns / questions that arise for each topic.

General Guidelines From Sampling Instructions	1. Discharge range: Month end _____ (From Q16) 2. Length of stay exclusion (> 10 days) _____ 3. Data required on the record list pulled: ☐ Patient name _____ ☐ Admitting & discharge date_____ ☐ Medical record number_____ ☐ Encounter / Visit number_____ Note if different from Encounter/Visit number ☐ Link to billing information_____ ☐ Link to pharmacy information_____ ☐ Link to clinical information_____ 3. The number of medical records to be pulled:_____ 4. Selecting a simple "random sample":_____ 5. Reallocating patients if one "Group" is null:_____ 6. Ordering / Identifying the records for the RAND abstractor:_____

Group A: Observation Patients

18. Do you envision any challenges in separately identifying observation status patients?
    - ❑ No
    - ❑ Yes: _____

    _____

    _____

Groups B – G

19. We presume these groups are well-defined, but please identify any issues in our instructions or in how you would identify these patients. Utilize the spaces to the right to note and comments / concerns / questions raised in the discussion

Group B Normal Newborns	❑ We do not have a maternity service Notes:
Group C: Pediatrics	❑ We do not care for pediatric patients Notes:
Group D: AMI / ACS	❑ We do not care for AMI / ACS patients Notes:
Group E: Asthma	❑ We do not care for asthma patients Notes:
Group F: Psychiatric	❑ We do not care for psychiatric patients Notes:
Group G: All Others	Notes: _____ Additional cases will be allocated to All Others

Financial and Billing Information

20. We are interested in the following information for each patient discharge:
    - Duration of care for intensive care, general acute care, rehabilitation / step down care
    - Expected reimbursement for ED and total stay
    - Actual payment for total stay
    - Charges allocated by revenue center ID with date stamp

21. How will you calculate duration of care in each of the specified sites of care?

We are assuming this will be captured in your billing system, however, please advise if there is a better place to capture duration of care. _____

_____

Care Site	Method for calculating duration of care
Intensive care (all critical care units)	
General acute care	
Rehabilitation / Step down	

22. Charges and reimbursement

	Total Charges	Expected Reimbursement	Actual Payment
a) What is the process for obtaining this information from your systems?		❑ Same as total charges ❑ Other:	❑ Same as total charges ❑ Other:
b1) What form is it in?	❑ Electronic ❑ Paper-based Other:_____	❑ Electronic ❑ Paper-based Other:_____	❑ Electronic ❑ Paper-based Other:_____
b2) Is this for all insurers?	❑ Yes ❑ No (specify) _____ _____	❑ Yes ❑ No (specify) _____ _____	❑ Yes ❑ No (specify) _____ _____
c) Please describe the financial systems in which this information resides		❑ Same as total charges ❑ Other:	❑ Same as total charges ❑ Other:
d) If different from Encounter / Visit Number, please describe how financial information is linked to clinical systems and medical records?			

Medications

23. What is the best source for generating a list of medications for a patient upon discharge?

- ❑ Medication Administration Record
- ❑ Pharmacy Dispensing System
- ❑ Medical Record
- ❑ Billing System
- ❑ Other:_____

24. If a patient is admitted from the Emergency Department, how do you identify medications provided to them in the Emergency Department?
- ❑ The same pharmacy system also serves the Emergency Department
- ❑ Records will need to be matched manually
    - What identifier will be used to match the records?_____

25. If a patient is admitted from Observation status, how do you identify medications provided to them while in Observation Status?
- ❑ The same pharmacy system also serves patients in Observation status
- ❑ Records will need to be matched manually
    - What identifier will be used to match the records?_____

Other Questions

26. Can the UB04 data be printed or exported to a data file?
- ❑ No
- ❑ Yes printed only
- ❑ Yes, only exported to a data file
- ❑ Yes, printed or exported to a data file

27. Do you have a policy and related standards that allows your nurses to "chart by exception"
- ❑ Yes
- ❑ No

Confirmation of Discussion

28. Using the information collected above outline the steps to confirm our understanding of how the hospital is going to link patient information between the clinical, laboratory, pharmacy and billing/financial systems through both inpatient and observation status patients.

_____

_____

_____

29. Records for the month of: _____will be sampled by (date) _____

30. Do you think that it will be possible to have the 20 records pulled and abstracted by _____ (3 weeks from the meeting)?
- ❑ Yes
- ❑ No

What do you foresee as your major hurdles to accomplishing this task in the allotted time?

_____

_____

31. By when will you have completed the records (date):_____

32. Key Contacts

a) Inpatient and Observation Data

	Sampling	Medical Record Abstraction	Pharmacy	Laboratory	Financial/ Billing	Other Data in Electronic From
Name:						
Title:						
Phone Number:						
E-mail:						
Room #:						

b) Primary Hospital Contact for Feasibility Study
(individual responsible for discussion with RAND and for coordination of individuals involved in component activities)

Name:	*Title:*
Phone:	*Pager:*
E-mail:	*Fax:*
Room #:	
Assistant Name:	*Assistant Phone:*
Assistant e-mail:	

Closing Remarks for Non-Participating Hospital (from Question 10)

As we said earlier, we are disappointed that we will not be able to work further with your hospital but we very much appreciate the time you spent with us today. It has been extremely helpful for us to gain insights about your issues and concerns. As we plan for the implementation of this survey it is also instructive for us to understand the IRB process and requirements hospitals will encounter. Should you at some point in the future desire to participate with the NCHS in any of their national surveys, please feel free to contact them:

Name:
Title:
Phone:
E-mail:
Address

Closing Remarks for Participating Hospital (from Question 32)

Thank you for your time today. This has been very helpful to us. The sampling process we have discussed today is also included in the Field Manual along with detailed abstraction instructions.

The RAND abstractor will be _____.

Given the timing discussed above, she would like to return on approximately _____ (date) to abstract the 20 records also completed by your staff.

Would those dates be alright with you? We will discuss these dates with her and confirm with you within a couple days.

We are extremely appreciative of your willingness to work with us and the CDC in developing these processes and procedures. This is truly a feasibility test and we are honestly seeking your comments and input into learning about what works and doesn't, which is why we have scheduled the debriefing with you at the end of the abstraction process and then again with all the hospitals after we have had a chance to gather and aggregate all of your feedback. We are very much looking forward to working with you to refine this survey which will provide a basis for health policy and research over the next decades.

Facility Questionnaire

NATIONAL HOSPITAL DISCHARGE SURVEY REDESIGN – PILOT SURVEY
Hospital Facility Information Form

Thank you for participating in the pilot study for redesign of the National Hospital Discharge Survey. The information collected will be invaluable to policy makers, researchers and all who provide patient care in America's hospitals and healthcare systems.

This survey collects information on the capabilities, capacity and characteristics of your organization, which will be linked to the clinical data collected through the patient abstraction form. The first part of this questionnaire (questions 1 and 2) collects basic hospital and key contact information. The second part (questions 3 - 8) are the same as the American Hospital Association (AHA) annual survey and utilize AHA definitions. Please feel free to attach your response to the AHA survey. The third part (questions 9 – 17) asks for information that is not generally part of the AHA survey, for example more detailed information on reimbursement, staffing and health information technology.

If you have questions as you fill out this form, please feel free to contact _____[Contractor Name]_____:

Name
Phone number
E-mail

PLEASE TYPE OR PRINT ALL INFORMATION

1) Hospital Information

AHA Number					
Legal Name					
Address					
City		**State**	__ __	**Zip**	__ __ __ __ __ - __ __ __ __
Phone	(__ __ __) __ __ __ - __ __ __ __	**Fax**	(__ __ __) __ __ __ - __ __ __ __		

2) Person Completing This Form

Name _____

Title _____

E-mail _____

Dept Address _____

Phone _____ Fax _____

You do not need to complete Questions 3-8 if you attach your 20XX AHA Survey.

3) Aggregate Hospital Utilization Statistics for Calendar Year 20XX

Total Acute Inpatient Admissions				Inpatient Days	
Average Length of Stay (all acute inpatients)				Live Births	
# Operating Rooms		Surgeries: Inpatient		Surgeries: Outpatient	
Emergency Department Visits				Outpatient Visits	
Was the Facility Open as of January 1, 2005	☐ Yes ☐ No			Number of Days Open During Reporting Period	

4) Accreditation and Certification

Is your hospital accredited/certified by the following agencies?

CMS/Medicare Certified ☐ No ☐ Yes

Joint Commission Accredited ☐ No ☐ Yes (year of last accreditation: 200__)

5) Hospital Ownership and Affiliations

a) Ownership Type

☐ Government

☐ Proprietary

Percent of this hospital that is owned by physicians who work for or are affiliated with this hospital: ___ ___ ___%

☐ Non-Profit

☐ Church related or other religious order affiliated

☐ Other: specify _____

b) Teaching status

i. Are you a Council of Teaching Hospitals and Health Systems (COTH) member? ☐ No ☐ Yes

ii. Are you the primary teaching hospital for a medical school? ☐ No ☐ Yes

c) Is the hospital a subsidiary of a larger company?

☐ No

☐ Yes: Please indicate the name and contact information for the parent company

Corporation Name _____

Address _____

City _____ State: ___ ___ Zip: _____

Total number of hospitals owned by this corporation: _____

d) Is the hospital affiliated with any organized physician practices?

	Yes	No
Independent Practice Association	☐	☐
Group practice without walls	☐	☐
Open physician-hospital association	☐	☐
Closed physician-hospital association	☐	☐

6) Which <u>one</u> of the descriptions below best describes the services offered by your hospital?

☐ General Acute Care ☐ Heart ☐ Psychiatric only facility

☐ Children's Hospital ☐ Maternity/Obstetrics ☐ Rehabilitation only

☐ Osteopathic Hospital ☐ Eye, ear, nose and throat ☐ Other:_____

☐ Cancer ☐ Alcohol/drug dependency only

7) Hospital Inpatient Bed Capacity

AHA 2005 Survey Question #	Hospital Service	# of Staffed Beds	Do Not Provide
1	General medical – surgical care		☐
2	Pediatric medical – surgical care		☐
3	Obstetrics (Please specify the level of unit provided by the hospital if applicable.)		☐
4	Medical surgical intensive care		☐
5	Cardiac intensive care		☐
6	Neonatal intensive care		☐
7	Neonatal intermediate care		☐
8	Pediatric intensive care		☐
9	Burn care		☐
10	Other special care		☐
11	Other intensive care (Please specify the type of other intensive care provided by the hospital if applicable.)		☐
12	Physical rehabilitation		☐
13	Alcoholism – drug abuse or dependency care		☐
14	Psychiatric care		☐
15	Skilled nursing care		☐
16	Intermediate nursing care		☐
17	Acute long term care		☐
18	Other long term care		☐
19	Other care (Please specify the type of other care provided by the hospital if applicable.)		☐

8) Clinical Capabilities and Services

The categorizations of these capabilities and services and the definitions are those used by in the AHA 20XX survey.

AHA 2005 survey question #	Clinical Capabilities and Services	Service Provided In This Hospital	
		Provide	Do Not Provide
20	Adult day care program	☐	☐
21	Airborne infection isolation room (specify # of rooms)	____ # Rooms	☐
22	Alcoholism – drug abuse or dependency outpatient services	☐	☐
23	Alzheimer Center	☐	☐
24	Ambulances services	☐	☐
25	Arthritis treatment center	☐	☐
26	Assisted living	☐	☐
27	Auxiliary	☐	☐
28	Bariatric/weight control services	☐	☐
29	Birthing room – LDR room – LDRP room	____ # Rooms	☐
30	Blood Donor Center	☐	☐
31	Breast Cancer screening / mammograms	☐	☐
32	Cardiology and cardiac surgery services		
32a	• Adult diagnostic/invasive catheterization	☐	☐
32b	• Pediatric diagnostic/invasive catheterization	☐	☐
32c	• Adult interventional cardiac catheterization	☐	☐
32d	• Pediatric interventional cardiac catheterization	☐	☐
32e	• Adult cardiac surgery	☐	☐
32f	• Pediatric cardiac surgery	☐	☐
32g	• Cardiac rehabilitation	☐	☐
33	Case management	☐	☐
34	Chaplaincy/pastoral care services	☐	☐
35	Chemotherapy	☐	☐
36	Children wellness program	☐	☐
37	Chiropractic services	☐	☐
38	Community outreach	☐	☐
39	Complementary medicine services	☐	☐
40	Computer assisted orthopedic surgery (CAOS)	☐	☐
41	Crisis prevention	☐	☐
42	Dental services	☐	☐
43	Emergency services		
43a	• Emergency department	☐	☐
43b	• Freestanding/Satellite emergency department	☐	☐
43c	• Trauma center (certified)	Level: _____	☐
44	Enabling services	☐	☐
45	End of life services		
45a	• Hospice program	☐	☐

AHA 2005 survey question #	Clinical Capabilities and Services	Service Provided In This Hospital	
		Provide	Do Not Provide
45b	• Pain management center	☐	☐
45c	• Palliative care program	☐	☐
46	Enrollment assistance services	☐	☐
47	Extracorporeal shock wave lithotripter (ESWL)	☐	☐
48	Fitness center	☐	☐
49	Freestanding outpatient care center	☐	☐
50	Geriatric services	☐	☐
51	Health fair	☐	☐
52	Health information center	☐	☐
53	Health screenings	☐	☐
54	Hemodialysis	☐	☐
55	HIV – AIDS services	☐	☐
56	Home health services (visits)	☐	☐
57	Hospital – based outpatient care center – services	☐	☐
58	Indigent care clinic	☐	☐
59	Linguistic/translation services	☐	☐
60	Meals on wheels	☐	☐
61	Mobile health services	☐	☐
62	Neurological services	☐	☐
63	Nutrition programs	☐	☐
64	Occupational health services	☐	☐
65	Oncology services	☐	☐
66	Orthopedic services	☐	☐
67	Outpatient surgery	☐	☐
68	Patient Controlled Analgesia (PCA)	☐	☐
69	Patient education center	☐	☐
70	Patient representative services	☐	☐
71	Physical rehabilitation outpatient services	☐	☐
72	Primary care department	☐	☐
73	Psychiatric services		
73a	• Psychiatric child – adolescent services	☐	☐
73b	• Psychiatric consultation – liaison services	☐	☐
73c	• Psychiatric education services	☐	☐
73d	• Psychiatric emergency services	☐	☐
73e	• Psychiatric geriatric services	☐	☐
73f	• Psychiatric outpatient services	☐	☐
73g	• Psychiatric partial hospitalization program	☐	☐
74	Radiology therapeutic		
74a	• Image-guided Radiation Therapy (IGRT)	☐	☐

AHA 2005 survey question #	Clinical Capabilities and Services	Service Provided In This Hospital	
		Provide	Do Not Provide
74b	• Intensity-Modulated Radiation Therapy (IMRT)	☐	☐
74c	• Shaped Beam Radiation System	☐	☐
75	Radiology, diagnostic		
75a	• CT scanner	☐	☐
75b	• Diagnostic radioisotope facility	☐	☐
75c	• Electron beam computed tomography (EBCT)	☐	☐
75d	• Full-field digital mammography (FFDM)	☐	☐
75e	• Magnetic resonance imaging (MRI)	☐	☐
75f	• Multi-slice spiral computer tomography (<64 + slice CT)	☐	☐
75g	• Multi-slice spiral computed tomography (64+ slice)	☐	☐
75h	• Positron emission tomography (PET)	☐	☐
75i	• Positron emission tomography/CT (PET/CT)	☐	☐
75j	• Single photon emission computerized tomography (SPECT)	☐	☐
75k	• Ultrasound	☐	☐
76	Reproductive health		
76a	• Fertility Clinic	☐	☐
76b	• Genetic testing/counseling	☐	☐
77	Retirement housing	☐	☐
78	Robotic surgery	☐	☐
79	Sleep center	☐	☐
80	Social work services	☐	☐
81	Sports medicine	☐	☐
82	Stereotactic radiosurgery	☐	☐
83	Support groups	☐	☐
84	Swing bed services	☐	☐
85	Teen outreach services	☐	☐
86	Tobacco treatment/cessation program	☐	☐
87	Transplant services		
87a	• Bone marrow transplant services	☐	☐
87b	• Heart	☐	☐
87c	• Kidney	☐	☐
87d	• Liver	☐	☐
87e	• Lung	☐	☐
87f	• Tissue	☐	☐
87g	• Other	☐	☐
88	Transportation to health facilities	☐	☐
89	Urgent care center	☐	☐
90	Virtual Colonoscopy	☐	☐
91	Volunteer services department	☐	☐
92	Women's health center/services	☐	☐
93	Wound management services	☐	☐

9) Financial information (20XX)

a) Patient insurance: Please indicate the insurance mix among patients treated in your facility and the distribution from where your revenue comes.

	% with This Source of Primary Insurance Coverage	% of Facility's Total Revenue
Medicare		
Medicaid		
Private/Commercial		
Self-Pay		
• Uncovered Services		
• No Insurance		
Charity Care		
No Charge		
TRICARE		
Workers' Compensation		
Other Government		
Other:_____		
Other:_____		
Other:_____		
Other:_____		
Other:_____		

b) Payer type: Of the revenue that this hospital receives from each of the different insurance types, indicate the percent that comes from each type of payment.

	Medicare	Medicaid	Private/Commercial
Fee-for-service plan			
HMO Plan			
PPO Plan			
Other:_____			
Other:_____			

10) Did your hospital receive any Medicaid Disproportionate Share Program Funding in the prior year?

☐ Yes
☐ No

11) Capital Investment

a) Was this hospital in the process of, or did this hospital complete, building any new buildings within the last year?

☐ No
☐ Yes

i) How many new buildings? _____

ii) What is the purpose of the new building (s)? Please check all that apply

☐ Academic
☐ New combined adult and pediatric hospital
☐ New Adult Inpatient Hospital
☐ New Pediatric Inpatient Hospital
☐ Adult outpatient building
☐ Pediatric Inpatient building
☐ Research
☐ Other, please specify _____
☐ Other, please specify _____

12) Emergency Department (ED)

☐ We do not have an emergency department (skip to 12b)
☐ Our emergency department is staffed 24 hours
☐ We have an emergency department, but it is not open 24 hours/day

a) Emergency Department Volume

		Total Patients 20XX		
Service	**# of licensed ED beds/bays**	**Admitted from ED to this hospital**	**Transferred from this ED to another facility**	**Patients seen and discharged**
General/Overall				
IF YOU HAVE DEDICATED ED BEDS/BAYS AND CAN BREAK DOWN BY SERVICE, INDICATE BELOW				
Adult				
Pediatric				
Psychiatric				

b) What is the trauma level rating of the Emergency Department and hospital?
(check appropriate boxes)

Area	None	Level I	Level II	Level III	Level IV	Level V	Other/ Unknown
Adult	☐	☐	☐	☐	☐	☐	☐
Pediatrics	☐	☐	☐	☐	☐	☐	☐

13) What is the level of care provided by your Neonatal Intensive Care Unit?

☐ I ☐ II ☐ III ☐ IV ☐ V ☐ Not Applicable

14) Hospital Observation/Outpatient Accommodations (20XX)

	# of Licensed Beds	Total Patients
Dedicated Observation Unit		
Other Outpatient		

15) Total Observation Stay Volume (20XX)

Observation Stays (Medicare only)		TOTAL Observation Stays (Including Medicare)	

16) Facility Staffing (20XX)

a) Medical Staff

i) Total Medical Staff

What is the total number of physicians, dentists, podiatrists and other licensed independent practitioners (LIPs) privileged at your facility.

Do not include residents or fellows unless they practice independently as full members of the medical staff for some services. Include physicians that practice in outpatient departments.

Total Physicians: _____

ii) Medical Staffing by Specialty

How many licensed independent practitioners (LIPs) of each type listed below practice within, or admit to, your hospital (i.e., they have privileges)? The practitioner type is based on self-designation of primary specialty. Do not include residents or fellows in any of these areas. Include LIPs that practice in outpatient departments, individuals who are licensed by your facility but do not practice on site (Tele-LIPs), and the number of locum tenens you employed during the calendar year. Identify only one specialty and one category per provider.

Discipline/Department/Division	Number of Privileged LIPs	Number of Tele-LIPs	Number of Locum Tenens
Anesthesiology (those who work in OR or pain clinic, but not as critical care intensivists)			
Dental			
Dermatology			
Emergency Medicine			
• Pediatric Emergency Medicine			
Family Medicine			
Internal Medicine			
• Allergy			
• Cardiology			
• Endocrinology			
• Gastroenterology			
• General Internal Medicine			
• Geriatrics			
• Hematology/Oncology			
• Infectious Disease			
• Nephrology			
• Rheumatology			
• Other Internal Medicine			
Hospitalists—See Question 16b			

Discipline/Department/Division	Number of Privileged LIPs	Number of Tele-LIPs	Number of Locum Tenens
Intensive Care Medicine (Include those trained through any specialty—e.g., Internal Medicine, Anesthesia, Surgery)			
• Pediatric Intensive Care Medicine (specify)			
Neurology			
Obstetrics/Gynecology			
• General Ob/Gyn			
• Gynecologic Oncology			
• Gynecology only			
• Maternal Fetal Medicine			
• Obstetrics Only			
• Reproductive Endocrinology			
• Other Ob/Gyn			
Pathology			
Pediatrics			
• Adolescent Medicine			
• Allergy			
• Cardiology			
• Developmental/Behavioral Pediatrics			
• Endocrinology			
• Infectious Disease			
• Gastroenterology			
• General Pediatrics			
• Genetics			
• Hematology/Oncology			
• Neonatology			
• Nephrology			
• Neurology			
• Pulmonology			
• Rheumatology			
• Other pediatric			
Physical Medicine and Rehabilitation			
Podiatry			
Psychiatry			
• Pediatric Psychiatry (specify)			

Discipline/Department/Division	Number of Privileged LIPs	Number of Tele-LIPs	Number of Locum Tenens
Radiology			
• Nuclear Medicine			
• Neuroradiology			
• Interventional Radiology			
• Pediatric Radiology			
• Other Radiology			
Surgery			
• Cardiothoracic Surgery			
• General Surgery			
• Hand Surgery			
• Neurosurgery			
• Ophthalmology			
• Otolaryngology			
• Oral and maxillofacial surgery			
• Orthopedic Surgery			
• Pediatric Cardiothoracic Surgery			
• Pediatric Orthopedic Surgery			
• Pediatric Otolaryngology			
• Pediatric Ophthalmology			
• Pediatric General Surgery			
• Plastic Surgery			
• Surgical Oncology			
• Urology			
• Vascular Surgery			
• Other Surgery			
Other: (specify)			
Other: (specify)			
Other: (specify)			
Other: (specify)			
Other: (specify)			
Other: (specify)			
Other: (specify)			
Other: (specify)			
Other: (specify)			

b) Hospitalists

i) Does this hospital employ hospitalists (doctors who only provide inpatient care, or specialize primarily in inpatient care)?

☐ No (Skip to next section, part 16c)
☐ Yes

ii) Please indicate the services where hospitalists work and the number of hospitalist FTEs that the hospital has for each of the services. A person working 40 hours/week constitutes one FTE. A person working 20 hours/week would be 0.5 FTE.

Service	Average monthly (20XX) Hospitalist FTEs
Internal medicine	
Surgery	
Pediatrics	
Other: Specify	
Other: Specify	
Other: Specify	
Other: Specify	
Total Hospitalists:	

c) Other Hospital Staff

Please list the total number of FTEs of each type of employee that is employed per month in the following inpatient areas. A person working 40 hours/week constitutes one FTE. A person working 20 hours/week would be 0.5 FTE.

Area	Nurse Practitioners	Physicians assistants	Registered Nurses	Licensed Practical Nurse	Nurse Aides	Other Professional Staff	Transport/ Administrative/ Clerical/other Ancillary Staff
General Medical / Surgical							
Pediatric							
Adult Intensive Care							
Pediatric Intensive Care							
Neonatal ICU							
Psychiatry							
Labor/Delivery/ Well Baby Units							
Other:_____							

i) How many Certified Registered Nurse Anesthetists FTEs are employed by your hospital?

_____ FTE

ii) How many FTE open positions are you presently recruiting for in the following nursing disciplines?

Advanced Practice Nurses _____ FTE (e.g., CRNA, NP)

Registered Nurses _____ FTE

LPN Nurses _____ FTE

d) Unionization. What percent of the following individuals are members of a union?

Nurses _____%

Other hospital staff _____%

Residents (if applicable) _____%

e) Trainees

i) **Students: Do you train students at your hospital?**

☐ No (Skip to next question 16e) ii))

☐ Yes

Approximately how many of the following types of students rotated through your hospital in an average month (20XX)?

Disciplines	Average Monthly Number of Students (20XX)
Medical / Osteopathic Doctor	
Dental	
Pharmacy	
Nursing	
OT/PT	
Physician Assistant	
Medical Laboratory & Cyto Technologists / Technicians	
Radiology Technologists	
Other: Specify	
Other: Specify	

ii) Residents: Do you offer physician residency training at your hospital?

☐ No

☐ Yes

17) Health Information Technology (HIT)

a) If you have HIT, indicate in which areas of the hospital functionality exists

		Hospital Inpatient Wards	ICU	ED	Observation Unit	Outpatient
Patient Demographic Information		☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off
Computerized Orders for Prescriptions		☐ Yes–some ☐ Yes – all ☐ No ☐ Unsure ☐ Turned Off	☐ Yes–some ☐ Yes – all ☐ No ☐ Unsure ☐ Turned Off	☐ Yes–some ☐ Yes – all ☐ No ☐ Unsure ☐ Turned Off	☐ Yes–some ☐ Yes – all ☐ No ☐ Unsure ☐ Turned Off	☐ Yes–some ☐ Yes – all ☐ No ☐ Unsure ☐ Turned Off
If yes →	Are drug inter-actions warnings or contraindications provided?	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off
	Are prescriptions sent electronically to the pharmacy?	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off
Computerized Orders for Tests?		☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off
If yes →	Are orders sent electronically?	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off
Lab Results?		☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off
If yes →	Are out of range levels highlighted?	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off
Imaging Results?		☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off
If yes →	Can the ordering physician view electronic images ?	☐ Yes ☐ No ☐ Unsure	☐ Yes ☐ No ☐ Unsure	☐ Yes ☐ No ☐ Unsure	☐ Yes ☐ No ☐ Unsure	☐ Yes ☐ No ☐ Unsure
Clinical Notes?		☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off
If yes →	Do they include medical history and follow-up notes?	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off
	Do they include reminders for guideline-based interventions and/or screening tests?	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off

a) continued. Health information technology functionality

		Clinical Areas	Clinical Laboratory
Public Health Reporting?		☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off
If yes →	Are notifiable diseases sent electronically to public health reporting agencies?	☐ Yes ☐ No ☐ Unsure ☐ Turned Off	☐ Yes ☐ No ☐ Unsure ☐ Turned Off

b) If you have an electronic medical record, indicate in which direct patient care settings the EMR is linked (i.e., information from one area is available to the others).

	Inpatient Wards	ICU	ED	Obs Unit	Outpatient
Inpatient Wards		☐	☐	☐	☐
ICU			☐	☐	☐
ED				☐	☐
Observation Unit					☐

18) Medical Coding

a) Does your coding staff use electronic coding software?

☐ No
☐ Yes Vendor:_____

b) Please provide the average number of ICD-9 CM diagnosis and procedure codes for the last calendar year on a per patient basis.

	Average	Median	Maximum
Number of Diagnosis			
Number of Procedures			

Patient Abstract Form

PATIENT ABSTRACT – NATIONAL HOSPITAL DISCHARGE SURVEY

A. STUDY-SPECIFIC INFORMATION

1. Hospital Number _____ _____ _____ _____ | **2. HDS Number:**_____ _____ _____ _____

B. INFORMATION THAT IS REQUESTED ON UB-04 CLAIM FORM

3. Patient Name

_____ *Last* | _____ *First* | _____ *Middle Name or Initial*

4. Patient Street Address:

5. Zip: __ __ __ __ __ - __ __ __ __

6. City

7. State __ __

8. Birth Date:
MM __ __ DD__ __ YYYY __ __ __ __
Age if no birth date: __ __ __ ☐ Years ☐ Months ☐ Days

9. Sex
☐ Male ☐ Female
☐ Not stated

10. If Acute Inpatient Admission, identify type:
☐ Emergency ☐ Urgent ☐ Elective ☐ Newborn ☐ Trauma
☐ Unable to tell ☐ Not Applicable

11. HIC #:
__ __ __ __ __ __ __ __ __ __ __ __
☐ Not applicable

12. Source of Admission
☐ Physician referral
☐ Clinic referral
☐ Managed care plan referral
☐ Acute to acute transfer (from a different facility)
☐ Transfer from a SNF
☐ Transfer from another healthcare facility
☐ Emergency room (this facility)
☐ Court / law enforcement
☐ Other transfer
☐ Unknown

13. Status/Disposition of the Patient at Discharge:
☐ Discharge to home or self care
☐ Discharge/transferred to short term inpatient
☐ Discharge/transferred to SNF
☐ Discharge/transferred to Intermediate care facility
☐ Discharge/transferred to another institution
☐ Discharged home with home health
☐ Left against medical advice
☐ Expired
☐ Discharge/transfer to federal facility
☐ Discharge/transfer to home hospice
☐ Discharge/transfer to hospice facility
☐ Discharge/transfer to within facility swing bed
☐ Discharge/transfer to acute rehabilitation
☐ Discharge/transfer to long term care
☐ Discharge/transfer to Medicaid facility
☐ Discharge/transfer to psychiatric facility
☐ Discharge/transfer to critical access hosp
☐ Unknown

14. Attending Physician UPIN/NPI: _____

15. Operating Physician UPIN/NPI: _____

16. Admitting Diagnosis: ___ ___ ___.___ ___ **ICD-9-CM** _____**Description**

17. Surgical and Diagnostic Procedures ☐ **Check box if none**

	ICD-9-CM or CPT-4 Code*	Description	Procedure Date
Prin Px			MM __ __ DD __ __
Oth Px			MM __ __ DD __ __
			MM __ __ DD __ __
			MM __ __ DD __ __
			MM __ __ DD __ __
			MM __ __ DD __ __

* Electronic version of claim form will have up to 25 procedures. All 25 should be obtained, if coded.

* Use CPT-4 Code for Hospital Observation (Medicare Part B) Admissions

18. Final Diagnoses (including E-Codes)			
	ICD-9-CM Code	**Description**	**Present at Admission?**
Prin Dx			☐Y ☐N ☐Unk
Oth Dx			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk

* Electronic version of claim form will have up to 25 diagnoses. All 25 should be obtained, if coded.

19. Charges allocated by revenue center ID: Please provide a print out of all charges aggregated by revenue center ID for this admission. Room charges should be individually identified. With this printout include the date when charges were incurred.

C. MEDICAL RECORD FACE SHEET INFORMATION

20. Medical Record Number:

20a. Encounter/Visit Number:

21. Race
☐ White
☐ Black/African American
☐ Asian
☐ Native Hawaiian/Other Pacific Islander
☐ American Indian/ Alaska Native
☐ Other:_____
☐ Unknown

22. Ethnicity
☐ Hispanic
☐ Not Hispanic
☐ Unknown

23. Marital Status
☐ Married ☐ Widowed
☐ Separated ☐ Single
☐ Divorced ☐ Not stated

24. Employment Status:
(if patient is < 18 years old, note status for guarantor)
☐ Employed
☐ Student
☐ Homemaker
☐ Retired
☐ Unemployed
☐ Unknown

25. English Proficiency:
Is there evidence the patient is proficient in English? Document for the patient, if patient is ≥ 13 years old. If patient < 13 then indicate for caregiver.
☐ Yes
☐ No - Primary language is:
_____
☐ Unknown

26. Expected Source of Payment	Primary	Other Sources
☐ No source indicated		
Worker's compensation	☐	☐
Medicaid / SCHIP	☐	☐
Medicare	☐	☐
Other Gov't (e.g., CHAMPUS, Tricare, VA)	☐	☐
Private / commercial insurance	☐	☐
Self-pay	☐	☐
No charge	☐	☐
Other	☐	☐

27. Payer Type for Primary Insurance *(if applicable)*

☐ Indemnity/Fee for Service
☐ Preferred Provider (PPO)/Point of Service (POS)
☐ HMO/Other Managed Care
☐ Unknown, unable to tell
☐ Not applicable

D. CURRENT EPISODE/HOSPITAL STAY INFORMATION

Questions 28-35 refer to this hospital stay. **For NEWBORNS only, skip to Question 33.**

28. Mode of Arrival

☐ Ambulance (air/ground) ☐ Walk-in ☐ Unknown

29. Living Situation at Admission

☐ Private residence, shared
☐ Private residence, alone
☐ Private residence, unknown if alone or shared
☐ Psychiatric facility
☐ Other institution or facility (non-psychiatric)
☐ Homeless
☐ Other / not stated

30. Was the patient transferred from another emergency department?

☐ No
☐ Yes

31. Was this patient seen in this hospital's Emergency Department?

☐ No → **SKIP TO QUESTION 32**

☐ Yes → Please indicate date and time of **first care** in ED

MM __ __ DD __ __ YY __ __ Time: ___ ___ : ___ ___ (24-hour clock)

After the ED, the patient was treated in the following status or statuses:

☐ Observation only ☐ Observation converted to acute inpatient ☐ Acute inpatient only

Date and time of **first physician order** to change status (to observation or inpatient)

MM __ __ DD __ __ YY __ __ Time: ___ ___ : ___ ___ (24-hour clock)

→ **SKIP TO QUESTION 33**

32. Indicate patient's status while in the hospital and the date and time of initial care under the *first* (or only) status:

☐ Observation only
☐ Observation converted to acute inpatient
☐ Acute inpatient only

Date/time of **first care:**

MM __ __ DD __ __YY__ __

Time: ___ ___ : ___ ___ (24-hour clock)

33. Was the patient treated in a critical care bed? Provide beginning and end date for first (or only) critical care treatment, if applicable.

☐ No → **SKIP TO QUESTION 34**
☐ Yes

First critical care start date: MM __ __ DD __ __

First critical care stay end date: MM __ __ DD __ __

Was there more than 1 critical care stay this admission? ☐ No ☐ Yes

34. DNR During Admission?

☐ No
☐ Yes, date of 1st order:
MM ___ ___ DD ___ ___
☐ Yes, order present, not dated
☐ Documentation of DNR but no order

35. Date and Time of Discharge

MM __ __ DD __ __YY__ __

Time: ___ ___ : ___ ___ (24-hour clock)

E. PATIENT CLINICAL VARIABLES (Obtained from Medical Record)

For NEWBORNS only, skip to Question 44.

36. Vital Signs Value On First Presentation

Check if not done within first 24 hours

Blood Pressure: ___ ___ ___/___ ___ ___ mmHg ☐

Heart Rate: ___ ___ ___ per minute ☐

Respiratory Rate: ___ ___ per minute ☐

Temperature: ___ ___ ___.___ ☐ °C ☐°F ☐

Specify route: _____ ☐ Route unknown

Oxygen saturation: ___ ___ ___ % ☐RA ☐On O_2 ☐

Height: ___ ft ___ ___ in **OR** ___ ___ ___ cm ☐

Weight: ___ ___ ___ lbs **OR** ___ ___ ___ kg ☐

37. Clinical Laboratory Results: Initial Results

Check if not done within first 24 hours

Hematocrit (Hct): ___ ___.___% ☐

White Cell Count (WBC): ___ ___ ___.___ x1000/µL ☐

Platelet Count (Plt): ___ ___ ___ x1000/µL ☐

Sodium (Na): ___ ___ ___ mmol/L ☐

Potassium (K): ___ ___.___ mmol/L ☐

Urea Nitrogen (BUN): ___ ___ ___ mg/dL ☐

Creatinine (Cr): ___ ___.___ mg/dL ☐

38. First Pain Assessment (within first 24 hours):

☐ Severe ☐ Moderate ☐ Mild ☐ No Pain ☐ Unknown

OR

Pain scale: ___ ___ / 10 **OR** ___ / 5

39. Drug Allergies at Time of Admission

☐ Yes (specify):_____

_____

☐ None ☐ Unknown / Not stated

40. Cigarette Use:

Exclude: If patient age < 10 years

☐ Current smoker

Not current smoker:

- ☐ Quit ≤ 1 year ago
- ☐ Quit > 1 year ago or time not specified
- ☐ Never smoked → **SKIP TO Q42**
- ☐ Not current smoker, no further information → **SKIP TO Q42**

☐ No data / Not applicable → **SKIP TO Q42**

41. For Current/Past Cigarette Smokers:

___ ___ ___ Pack years

OR

___ ___ Packs per day

___ ___ Years smoked

☐ No data / Not applicable

42. ASA Classification for Surgical Patients

☐ Class 1 ☐ Class 2

☐ Class 3 ☐ Class 4

☐ Class 5 ☐ Class 6

☐ No data ☐ Not applicable

43. Vital Signs on the *DAY PRIOR TO OR DAY OF DISCHARGE*: Check all that apply

Exclude: If patient stay < 3 days OR patient not discharged to home OR patient age < 16 years

- ☐ Temperature > 37.8° C (100.0°F)
- ☐ Heart rate > 100
- ☐ Respiratory rate > 24
- ☐ Systolic BP < 90 mm Hg
- ☐ Oxygen saturation < 90% on room air OR < 95% on O_2

- ☐ None of the above

☐ Not applicable (LOS < 3 days / not discharged home / < *16 years*)

→ Skip to Question 46

FOR NEWBORNS

44. Birth Statistics

Length: __ __ . __ in **OR** __ __ cm

Weight: __ __ lbs __ __ oz **OR** __ __ __ __ gm

Apgar Scores: __ __ at 1 minute, __ __ at 5 minutes

Estimated Gestational Age: ___ ___ weeks ___ days **OR**

Estimated Date of Confinement (EDC) MM __ __ DD __ __ YY __ __

45. Mother's Medical Record Number:

46. Medications at Admission and Discharge: *(list up to 20)*

	Medications Patient Was Taking Immediately Preceding Admission	Medications Prescribed at Discharge	
1.			Check if IV ☐
2.			Check if IV ☐
3.			Check if IV ☐
4.			Check if IV ☐
5.			Check if IV ☐
6.			Check if IV ☐
7.			Check if IV ☐
8.			Check if IV ☐
9.			Check if IV ☐
10.			Check if IV ☐
11.			Check if IV ☐
12.			Check if IV ☐
13.			Check if IV ☐
14.			Check if IV ☐
15.			Check if IV ☐
16.			Check if IV ☐
17.			Check if IV ☐
18.			Check if IV ☐
19.			Check if IV ☐
20.			Check if IV ☐
	☐ None ☐ Not applicable (newborn)	☐ None ☐ Not applicable (patient expired)	
	☐ Unknown	☐ Unknown	

F. FINANCIAL AND BILLING RECORD DATA ELEMENTS

47. Charges, Expected Reimbursement, Actual Payment	Duration Of Care	Expected Reimbursement	Actual Payment
Emergency Care			
Observation Care			
Inpatient Care – Intensive Care	_____ days		
Inpatient Care – General Acute	_____ days		
Rehabilitation/Step Down Care	_____ days		
Total for This Hospital Encounter			

48. Social Security Number ___ ___ ___ - ___ ___ - ___ ___ ___ ___ ☐ Not Available

G. INFORMATION FROM OTHER HOSPITAL CARE WITHIN 30 DAYS

49. If the patient was treated at this hospital as an acute inpatient, observation status or in the emergency department within the 30 days *prior* to this hospital stay (index admission) or 30 days *following* discharge, provide the following information about the hospital encounter. If the patient was seen more than three times in any of these settings pre or post the abstracted admission, please list the three that were closest to the admission.

	Admission Date	Discharge Date	Encounter Type	Principal Diagnosis ICD-9-CM	Principal Procedure ICD-9-CM/CPT-4*	DRG (If Inpatient)
30 days prior to admission Check here if: ☐ None ☐ Not applicable (newborn) ☐ Unknown						
1	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			
2	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			
3	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			
Index Admission	____/____/____	____/____/____				
30 days post discharge Check here if: ☐ None ☐ Not applicable (patient expired) ☐ Unknown						
1	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			
2	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			
3	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			

* Use most significant CPT procedure for previous observation status admissions.

Instructions for Completing the Patient Abstract Form

RECORD ABSTRACTION

Introduction

This chapter provides guidance to the medical record abstractor regarding individual data elements to be collected in the Patient Abstract Form. Each data element is described in more detail in this section. Please refer to the data definitions to ensure consistency in data abstraction.

Data Collection Instructions

General

Abstract medical records in the order they are listed. Before abstracting, ensure that the medical record is the correct once by confirming medical record number, visit or encounter number, patient name, patient birth date, and admission and discharge dates.

Sources of Data

Data may come from the patient's medical record, electronic data provided in printed hard copy form, or data abstracted from online sources within the facility. Incorporate all requested data elements from electronic data into the survey unless elements are available in electronic form in the requested format.

Sources of data are listed hierarchically in the order of preference. It is not necessary to review all listed sources of information. Use your judgment in selecting the best source from this list based on the documentation found at your facility.

Detailed Data Element Descriptions

A. STUDY SPECIFIC INFORMATION

Data Element Numbers: 1-2

Data Element Name: Study-specific information

Hospital Number: Identification number assigned to the hospital by the American Hospital Association (AHA)

HDS Number: Number assigned to the sampled record for processing

Sources: Provided by the NCHS

B. INFORMATION THAT IS REQUESTED ON UB-O4 CLAIM FORM

Data Element Numbers: 3-19

Data Element Name: The following patient-related items are data elements required on the UB-04 claim form.

Patient Name
Street Address
City
Zip Code
State
Birth Date OR Age (if no birth date)
Sex
Type of Acute Inpatient Admission
HIC Number (Medicare Patient Number)
Source of Admission
Status/Disposition at Discharge
Attending Physician UPIN/NPI
Operating Physician UPIN/NPI
Admitting Diagnosis ICD-9-CM and description
Surgical and Diagnostic Procedures: Electronic version provides for up to 25 codes.
Final Diagnoses and whether present at admission: Electronic version provides for up to 25 codes.
Charges by Revenue Center ID (including dates of charges and identified room charges)

Sources: UB-04 (or electronic form)
Billing record

C. MEDICAL RECORD FACE SHEET INFORMATION

Data Element Number: 21-27

Data Element Name: Data elements generally coded on the Face Sheet

Race

Ethnicity: Hispanic/Not Hispanic (Note: May be incorporated into Race)

Marital Status

Employment Status: Patient's employment status at the time of hospital presentation for this admission, or, if patient is less than 18 years old, employment status of the guarantor.

English Proficiency: Proficiency of patient if ≥ 13 years old, otherwise, proficiency of caregiver. If not coded on the Face Sheet, English proficient = Able to interact with healthcare providers in English and understand instructions provided and convey his/her own needs to healthcare providers. If not proficient, enter the primary language, if documented.

Consider a patient/parent/caregiver to be NOT proficient in English if s/he:
- Required/needed an interpreter
- Required a family member to act as an interpreter
- Signed a consent form in a language other than English or the consent was cosigned by an interpreter
- Required physician to conduct the history in a language other than English
- Received printed materials in a language other than English

Expected Source of Payment

Payer Type (primary)

Sources: Face sheet
Hospital information system, if not on Face Sheet
Nursing admitting note, if not on Face Sheet
Consent forms

D. CURRENT EPISODE/HOSPITAL STAY INFORMATION

Data Element Number: 28

Data Element Name: Mode of Arrival

Definition: Whether patient arrived at hospital location for this encounter by ambulance or walk-in. This item does not apply to newborns.

Sources: ED record
EMT/Ambulance transport record
Nurse admission note
Admitting history and physical

Data Element Number: 29

Data Element Name: Living Situation at Admission

Definition: Patient's living situation at the time of hospital presentation. This item does not apply to newborns.

Private residence: Patient came from a non-institutional setting, including a house, rented home or apartment, residential hotel, etc. Distinguish between living alone and living with others, if data are documented. If it is not clear from the documentation whether the patient lives with someone, assume that s/he lives alone.

Psychiatric facility: Includes any residential psychiatric, mental health, or substance abuse facility.

Other institution/facility (non-psychiatric): This includes acute care facility, skilled nursing facility (SNF), rehabilitation center, nursing home (NH), assisted living, prison, or any other long term care facility.

Homeless: Patient is noted to be homeless or staying in a shelter of any kind.

Other/Not stated: Any living arrangement not included above

Sources: Admitting history and physical
Nursing admission note
Discharge planning note

Data Element Number: 30

Data Element Name: Transfer from Other Emergency Department. This item does not apply to newborns.

Definition: Whether patient was seen in another hospital's Emergency Department prior to being directly transferred to the current facility.

Sources: ED record
Admitting history and physical

Data Element Number: 31

Data Element Name: Seen in Facility's Emergency Department

Definition: Whether this patient encounter included care in the facility's own ED and the timing of that care. **If the patient was NOT seen in this facility's ED, skip to Q32.**

Guidelines: If the patient was seen in the facility ED, indicate the date and time the patient was first documented as **receiving care**. This corresponds to the first documentation by a healthcare provider tending to the patient. Enter time in military time. For example, enter 0200 for 2:00 am and 1400 for 2:00 pm.

Check the box to indicate the type(s) of care to which the patient transitioned after the ED (observation only, observation that converted to acute inpatient care, or acute inpatient care only).

Give the date and time of the **first MD order** to change the patient's status of care from the ED (to either observation or acute inpatient care). Enter the date and time of the MD order even if the patient did not physically move and receive that care (e.g., move to an observation or inpatient bed) until much later. Enter only the order time of the first transition to other care, if there is more than one. In other words, if after the ED the patient went to observation that converted to acute inpatient care, enter just the timing of the order for observation.

Sources: ED triage form
ED nursing admission note
ED MD progress notes
MD orders

Data Element Number: 32

Data Element Name: Encounter Type

Definition: The type(s) of encounter that defined this admission. This item does not apply to newborns. **This question applies only to patients NOT seen in the facility's ED.**

Guidelines: Check the appropriate box to indicate whether the patient's episode of care was strictly observation (patient never acquired inpatient status), observation that converted to an acute inpatient admission, or an acute inpatient admission without any initial observation.

Indicate the date and time the patient was first documented as **receiving care.** This corresponds to the first documentation by a healthcare provider tending to the patient. Enter time in military time. For example, enter 0200 for 2:00 am and 1400 for 2:00 pm.

Sources: Nursing admission note

Data Element Number: 33

Data Element Name: Critical Care

Definition: Whether the patient was treated in a critical care bed during this admission.

Guidelines: Critical care = Admission to any critical care unit (e.g., ICU, CCU, NICU, etc.)

Indicate if the patient was treated in a critical care unit during this hospital admission. If so, enter the date the first episode (if more than 1) of critical care started and the date this critical care episode ended. This corresponds to the first documentation by a healthcare provider tending to the patient in a critical care unit. If the patient had more than 1 critical care stay during this admission, check the box provided.

Sources: Nursing notes
MD progress notes

Data Element Number: 34

Data Element Name: DNR during Admission

Definition: Indication of whether the patient had a Do Not Resuscitate (DNR) order or status at any point during this hospital admission. Patients who have DNR orders will not have resuscitation (chest compressions, mechanical ventilation, defibrillation) initiated in the event of cardiac/respiratory arrest other than possibly pharmacologic intervention.

Guidelines: If there is a DNR order from a physician in the record, note the date the first DNR order was written. If there is an indication that the patient had DNR status, but no MD order is found, check "Documentation of DNR but no order."

Sources: MD orders
DNR form signed by patient/patient representative and physician
MD progress notes

Data Element Number: 35

Data Element Name: Discharge Date and Time

Definition: Date and time patient left the hospital or died

Guidelines: Enter the date and time the patient was noted to leave the hospital. If the patient expired, note the date and time the patient was pronounced dead. Enter time in military time. For example, enter 0200 for 2:00 am or 1400 for 2:00 pm.

Sources: Nursing discharge note
MD progress notes

E. PATIENT CLINICAL VARIABLES (Obtained from Medical Record)

Data Element Number: 36

Data Element Name: Vital Signs Value on First Presentation

Definition: Patient's FIRST measured vital signs on hospital presentation, as measured within the first 24 hours. This item does not apply to newborns.

Blood Pressure: Enter FIRST systolic and diastolic values. Right justify all values (e.g., enter 140/70 as 140/070)

Heart Rate: Enter FIRST heart rate per minute. Right justify (e.g., enter 76 as 076)

Respiratory Rate: Enter FIRST respiratory rate per minute.

Temperature: Indicate whether the units are centigrade or Fahrenheit and the source of the first temperature measurement (e.g., axillary, oral, rectal).

Oxygen Saturation: Oxygen saturation is the measure of the percent of oxygen in the blood. It can be determined either through pulse oximetry or arterial blood gas (ABG) measurement. Alternative names that can be used to define oxygen saturation are: Pulse oximetry, Pulse ox, SaO_2, or O_2 sat.

Indicate whether the patient was on room air (RA) or was receiving oxygen at the time the FIRST oxygen saturation was measured. Include supplemental oxygen regardless of rate (liters/minute) and delivery system (e.g., nasal prongs, mask). If room air/supplemental O_2 is not specified, assume that the measurement was taken on room air (RA).

Height: If documented both by patient estimate and actual measurement, take the measured height over the estimated height. If only an estimated height is available, take this value.

If fractions are given (e.g., 5 feet 10 ½ inches), round the value to a whole number (e.g., 5 feet 11 inches). If the height is noted in meters (e.g., 1.85), convert this to centimeters by multiplying by 100 or moving the decimal point 2 digits to the right (e.g., 1.85 meters = 185 centimeters).

Weight: If the weight is documented both by patient estimate and actual measurement, take the measured weight over the estimated weight. If only an estimated weight is available, take this value.

If fractions are given (e.g., 150 ½ pounds), round the value to a whole number (e.g., 151 pounds).

Guidelines: Use the FIRST value noted after hospital arrival (if within first 24 hours) for each type of vital sign. Do NOT use values measured prior to arrival (e.g., physician's office, emergency

transport). If any vital sign is not noted in the first 24 hours of this hospitalization, check the box to indicate this.

Sources: ED record
Nursing admission form
Nursing notes
Vital signs flow sheet/graphic
Admitting history and physical
MD progress notes
Respiratory therapy notes

Data Element Number: 37

Data Element Name: Clinical Laboratory Results: Initial Results

Definition: Patient's FIRST measured laboratory values on hospital presentation, as measured within the first 24 hours. This item does not apply to newborns.

Hematocrit: Synonyms: Hct, crit. Percent of blood that is red blood cells. Enter the FIRST value to one decimal point.

White Cell Count: Synonyms: WBC, white count, total WBC, leukocyte count. White blood cell concentration in the blood. Enter the FIRST value to 1 decimal point in units of 1000. For example, enter 158,300 as 158.3.

Platelet Count: Synonyms: Thrombocyte count, plt. Platelet concentration in the blood. Enter the value in units of 1000. For example, enter 350,000 as 350.

Serum Sodium: Synonym: Serum Na, Na+. Concentration of sodium in the blood or serum. Enter the FIRST value as a whole number. If a fraction is given (e.g., 136.7), round the value to the nearest whole number (i.e., 137). Note that a value reported in meq/L is the same as mmol/L.

Serum Potassium: Synonyms: Serum K, K+. Concentration of potassium in the blood or serum. Enter the FIRST value to 1 decimal point. Note that a value reported in meq/L is the same as mmol/L

Blood Urea Nitrogen: Synonym: BUN, urea nitrogen. Concentration of urea nitrogen in the blood or serum. Do NOT enter urea clearance. Be sure that the source of the specimen is blood.

Serum Creatinine: Synonyms: Serum creat, Cr. Concentration of creatinine in the blood or serum. Enter the FIRST value to 1 decimal point. Do NOT enter creatinine clearance. Be sure that the source of the specimen is blood.

Guidelines: Use the first value measured after hospital arrival if done within the first 24 hours. Do NOT use any preadmission values even if these are the only values in the record. If there is no specified lab value noted in the first 24 hours of this hospitalization, check the box to indicate this. Include a value only if the time sent to lab, time received in lab, or time recorded is within the first 24 hours of admission.

Sources: Laboratory results
ED record
Admitting history and physical
MD progress notes

Data Element Number: 38

Data Element Name: First Pain Assessment

Definition: FIRST assessment of the patient's level of pain on presentation to the hospital that was done within the first 24 hours. This item does not apply to newborns.

Guidelines: This may either be documented as a rating on a 10-point or 5-point scale or noted with a severity descriptor (e.g., moderate). Take the FIRST value documented after hospital arrival and within the first 24 hours. If pain severity is given as a range (e.g., mild to moderate, 5-6/10), note the more severe level of pain (e.g., mild to moderate = moderate, 5-6/10 = 6/10). If a 10-point scale is used, right justify when entering values less than 10 (e.g., enter 6/10 as 06).

If an alternative scale is used, translate the score to Severe, Moderate, Mild, No Pain, or Unknown as indicated by the legend of the scale used. Do NOT use assessments that are more than 24 hours after presentation to the hospital.

Sources:
ED record
Nursing admission note
Nursing notes
MD progress notes
Pain management flow sheets
Vital signs flow sheet/graphic

Data Element Number: 39

Data Element Name: Drug Allergies at Time of Admission

Definition: Allergy to any prescription or over-the-counter medication. This item does not apply to newborns.

Guidelines: Do NOT include reference to herbal preparations (e.g., St. John's Wort). Include any drug to which the patient is known or suspected to have an allergy or past untoward side effect. This includes references to specific drugs as well as drug categories (e.g., beta-blockers). Include any medication that a provider has noted that the patient is not a candidate to take or for which the patient has a contraindication (absolute or relative). Do NOT include allergies to other types of allergens (e.g., environmental, food, etc.)

Do NOT include allergies noted for the first time AFTER presentation to the hospital. For example, if a patient was noted to have no known drug allergies (NKDA) on presentation, but had an apparent reaction to a drug administered in the ED, you would enter "None" to this item.

Sources:
ED record
Nursing admission note
Admitting history and physical
MD progress notes
Medication administration record (MAR)
Medical record allergy alert sticker

Data Element Number: 40

Data Element Name: Cigarette Use

Definition: Assessment of patient's cigarette use at the time of admission. This information does NOT include use of cigars, pipes, and/or chewing tobacco. This item only applies to patients who are at least 10 years of age.

Guidelines: Consider the patient a cigarette smoker if s/he smokes any amount of cigarettes and of any frequency. If a patient is currently in a smoking cessation program and/or is using prescription nicotine aids to stop, base your answer on whether or not smoking had completely stopped at the time of this admission. If a patient is noted to be a "non-smoker" and there IS evidence of prior use, check the appropriate box regarding timing of stopping. If a patient is noted to be a "non-smoker" and there are no data about past use, check "Not current smoker, no further information."

If 2 healthcare providers document conflicting data (e.g., MD notes include a statement by an MD that the patient is a smoker, but another MD notes that the patient does not smoke), note the more "positive" value (e.g., patient is a smoker).

Sources: Admitting history and physical
MD progress notes
Nursing admission note
Nursing notes

Data Element Number: 41

Data Element Name: Cigarette Smoking History

Definition: This item applies only to patients who are current smokers or known to be past smokers. Enter the pack years smoked, if available OR any information about quantity of packs smoked per day and years smoked. "Pack years" is calculated by multiplying the number of packs smoked per day times the number of years of smoking. Do NOT enter smoking quantity/duration into the "pack years" field unless the value is specified in the record as referring to "pack years." If quantity smoked and duration of smoking are not both specified, enter what data are given.

Guidelines: If 2 healthcare providers note conflicting data (e.g., MD notes include a statement by an MD that the patient has smoked 2 packs of cigarettes a day for 10 years, but another MD notes that the patient has smoked 2 packs of cigarettes a day for 15 years), document the more "positive" value (e.g., patient smoked 2 packs of cigarettes for 15 years).

Sources: Admitting history and physical
Nursing admission note
Nursing notes
MD progress notes

Data Element Number: 42

Data Element Name: ASA Classification for Surgical Patients

Definition: Assessment of patient surgical risk based on a system created by the American Society of Anesthesiologists (ASA). This item does not apply to newborns.

Class 1	Generally healthy, localized pathologic process
Class 2	Stable mild to moderate systemic condition (e.g., smoker, history of hypertension, obesity, diabetes, asthma, age > 70 years)
Class 3	Moderately severe systemic disorder (e.g., poorly controlled disorders, history of coronary artery disease, cardiac arrhythmia)
Class 4	Severe and clearly life-threatening disorder (e.g., recent myocardial infarction, acute coronary syndrome, severe congestive heart failure or COPD, hepatic or renal failure)
Class 5	Little chance of survival; not expected to survive without the surgery
Class 6	A declared brain-dead patient whose organs are being removed for donor purposes

Guidelines: This must be noted in the chart by a physician and specifically described by patient class (or ASA). Do not try to determine ASA class based solely on patient medical history. Check "Not applicable" if the patient did not have surgery or another interventional procedure requiring an anesthesia assessment during the admission.

Sources: Anesthesiology preoperative note
Anesthesia record
MD progress notes

Data Element Number: 43

Data Element Name: Vital Signs (day prior to and day of discharge)

Definition: Any single vital sign within the specified ranges on the ***day before or day of*** discharge. This applies only to patients who had an acute hospital length of stay of at least 3 days, was discharged to home, and was at least 16 years old.

Guidelines: Indicate if any physiologic measure in the specified range listed below was documented at any time *on the day before or day of* discharge:

- Temperature > 37.8 °C or > 100 °F
- Heart rate > 100/minute
- Respiratory rate > 24/minute
- Systolic blood pressure < 90 mm Hg
- O_2 saturation < 90% on room air (RA) OR < 95% on supplemental oxygen by any means (e.g., mask, nasal prongs) and of any concentration

Note the occurrence of any of the above regardless of the frequency and/or duration of its occurrence. Only count measurements above the specified level (e.g., include a temperature of 37.9 °C, but not 37.8 °C).

Sources: Vital signs flow sheet/graphic
Nursing notes
MD progress notes
Respiratory therapy notes

Data Element Number: 44

Data Element Name: Birth Statistics

Definition: This item is for newborns ONLY. Newborn's statistics at the time of birth.

Guidelines: Document the following:

Birth Length: Enter birth length in inches or centimeters. If length is given in inches enter to one decimal point (e.g., 21 ½ inches should be recorded as 21.5 inches). If no fraction is given, record the whole number with the fractional digit of zero (e.g., 22 inches should be recorded as 22.0 inches)

Birth Weight: Enter birth weight in pounds and ounces or grams.

Apgar Scores: Enter scores measured at 1 and 5 minutes after birth. For the Apgar score, a value of 0-2 is given to each of 5 criteria: heart rate, respiratory effort, muscle tone, response to stimulation, and skin color. A score of 10 indicates the best possible condition.

Estimated Gestational Age: A full-term pregnancy is considered to be 40 weeks, though pregnancy lengths between 38 and 42 weeks are considered normal. A fetus born prior to the 37th week of gestation is considered premature. Enter estimated gestational age (EGA) in weeks (and days, if given).

Estimated Date of Confinement: Also called expected date of confinement of EDC. The date at which an infant is expected to be born, calculated from the date of the last menstrual period.

Sources: Delivery record
Nursery admission notes

Data Element Number: 45

Data Element Name: Mother's Medical Record Number

Definition: This item is for newborns ONLY. Medical record number of the newborn's mother.

Sources: Face Sheet
Other on-line system link

Data Element Number: 46

Data Element Name: Medications at Admission and Discharge

Definition: Summary of all medications that the patient was taking immediately preceding admission to the hospital (up to 20) and at the time of discharge (up to 20). Do NOT include medications taken within weeks of admission, but discontinued by the time of admission (e.g., a recently completed course of antibiotics). If patient is transferred to another facility at discharge, list

patient medications at the time of transfer. For all medications at the time of discharge /transfer, indicate by checking the box after each medication if the route was intravenous (IV).

Guidelines: If there are more than 20 medications listed at either admission or discharge, list drugs in the following order of priority until 20 are listed:

1. Medications, all routes EXCEPT topical:
    A. Taken daily
    B. Taken PRN or as needed
2. Medications, topical:
    A. Taken daily
    B. Taken PRN or as needed
3. Herbals and nutritional supplements

Sources: ED record
Nursing admission note
Admitting history and physical
MD progress notes
Discharge summary
Drug Reconciliation Form

F. FINANCIAL AND BILLING RECORD DATA ELEMENTS

Data Element Number: 47

Data Element Name: Charges/Expected Reimbursement/Actual Payment

Definition: Provide the following:

Duration of care in days for: Inpatient care, intensive
Inpatient care, general acute
Rehabilitation/Step down care

Reimbursement data: Expected, emergency care
Expected, observation care
Expected, total hospital encounter

Actual payment, observation care
Actual payment, total hospital encounter

Sources: Billing record

Data Element Number: 48

Data Element Name: Social Security Number (SSN)

Definition: Patient's 9-digit social security number

Sources: Face sheet
Billing system
Hospital information system

G. INFORMATION FROM OTHER HOSPITAL CARE WITHIN 30 DAYS

Data Element Number: 49

Data Element Name: Acute Admission/Observation/ED Visit in 30 Days Prior to/After this Admission

Definition: Any acute admissions/observations/ED visit of this patient in the 30 days **prior** to the current admission date (up to 3) or in the 30 days **after** the current discharge date that occurred in this same facility (up to 3).

Guidelines: This data element requires examination of the patient's entire sequence of medical records for any encounters (acute inpatient, observation, emergency department) for the 30 days prior to admission and 30 days after discharge. This information may also be produced from the hospital's administrative records of ED, observation, and inpatient admissions.

Include for all relevant admissions the admission and discharge dates, type of encounter, the principal diagnosis (ICD-9-CM), principal procedure (ICD-9-CM or most significant CPT-4), and the DRG (if an inpatient admission).

For reference, you may record the dates of the current admission (i.e., index admission) that you are abstracting. If there are more than 3 pre or post events, record those that are closest in time to the index (current) admission.

Sources: Complete patient record
Hospital information system

Appendix B

National Hospital Discharge Survey Interviewees

APPENDIX B

National Hospital Discharge Survey Interviewees

Individual Interviews

Name	Title	Organization
Linda Aiken, PhD, RN	Professor of Nursing and Sociology	Center for Health Outcomes Studies
John Ayanian, MD, MPP	Associate Professor of Health Care Policy; Associate Professor in the Faculty of Public Health; Associate Professor of Medicine	Harvard Medical School Department of Health Care Policy
Laurence Baker, PhD	Chief, Health Services Research	Stanford University
E. Richard Brown, PhD	Director	UCLA Center for Health Policy Research
Jeremy Brown, MD	Assistant Professor of Medicine, Emergency Medical Care	George Washington University
Mark Chassin, MD	Professor and Chair, Health Policy; Professor of Medicine, Mount Sinai School of Medicine	Department of Health Policy, Mount Sinai School of Medicine
Michael Chernew, PhD	Professor, Department of Health Management and Policy, Department of Economics, and Department of Internal Medicine	University of Michigan
Benjamin K. Chu, MD	Regional President	Southern California Kaiser Foundation Health Plan and Hospital
Steven Clauser, PhD	Chief, Outcomes Branch	National Cancer Institute
Barbara Fleming, MD, PhD	Chief Quality and Performance Officer	Veterans Health Administration
Elizabeth Fowler, PhD	Former Professional Staff	U.S. Senate Finance Committee
Joe Francis, MD	Acting Deputy Chief Research and Development Officer	US Department of Veterans Affairs
Tim Hofer, MD	Research Investigator Associate Professor	VA Center for Practice Management and Outcomes Research Department of Internal Medicine, Univ of Michigan
Susan D. Horn, PhD	Senior Scientist	Institute for Clinical Outcomes Research
David Hunt, MD, FACS	Medical Officer	CMS Office of Clinical Standards and Quality
Meg Johantgen, PhD, RN	Associate Professor	University of Maryland School of Nursing
Michael Karpf, MD	Executive Vice President, Health Affairs	University of Kentucky
Vahe Kazandjian, PhD	Senior Vice President	Maryland Hospital Association
Nicole Lurie, MD, MSPH	Senior Natural Scientist; Co-Director, Public Health, Center for Domestic and International Health Security	RAND
Mike Morissey, PhD	Professor of Public Health	Univ of Alabama, Birmingham

Name	Title	Organization
Jack Needleman, PhD	Associate Professor, Department of Health Services	UCLA School of Public Health
Joseph Newhouse, PhD	John D. MacArthur Professor of Health Policy and Management Chair, Committee on Higher Degrees in Health Policy Malcolm Wiener Center for Social Policy	Division of Health Policy Research and Education Harvard University
Michael J. O'Grady, PhD	Former Assistant Secretary for Planning and Evaluation	Department of Health and Human Services
Stephen Pitts, MD, MPH	Assistant Professor and Emergency Room Physician	Emory University Schools of Medicine and Public Health
Neil Powe, MD, MPH, MBA	Director	Welch Center for Prevention, Epidemiology and Clinical Research
A. Bruce Steinwald	Director, Health Care	Government Accountability Office
Bruce C. Vladeck, PhD	Interim President Principal	University of Medicine and Dentistry of New Jersey Ernst & Young, Health Sciences Advisory Services
Gail Wilensky, PhD	Senior Fellow	Project HOPE

Group Interviews

Organization	Participants	
Agency for Healthcare Research and Quality	Roxanne Andrews Karen Beauregard Steve Cohen Anne Elixhauser Trina Ezzati-Rice	Irene Fraser Ernest Moy Bill Munier Pamela Owens Claudia Steiner
American Hospital Association	Nancy Foster, Senior Associate Director, Health Policy Allisa O'Keefe Carolyn Steinberg	
CMS Headquarters	Herb Kuhn, Director, CMS Pat Brooks, Renee Mentnech	Liz Richter Todd Smith Daniel Stein
CMS, Boston Regional Office	Charlotte Yeh, M.D.- Regional Administrator Edwin Huff, Ph.D., M.A., B.A., Science Officer, Division of Clinical Standards and Quality	
Joint Commission for Accreditation of Healthcare Organizations	Jerod Loeb, MD – Executive Vice President, Division of Research Sharon Sprenger	
University Health System Consortium	Raj Bahal, MD, MPH, Medical Director, Clinical Effectiveness & System Redesign; Director, Clinical Informatics Susan Bradshaw, Senior Director, Clinical Information Mgmt Svcs Julie Cerise, RN, MSN, Senior Director Clinical Process Improvement	

Appendix C

National Hospital Discharge Survey Workgroup Panel Members

APPENDIX C

National Hospital Discharge Survey Workgroup Panel Members

Name	Title	Organization
Robert Brook, MD, ScD	Director, RAND Health	RAND Corporation
David Carlisle, MD, PhD	Director	California Office of Statewide Health Planning (OSHPD)
Carolyn Clancy, MD	Director	AHRQ
Paul Ginsberg, PhD	President	Center for Studying Health System Change Mathematica Policy Institute
Mark Hornbrook, PhD	Senior Investigator Chief Scientist	Kaiser Center for Health Research
Ed Hunter	Associate Director for Planning, Budget, and Legislation	NCHS
Charles (Chip) Kahn III, MPH	President	Federation of American Hospitals
Beth McGlynn, PhD	Associate Director, RAND Health	RAND Corporation
Karen Milgate, MPP	Principal Policy Analyst	Medicare Payment Advisory Commission
John Rolph, PhD	Professor of Statistics	Marshall School of Business at the University of Southern California Center for Applied Mathematics and Statistics
James V. Scanlon	Deputy Assistant Secretary	ASPE Office of Science and Data Policy
Julie Sochalski, PhD, FAAN, RN	Associate Professor of Nursing	University of Pennsylvania School of Nursing

Appendix D

Description of Policy Issues and Sample Research Questions

APPENDIX D

DESCRIPTION OF POLICY ISSUES AND SAMPLE RESEARCH QUESTIONS

Policy Issue	Brief Description	Sample Research Questions
Cost of care / Resource use	Addresses questions of how much is spent on health care; may be used to assess efficiency or waste.	• How much is paid for care and who pays? • What is the cost of an episode of care? • What is the cost of care for the uninsured? • How do the costs of treatment patterns compare? • How much is spent on patients in the top decile of utilization? • What are the costs (and benefits) of new services, technologies and treatments? • What is the optimal allocation of new services, technologies and treatments to achieve the desired clinical outcome? • What is the improvement in health per health care dollar spent? • What is the value received for every health care dollar spent and how is value measured? What is the cost by type of outcome? • How does functional status improve in relation to the investment in health care?
Continuity of care – Patient transitions between care settings	Addresses questions of effectiveness by helping to understand how and how well patients are cared for as they move between sites of care.	• What is an episode of care? • How is functional status of a patient affected by the hospital encounter? • Are patient characteristics associated with the number and type of transitions of care? • How does home care or longer hospitalization affect the cost of care and quality? • How do we track the care of patients with chronic disease (particularly the elderly)? • How do patients move through the system? • Which providers are seen, when and by whom? • How do patients access the health care system over time? • How do transitions of care affect quality?

DESCRIPTION OF POLICY ISSUES AND SAMPLE RESEARCH QUESTIONS, CONTINUED

Policy Issue	Brief Description	Sample Research Questions
Movement of care from inpatient to other care settings	Provides an understanding of how treatment patterns and practices change for example with changing technical competency or modifications in payment policies.	• Which procedures are being done in what care settings? How is this changing over time? • Which diagnoses are being treated in what care settings? How is this changing over time? • What is the burden of illness of patients in each care setting and how is this changing over time? • What are the characteristics of surgeries that are moving out of the hospital? • What are the cost and quality implications of the migration of care to other settings?
Care delivered throughout the hospital	Provides depth and breadth to understanding the care delivered to patients in hospitals. This could include clinical services provided to patients, when services were provided, and the sites of care in which patients receive services. Clinical services would likely initially include the fact that service was provided and with greater access to electronic data, the results of those services.	• Which physicians and other caregivers provide care for the patient during their hospitalization? • What are the patterns of drug utilization, which drugs are prescribed, and when are they administered? • Which diagnostic tests are ordered and provided (laboratory, radiology, other)? • Are inpatient clinical guidelines followed? • What care is provided to the patient in all hospital-based care settings – emergency department, outpatient clinics, observation, rehabilitation, SNF (if available)? • How consistent are admission and discharge diagnoses? • What are the differences in severity, care and outcomes in specialty hospitals?
Disparities / Access	Addresses questions of equitable care with the intent of expanding more deeply into SES metrics such as better definitions of race and ethnicity, income, wealth, occupation, etc.	• Are there differences in hospital utilization by various SES characteristics? • Are there SES differences across patients by disease or procedure? • Are there SES differences in processes or outcomes of care? • Do rates of utilization vary by insurance status?

DESCRIPTION OF POLICY ISSUES AND SAMPLE RESEARCH QUESTIONS, CONTINUED

Policy Issue	Brief Description	Sample Research Questions
Quality of care and patient safety	Addresses questions of the degree to which processes of care are consistent with guidelines/standards and whether outcomes vary by facility characteristics.	• What is the quality of care for people across care settings? • What is the appropriateness of care in each care setting? • What is the rate of readmission? • Does quality affect functional status? • Does risk-adjusted mortality vary? • How does procedural volume affect facility and provider outcomes? • What conditions and comorbidities are present at admission? • What are the rates of complications attributable to hospital stays? • Which patterns of preventable adverse events are occurring?
Mix and use of labor	Focuses on the mix and use of labor in each health care setting. This could include a broad understanding of skill mix and hours or detailed time and motion studies.	• What types of health providers actually deliver care to the patient and how much care is delivered? • What are the innovations that most affect demand for different types of providers? • Is the mix of providers associated with differences in processes or outcomes of care? • Do diagnoses and procedure volumes relate to concentrations of different care professionals (the supply side of the equation)?
Use and value of technological changes and innovations	Provides a basis for understanding the role and value of technology (particularly new and emerging) in health care. This topic includes the ability to determine specific types of technologies (e.g., robotic surgery) used in caring for the patient. It could also include device tracking for monitoring and safety.	• What is the value of one form of technological innovation over another for treating disease (drugs and devices)? • What are the costs and benefits of new services, technologies and treatments? • What are the trends in treating disease (not just hospitalization from a disease)? • What is the use of and rate of adoption for complex technology?
Focused studies	Drills down to answer focused questions, e.g., diseases that are high cost / high volume, important from a public health perspective or of special interest.	• How can we track and trend the “top 10” diseases (cost or volume)? • How can we track and trend “rare” diseases? • What are the important markers /indicators to understand severity by condition?

DESCRIPTION OF POLICY ISSUES AND SAMPLE RESEARCH QUESTIONS, CONTINUED

Policy Issue	Brief Description	Sample Research Questions
Standards against which performance can be compared (Benchmarking)	Provides comparison points (often averages or best practices) at any level of the health care system or any geographical aggregation desired. Comparisons could include utilization of health services questions about the composition of facilities or providers.	• What are benchmarks at different levels in the health care system – local, regional, national, global? • What comparisons can we draw about care delivered in institutions by size, ownership, teaching status, geography or other factors? • What are the characteristics of care by state or MSA?
Public health and surveillance	Provides ability to track and trend disease and conditions of interest to public health.	• What public health interventions occurred before a person contracted the disease for which he/she was hospitalized (e.g., vaccinations)? • What environmental factors contributed to the hospitalization? • Do increased rates of pneumococcal vaccines lead to changes in rates of hospitalization? • How prepared are providers for health care emergencies (e.g., processes, systems, surge capacity, isolation, helicopters, redundancies, etc.)?
Impact of globalization	Provides information on the potential role of the global healthcare market in providing care to US residents and/or how the US health care market performs in the global health care environment.	• What are the characteristics of care that could be obtained outside the United States? • How would this ease demands on the U.S. healthcare system for workforce and beds? • Which measures should be used to compare the U.S. system to that in other countries (cost, disease specific measures, quality, safety)?
Role / value of an electronic medical record	Provides an understanding of our future ability to collect and manage clinical information with the advent of EMRs and particularly Regional Health Information Networks and the National Health Information Network.	• What needs to be done to ensure linkages to other data sources to maximize the utility and leverage the vast array of data which will increasingly become available? • How well are “legacy systems” in hospitals and other providers integrated? • What factors predict adoption of new systems? • Are processes and outcomes of care better at facilities with advanced EMR products?

Appendix E

A Menu of Non-Mutually Exclusive Options for Redesigning the NHDS

APPENDIX E

A MENU OF NON-MUTUALLY EXCLUSIVE OPTIONS FOR REDESIGNING THE NHDS

Option	Basic Description
1	***Continue the NHDS as It Currently Exists*** *(page E-2)* Maintain NHDS as is
2	***Eliminate the NHDS as It Currently Exists*** *(page E-3)* HCUP/NIS represents DHHS's source for inpatient data
3	***Coordinate DHHS Inpatient Data Collection, Particularly HCUP*** *(page E-4)* • Conduct representative sampling in hospitals in non-HCUP states • Data pertaining to NHDS-selected hospitals for a national probability sample are extracted from the HCUP hospital data in the SID participating states
4	***Use NHDS to Supplement MEPS and Vice-Versa*** *(page E-6)* Complete an NHDS data abstraction on the approximately 3000 annual admissions to hospitals of individuals in MEPS, creating a longitudinal survey of hospitalized patients
	Options that Add Variables
5	***Increase Clinical Depth*** *(page E-8)* Add hospital-based clinical variables (e.g., medications, laboratory tests, radiology procedures) to capture more information about the care of hospitalized patients
6	***Increase Patient Demographic Information*** *(page E-10)* Collect additional patient information that permits analysis of sociologic/access issues (e.g., languages spoken, detailed ethnicity)
7	***Increase Hospital Resource Use Information*** *(page E-12)* Add hospital resource use and incorporate charges (as a proxy for cost) for hospitalized patients. For example, workforce (e.g., licensed independent practitioners, technicians), service allocation by cost center (e.g., ICU, cardiac catheterization laboratory, endoscopy, NICU, laboratory, radiology)
8	***Obtain Data on Pre- and Post-Hospital Care*** *(page E-14)* Using hospitalized patients as the unit of analysis, obtain data about their immediate pre- and/or post-hospital care • Ambulatory care (e.g., physicians' offices, ambulatory surgery centers) • Institutional care (e.g., rehabilitation, SNF, long term care)
9	***Track by Episode of Care*** *(page E-16)* Using hospitalized patients as the unit of analysis, track the care patients receive across all care settings for an "episode" of care
10	***Conduct Longitudinal Tracking of a Patient Cohort*** *(page E-18)* Using hospitalized patients as the unit of analysis, longitudinally track a patient cohort forward for a specified period of time (2 or 3 years)
	Options that May Change the Sampling Design
11	***Incorporate Inpatient and Short-Stay Admissions*** *(page E-20)* Using patients occupying an "acute" hospital bed as the unit of analysis, collect NHDS data for any hospital-based care setting using available hospital records. This approach would "reconstitute" much of the earlier NHDS sample by including care now classified as "outpatient" but still requiring acute hospital facilities.
12	***Incorporate Patient Care Encounters Throughout the Hospital*** *(page E-22)* Using the patient encounter with any hospital-based service as the unit of analysis, track patient care from point of entry (e.g., Emergency Department, Hospital Outpatient, Ambulatory Surgery, Inpatient) to discharge (e.g., Rehab, SNF) using available hospital records
13	***Track Disease-Specific Care*** *(page E-24)* For a limited set of conditions (e.g., high volume, high cost) track patient use of clinical and physical resources within the inpatient setting
14	***Obtain Outcome Data*** *(page E-26)* Consider strategies to obtain outcome data; suggested examples include: • Collect patient name and SSN to link to National Death Index • Track patient experiences with care (Hospital CAHPS) • Track readmissions
	Improved Data Collection
15	***National Statistical Hospitals*** *(page E-28)* Establish a network of hospitals where patients using hospital services consent to have their personal health information included as part of the national survey of care to patients receiving hospital-based services. Patients could opt out and their information would be excluded from any sampling. Being a national statistical hospital could be positioned as an honorable and important contribution to society.

OPTION DESCRIPTION

OPTION NUMBER: 1

OPTION TITLE: CONTINUE THE NHDS AS IT CURRENTLY EXISTS

OPTION DESCRIPTION AND GENERAL APPROACH
This option would retain the NHDS in its current form.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH
No change is required to the NHDS.

TYPES OF QUESTIONS APPROACH WILL ANSWER
The NHDS will continue to serve its historical role of:

- Tracking and trending of diseases and procedures in inpatient settings
- Analyzing broad disparities in care
- Analyzing the impact of payment and other regulations on hospital utilization

SAMPLE DESIGN AND CONSIDERATIONS
There are no statistical design issues or considerations with this option.

DATA LOCATION / RECORDS REQUIRED
No change

DATA ELEMENTS
Data elements parallel the UB92, associated with hospital demographic information. These include:

Patient Information	Administrative Information	Medical Information
Hospital number	Type of admission	Final diagnoses (up to 7)
Date of admission	Source of admission	Procedures and dates (up to 4)
Date of discharge	Patient disposition	
Patient residence zip code	Expected source of payment	
Date of birth	Hospital bed size	
Age	Hospital ownership	
Sex	Region of the country	
Race		
Ethnicity (Hispanic, not Hispanic)		

OPTION DESCRIPTION

OPTION NUMBER: 2

OPTION TITLE: ELIMINATE THE NHDS AS IT CURRENT EXISTS

OPTION DESCRIPTION AND GENERAL APPROACH
Discontinue the NHDS. Because the NHDS is integral to several Department of Health and Human Services reporting requirements to Congress (Health United States, Healthy People, National Reports on Quality and Disparities) and provides the benchmark used by AHRQ for inpatient care, researchers and policymakers will need to rely on other sources (e.g., HCUP) to approximate inpatient services.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH
Elimination

TYPES OF QUESTIONS APPROACH WILL ANSWER
Not Applicable

SAMPLE DESIGN AND CONSIDERATIONS
Eliminating the NHDS would mean that a national probability sample of inpatient discharges would not be available for research and policy purposes. Using comparisons from prior years, one could calculate the magnitude of biases present in other surveys and data sources; however, unbiased estimates would no longer be possible. A phase out strategy using overlapping data collection with a replacement data source might need to be implemented to allow continuation of longitudinal comparisons.

DATA LOCATION / RECORDS REQUIRED
None

DATA ELEMENTS AND AVAILABILITY
Not Applicable

OPTION DESCRIPTION

OPTION NUMBER: 3

OPTION TITLE: COORDINATE DHHS INPATIENT DATA COLLECTION, PARTICULARLY HCUP

OPTION DESCRIPTION AND GENERAL APPROACH

This option would leverage rather than duplicate inpatient data collection efforts in the 39 states (2005) represented in the HCUP State Inpatient Databases (SID). [1] The NHDS would retain responsibility for developing a national probability sample of hospitals by developing a sampling strategy, receiving the hospital data for those states in the HCUP sample directly from HCUP, continuing data collection in hospitals in the remaining 11 states not currently contained within the HCUP data.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

There are three potential considerations under this option:

1. Use NHDS services to fill HCUP gaps. Under this scenario, NHDS would collect data elements, most notably charges, that are currently part of HCUP but not included in the NHDS.
2. Use HCUP to provide NHDS information for HCUP states, limiting NHDS data collection only to those states not included in HCUP. HCUP would need to collect the data elements in NHDS that are not currently included in HCUP (to keep the NHDS whole).
3. Consolidation: If AHRQ and NCHS wished to consolidate the databases, the NHDS would need to enhance its data collection efforts in the non-HCUP states to include the HCUP data elements and HCUP would need to add NHDS elements not currently captured.

TYPES OF QUESTIONS APPROACH WILL ANSWER

This option allows an unbiased sample to continue to be available to answer key questions at potentially a lower cost than currently exists. Having a national probability sample that includes charges (cost) will address some of the key priority issues identified by the workgroup members.

SAMPLE DESIGN AND CONSIDERATIONS

If one were to choose to use HCUP to "supplement the NHDS," the likely strategy would be to maintain the current NHDS sampling strategy and draw the NHDS sample in the HCUP states from the SIDs. NHDS would be required to abstract data only from those states not included in HCUP. It is likely the non-HCUP states (generally small and rural) have a greater share of hospitals requiring manual abstraction. However, this option could potentially free up NHDS resources to be used to pursue some of the other options discussed here.

If one chooses to use the NDHS to "supplement HCUP," the 72,000 direct abstractions (out of 300,000 total) carried out for the NHDS could be reallocated to the non-HCUP states. This strategy would sample inpatient discharges in the non-HCUP states at a greater fraction than it does in current NHDS (manual) hospitals, which could be sufficient to derive weights that could be used to integrate the two sets into a truly representative, unbiased, and precise national sample of discharges. At some point (perhaps when the non-sampled discharges represent 3-

[1] States not in the SID include: Alabama, Alaska, Delaware, Idaho, Louisiana, Mississippi, Montana, New Mexico, North Dakota, Oklahoma and Wyoming (http://www.hcup-us.ahrq.gov/sidoverview.jsp#States). The District of Columbia and US Territories are also not included.

4% of total discharges), it might be desirable to reduce the sample size of the NHDS and eventually eliminate the sampling from these states.

The NCHS and AHRQ need to decide if the NHDS and HCUP should align, over time, the data elements they collect. An important consideration will be timeliness of data and the release of the NHDS national sample because it will take a number of months longer for NCHS to receive the data from AHRQ rather than obtaining it directly from the states. The additional delay, however, may represent a reasonable tradeoff to maintain the unbiased sample through a less resource intensive method.

DATA LOCATION / RECORDS REQUIRED

For the non-HCUP states, data would be obtained in the same manner employed by NHDS but the data submission to the NCHS would need to include charge information (similar to HCUP). If obtained electronically from hospital UB92 records, this will not be problematic. When data are collected manually by a Census field representative at the hospital site, the abstractor will need to get charge information from the hospital's business services department because those data are not available in the medical records. As mentioned above, given the nature of the states from which HCUP does not receive data, the probability that Census field representatives will carry a large share of responsibility for data collection is high.

DATA ELEMENTS AND AVAILABILITY

Decisions will need to be made regarding homogenizing the data elements collected by these two databases. The most notable change will be the inclusion of charge data into the NHDS database.

OPTION DESCRIPTION

OPTION NUMBER: 4

OPTION TITLE: USE NHDS TO SUPPLEMENT THE MEDICAL EXPENDITURE PANEL SURVEY (MEPS) AND VICE-VERSA

OPTION DESCRIPTION AND GENERAL APPROACH

This option would complete an NHDS abstraction on the 3000 annual hospitalized MEPS patients. In essence, this option represents a special case design of a longitudinal expansion to the NHDS (option 10).

MEPS provides the only publicly available longitudinal patient survey of health care utilization, cost and payment across the continuum of care in the United States. The provider component of MEPS is used to supplement the information about hospitalization collected in the household component, but it provides little information about the hospitalization. This option would add the NHDS (redesigned) module to the data already collected as part of MEPS about the hospitalized patient.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

No change is required to the NHDS, although it may be considered desirable for the NHDS to provide the necessary weightings and other requirements that would permit the NHDS to be enhanced by the breadth of data available from MEPS – Household Component.

TYPES OF QUESTIONS APPROACH WILL ANSWER

- How does health care use and spending vary among different sectors of the population?
- How does having health insurance and wealth impact a patient's options for care and the timing of care?
- What influence does patient management (e.g., home care, ambulatory care, preventive care) have on subsequent hospital care treatment and outcomes?
- What care factors are associated with better long term outcomes from inpatient treatment?
- Are certain comorbid conditions associated with higher risk of poor outcomes? If so, are there strategies to specifically address those conditions?
- Does access to different types of service improve patient function, prevent readmission or deter subsequent morbidity from disease?
- What continuity of care issues place patients at risk for readmission or continued morbidity?
- What are optimal care venues and services following hospital treatment for specific conditions?
- Access to which community services may reduce the risk of hospitalization and morbidity from disease?

SAMPLE DESIGN AND CONSIDERATIONS:
This option would not replace the NHDS, but rather would enhance the kinds of information available from an additional NHDS sample. This sample would likely not be combined into the NHDS national probability sample. However, it might be worth considering including the hospitals in which MEPS patients receive care in the NHDS facility sample. Because MEPS is itself a national probability sample, the hospitalized patient subset on whom NHDS data would be collected would be in its own right a national probability sample. However, the small size of this longitudinal sample (approximately 3000 annual hospitalizations) would not allow for detailed analysis of any but the most common medical conditions. There are issues of weighting for attrition of the sample, particularly due to its longitudinal nature. This option would likely rely on NCHS staff for consultation and integration expertise, and take advantage of the existing MEPS data collection efforts.

DATA LOCATION / RECORDS REQUIRED
Data would be obtained using the same abstraction as employed by the NHDS. However, because Household MEPS patients could be seen at virtually any facility, it may be necessary to obtain data either through electronic means or chart abstraction from non-NHDS hospitals. These data might also be extracted from existing state data, with appropriate permission.

DATA ELEMENTS AND AVAILABILITY
Additional data elements required through the MEPS data collection process would primarily include multiple diagnoses, procedures and any new elements identified during the NHDS redesign effort (i.e., selection of additional options). If the MEPS hospitals were included as an addition to the NHDS probability sample this option could provide access to richer and integrated source of clinical quality data at reasonable cost.

OPTION DESCRIPTION

OPTION NUMBER: 5

OPTION TITLE: INCREASE CLINICAL DEPTH

OPTION DESCRIPTION AND GENERAL APPROACH

This option would add hospital-based clinical variables that will provide the ability to better understand the care received by hospitalized patients. Clinical detail is essential to assess the quality and appropriateness of healthcare. No existing publicly available survey collects in depth information on clinical services provided to hospitalized patients.

There are two levels of clinical variable information with increasing complexity of collection. One can either collect information to indicate that a particular service or procedure was provided or one can collect the actual clinical result (e.g., glucose level, Apgar score, blood pressure). For some clinical analyses, knowing that a service was provided is sufficient (e.g., rescue medication following a dangerous drug administration). For most situations, however, clinical value is intrinsic to the actual result and knowing that a service was provided is inadequate.

Two potential, non-mutually exclusive approaches can be considered:

1. Focus on clinical variables that at present are generally available in computer systems (e.g., laboratory and pharmacy, and increasingly, radiology). The amount of information available will increase with the penetration of electronic medical and health records.
2. Extract a limited set of clinical data elements through medical record abstraction. One may wish to focus on elements that are frequently (when appropriate) available on standardized documents such as admission notes (e.g., chief complaint, recent hospitalizations, home medications and medication compliance, occupation) or discharge summaries (e.g., complications of care, transfer to higher level of care, unanticipated procedures, discharge medications, discharge follow up). (Note: If the workgroup recommends this option, we would appreciate input regarding a limited set of key clinical variables that could provide the most initial value.)

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

During the data collection process, additional data will be collected either electronically or through abstraction by the hospitals or field representatives. The number of data elements could potentially be many times the number currently collected for the NHDS.

TYPES OF QUESTIONS APPROACH WILL ANSWER

Clinical data collected will allow the user to draw inferences about quality and appropriateness of care provided. This option will add depth to the understanding of what care is provided in inpatient settings. The types of questions it will be able to answer are:

- What clinical resources are used to care for the patient?
- What are the patterns of drug utilization, including classes of drugs?
- What patterns of care lead to complications, morbidity and mortality?
- Are clinical guidelines followed?
- What gaps exist in providing optimal maternal-child health?
- Do procedures increase when there are more professionals to provide care?
- What is the value of one form of technological innovation over another for treating disease (drugs and devices)?
- What avoidable and unavoidable adverse events (e.g., medication errors, unanticipated complications, or falls) occur as a consequence of care in the hospital?

SAMPLE DESIGN AND CONSIDERATIONS

This option introduces the issue of standardizing data collection and terminology since many of the data elements included in this option would be obtained from the hospital charge master. Significant initial effort would need to be invested in developing algorithms and definitions that can handle multiple terms for the same thing. As new elements are introduced into the data collection there will be a period of time when data elements will be missing; while data collection efforts are being standardized, some values will need to be imputed. This option could include changing the sampling approach by introducing strata in order to collect clinical depth on selected cases and not sample at the same rate cases where there is little variability in clinical variables, e.g., normal delivery. However, this introduces design effects that may be unwelcome.

DATA LOCATION / RECORDS REQUIRED

All data elements would be maintained either in the form of electronic data or medical record content and housed at the facility surveyed. The accessibility and effort required to acquire the data would influence decisions regarding choice of elements to include. Some information, such as incident reports and facility safety data, may not be accessible. The volume of some clinical data elements (such as laboratory tests and results, patient vital signs) may be large and would require decisions about how to select relevant information. In addition, the variability and complexity of the data to be collected could dictate the need for a more sophisticated and trained medical data abstractor. However, some kinds of information, such as whether a medication was provided or a laboratory test requested, could be obtained from billing records.

DATA ELEMENTS AND AVAILABILITY

Data elements can vary based on the topic under consideration. However, standard elements could include:

Data Element	Availability	
	Inpatient	Outpatient
Prescription medications	Not publicly available	NHAMCS, NAMCS, MEPS, MedPAR, some private databases
Laboratory tests	Not publicly available	NHAMCS, NAMCS, MEPS, private databases
Radiology procedures	Not publicly available	NHAMCS, NAMCS, MEPS, MedPAR, private databases
Procedure codes (greater detail)	NHDS, HCUP, MEPS, MedPAR, private databases	NHAMCS, NAMCS, NSAS, MEPS, MedPAR, private databases
Vital signs • Height • Weight • Blood pressure	Not publicly available	Height & weight available only in the NAMCS. Vital signs available in NHAMCS, NAMCS.
Aggregate clinical scores, e.g., • Apache (severity of illness of IC patients) • Glasgow Coma (degree of brain injury) • Parsonnet (risk for cardiac surgery) ❖ Functional Status • ADLs • Apgar (condition of baby at 1, 5, 10 minutes post birth)	❖ Available in NNHS, NHHCS	❖ Available in NNHS, NHHCS

OPTION DESCRIPTION

OPTION NUMBER: 6

OPTION TITLE: INCREASE PATIENT DEMOGRAPHIC INFORMATION

OPTION DESCRIPTION AND GENERAL APPROACH

This option would seek to permit a more accurate analysis of socioeconomic status and access to care. These variables could include census tract, race, ethnicity, income, wealth, education, occupation, neighborhood socio-economic characteristics, or past socioeconomic experiences.[2] Matching race and ethnicity to Census definitions alone would add significant depth to the NHDS. Income and education would permit analytic comparisons with the National Health and Nutrition Examination Survey (NHANES). This option would require patient surveys or linking to another patient survey, such as MEPS.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

This option would use the existing sample of hospitalized patients identified by the NHDS sampling methodology. In addition to the demographic, administrative and medical information currently collected, either patient interviews or patient written surveys would be required to collect data on the socioeconomic characteristics of each person sampled through the survey. Patient information could be collected on patients at admission or during hospitalization (if appropriate) or through retrospective telephone or paper surveys. In addition to basic racial and ethnicity data, the NHDS currently includes SES information at the Census tract level derived from Census data and county level information derived from the Area Resource File (ARF).

TYPES OF QUESTIONS APPROACH WILL ANSWER

- What are the socioeconomic influences on health?
- What socioeconomic factors contributed to hospitalization?
- Are there differences in hospital utilization by various SES characteristics?
- Are there SES differences across patients by diagnosis or procedure?
- Are there SES differences in outcomes of care?

SAMPLE DESIGN AND CONSIDERATIONS

This option requires primary survey data collection, involving loss of sample through non-response and a need either to weight for non-response or include more cases. Some of the more important SES measures such as household income and wealth present particular challenges: 1) they are sensitive and should not be collected at time of admission due to concerns about assessing ability to pay; 2) short-version questions have a number of measurement errors associated with them, but more accurate, longer versions are quite burdensome. Detailed race and ethnicity are easier to obtain, but have only recently been acknowledged as important differentiating factors and are therefore not widely available. Using census tract or address as a proxy for many SES characteristics is commonly done, but is far less powerful than direct patient response. Data collection efforts that include sensitive personal information require patient informed consent.

DATA LOCATION / RECORDS REQUIRED

Most socioeconomic status information would need to be obtained directly from the patient or patient's family.

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[2] Braveman PA, et.al., Socioeconomic Status in Health Research One Size Does Not Fit All. *JAMA*. 2005; 294:2879-2888

DATA ELEMENTS AND AVAILABILITY

The data that would be collected in this option parallel those already collected as part of MEPS. If option 4 was selected, the benefits of selecting this option would be met.
Additional data elements could include:

Data Element	Availability
Detailed ethnicity	Not available
Income	MEPS – Household Component
Wealth	MEPS – Household Component
Education	MEPS – Household Component
Occupation	MEPS – Household Component, some private databases
Neighborhood socio-economic characteristics of the patient	Not available
Past socioeconomic experiences of the patient	Not available

OPTION DESCRIPTION

OPTION NUMBER: 7

OPTION TITLE: INCREASE HOSPITAL RESOURCE USE INFORMATION

OPTION DESCRIPTION AND GENERAL APPROACH

Inpatient care continues to represent the largest share of our health care dollar. Understanding the costs and general resource use associated with delivering care in the inpatient setting provides information to assist in allocating resources more efficiently and effectively. Within the hospital sector there is no publicly available way to reliably distinguish between charges, discounted charges and actual cost. This option is closely aligned with Option 5 – Clinical Depth, but seeks to analyze this information from the perspective of efficiency rather than effectiveness.

This option would use the existing sample of hospitalized patients identified by the NHDS sampling methodology. It would also collect additional information on resources used in the care of the patient throughout the hospitalization, possibly at the cost center level. Given the sensitivities of cost information, resource use could serve as a proxy for cost. Resources collected would include types, number and duration of services provided by licensed independent practitioners, nurses, technologists, and other professional personnel. It would also include detail on the numbers of days the patient spent at various levels of care (e.g., ICU, observation prior to hospitalization, or general medical/surgical), the supplies used, and the types of technology used to care for a patient (e.g., monitored bed, ventilators, endoscopy services).

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

This option would use the existing sample of hospitalized patients identified by the NHDS sampling methodology. However, the resources needed to collect detailed resource use data on every medical record abstracted could limit the NHDS sample. Hospital charge masters and billing records should contain a fair amount of this information. Most workforce issues would require more detailed time and motion studies. As more patient- and provider-specific information is obtained, the need to assure privacy and confidentiality increases.

TYPES OF QUESTIONS APPROACH WILL ANSWER

This option would provide answers to many questions that today can be analyzed only through private and limited databases. Some of these questions include:

- What is the value received for health care dollars spent?
- What is the cost of a hospitalization?
- How does the cost of hospitalization vary by disease?
- How does the cost of hospitalization vary by treatment patterns?
- How does the cost of hospitalization vary by insurance status?
- How does the cost of hospitalization vary geographically?
- How does the cost vary by type and skill of provider?
- In which inpatient settings, by which providers, and for which diagnoses and procedures is care most productive?
- What cost measures should be used?
- What resources are used to deliver care (true cost)?
- What types of staff deliver how much care?
- What are the costs (and benefits) of new services, technologies and treatments?

SAMPLE DESIGN AND CONSIDERATIONS

Like Option 5, this option introduces the issue of standardizing data collection and terminology because many of the data elements included would be obtained, at least initially, from the hospital charge master and billing system. Significant initial effort would need to be invested in developing algorithms and definitions that can handle multiple terms for the same thing and differences in cost center allocations between facilities. Efforts would also be required to develop geographic and institution-specific ways to convert resource use to costs since most hospitals do not yet use cost accounting systems. As new elements are introduced into the data collection, there will be a period of time when data elements will be missing; while data collection efforts are being standardized, some values will need to be imputed.

Time and motion studies would be of great value to achieving the goals of this option. Such studies would provide an understanding of patient-specific resource use, particularly labor. However, such studies would entail significant resources (time and money) and, except in specially-financed targeted studies, would not be fiscally feasible.

DATA LOCATION / RECORDS REQUIRED

The billing records and the charge master or cost records most likely would be the first sources of data. However, this would probably not provide departmental-specific information, particularly on labor use. In the absence of sophisticated automated labor systems, such information would need to be abstracted manually from department records or collected through time and motion studies.

The types of data required would vary depending on the nature and complexity of the question to be answered. A more sophisticated and trained medical record abstractor might be needed to assess aspects of inpatient care delivery.

DATA ELEMENTS AND AVAILABILITY:

Data Element	Availability	
	Inpatient	Outpatient
Pharmaceuticals	Limited private databases	NHAMCS, NAMCS, MEPS, MedPAR, private databases
Ancillary and diagnostic tests	Private databases	NHAMCS, NAMCS, MedPAR, private databases
Procedures	Limited number provide major procedures only in most inpatient databases	MEPS, or claims-based sources (MedPAR, private)
Hospital units where patients received care	Some private databases	NSAS, NHAMCS, HCUP-SASD, HCUP-EDDS, MEPS, MedPAR, NEISS, DAWN
Physicians providing care	MEPS, Some private databases	NHAMCS, NAMCS, NNHS, NHHCS, MEPS, MedPAR, private databases
Technology used in providing care	To the extent it can be defined as a location (e.g., GI lab) or through a procedure code (MRI) it can be derived.	To the extent it can be defined as a location (e.g., GI lab) or through a procedure code (MRI) it can be derived.

OPTION DESCRIPTION

OPTION NUMBER: 8

OPTION TITLE: OBTAIN DATA ON PRE- AND POST-HOSPITAL CARE

OPTION DESCRIPTION AND GENERAL APPROACH

This option seeks to collect information on the care provided to hospitalized patients in the peri-hospital period, perhaps for the 72 hours immediately prior to and after the admission. The option uses hospitalized inpatients as the unit of analysis and captures those parts of the episode of care (option 9) most temporally associated with the admission. The 72 hour example was selected because Medicare, for example, includes all care provided in this immediate preoperative period with the admission that follows. Although breadth of data collection could be limited, this option might include ambulatory, emergency, institutional and home care.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

Using hospitalized patients as the unit of analysis, this option would obtain data about the patient's care immediately preceding and following the hospitalization. The NHDS currently collects "Source of Admission" as a variable, but this information is limited.

Either patient interviews or patient written surveys would be required to collect peri-hospital care for each person sampled through the survey. Patient information could be collected on all patients at time of admission, during hospitalization or through retrospective telephone or paper surveys. The NHDS sample may have to be limited in order to apply the resources to collect these data.

TYPES OF QUESTIONS APPROACH WILL ANSWER

- What types of hospitalizations occur through emergency department admissions compared to direct admissions?
- What types of care are associated with immediate readmissions following hospitalization?
- Could hospitalization been prevented by more aggressive pre-hospital care?
- How do patient diagnoses change from admission to discharge?

SAMPLE DESIGN AND CONSIDERATIONS

This option requires primary survey data collection, which involves issues of loss of sample through non-response and a need either to weight for non-response or include more cases. The particularly difficult part of this data collection is the inability to collect information from people who are incapacitated and unable to communicate. Therefore missing information is not likely to occur completely at random. Of course this compounds and multiplies the data collection effort by requiring the surveyor to extend beyond the hospital in a "one-to-many" relationship. Data collection efforts that require linking records beyond one site of care (e.g., the hospital) trigger patient confidentiality and privacy issues. Patient informed consent would be required. Of all the efforts that provide breadth to the data collection effort, this is the least expensive.

DATA LOCATION / RECORDS REQUIRED

Although much of these data would be available from the patient's individual claims records through insurance companies (if insured), the more likely source of data would be from the patient or a family member, presuming the trigger event for the data collection is the admission of the patient.

DATA ELEMENTS AND AVAILABILITY

There are many data elements that could be collected. Those that are most commonly mentioned include:

Data Element	Availability
Physician and/or specialty seen prior to or post admission	MEPS, or claims-based sources (MedPAR, private)
Location where patient was discharged	
Procedures prior to admission	
Care provided in the hospital prior to admission	
Diagnosis upon admission	UB-04 when available, claims-based sources
Medications prior to admission	Some private databases
DME and home services provided	NHHCS

OPTION DESCRIPTION

OPTION NUMBER: 9

OPTION TITLE: TRACK BY EPISODE OF CARE

OPTION DESCRIPTION AND GENERAL APPROACH
This option seeks to incorporate information about care of hospitalized patients before and after the actual inpatient hospital encounter. The option uses hospitalized inpatients as the unit of analysis but tracks the care received across all care settings associated with the episode of care.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH
Using hospitalized patients as the unit of analysis, this option would obtain data about the patient's care associated with the reason for admission preceding and following the hospitalization. To the extent that this information exists within the treating institution, data collection would need to capture care received in non-inpatient venues (e.g., ambulatory care, emergency department, hospital-owned rehabilitation/skilled nursing, outpatient surgery). For services received from providers and organizations outside the institution (e.g., those listed above, other acute care hospitals), either patient interviews or patient written surveys would be required to collect care experiences for each person sampled through the survey. Patient information, although resource intensive, could be collected on all patients at time of admission, during hospitalization, or through retrospective telephone or paper surveys.

TYPES OF QUESTIONS APPROACH WILL ANSWER
- Were there predisposing conditions precipitating admission that could have been recognized, possibly avoiding hospitalization?
- What continuity of care issues exist that place patients at risk for readmission or continued morbidity?
- What are optimal care venues and services following hospital treatment for specific conditions?
- Access to which community services may reduce the risk of hospitalization and morbidity from disease?

SAMPLE DESIGN AND CONSIDERATIONS
It will be important albeit difficult to define an episode of care with sufficient stringency to ensure that data collection can be standardized. An episode of care, in contrast to general considerations for longitudinal care, will vary depending on the condition. Also, an episode of illness will need to be distinguished from ongoing care for chronic illnesses that are not episodic in nature. Data collection efforts that require linking records beyond one site of care (e.g., the hospital) trigger patient confidentiality and privacy issues. Patient informed consent would be required.

DATA LOCATION / RECORDS REQUIRED
Because an episode of care extends beyond the hospitalization, access to records or information will need to include locations other than the hospitals and their extended services. Consequently, access would potentially be required to ambulatory records, transfer records from and to other facilities, emergency records, home care records and other records associated with the illness but not part of the facility. The difficulty and cost of this option could be mitigated if this was implemented through a partnership with MEPS (Option 4).

DATA ELEMENTS AND AVAILABILITY

Depending on the depth of information that will be part of the survey, data elements are likely to include both administrative and clinical elements. In regard to some patients with complex diseases, the collection effort required to obtain information from all care venues associated with the episode of care could be overwhelming. It may be necessary, therefore, to limit data collection to only those key clinical and administrative elements contained in venues where data systems facilitate such retrieval. Some information may require collection from the patient directly and in a format that is similar to the MEPS protocol. Because of the need to collect data across care venues, patient privacy considerations must be addressed.

OPTION DESCRIPTION

OPTION NUMBER: 10

OPTION TITLE: CONDUCT LONGITUDINAL TRACKING OF A PATIENT COHORT

OPTION DESCRIPTION AND GENERAL APPROACH

This option uses hospitalized inpatients as the unit of analysis but tracks the care received across all care settings following their discharge after an index hospital admission. This option tracks hospital patients longitudinally for a defined period of time (e.g., 2-3 years) to understand both the longer term consequences of hospital care and the impact that various post-hospitalization treatment options have on the patients receiving care in the hospital.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

Using hospitalized patients as the unit of analysis, this option would obtain data about a periodic cohort of hospitalized patients. To the extent that information exists within the treating institution, data collection would need to capture care received in non-inpatient venues (e.g., ambulatory care, emergency department, hospital-owned rehabilitation/skilled nursing, outpatient surgery) and inpatient venues for readmissions. For services received from providers and organizations outside the institution (e.g., those listed above, other acute care hospitals), either patient interviews or patient written surveys would be required to collect care experiences for each person sampled through the survey. Patient personal information about the index admission could be collected on all patients at time of admission, during hospitalization, or through retrospective telephone or paper surveys. The NHDS sample may have to be limited so that there would be sufficient the resources to collect these additional data.

TYPES OF QUESTIONS APPROACH WILL ANSWER

- What care factors are associated with better long-term outcomes from inpatient treatment?
- Are certain comorbid conditions associated with higher risk of poor outcomes? If so, are there strategies to specifically address those conditions?
- Does access to different types of service improve patient function, prevent readmission or deter subsequent morbidity from disease?
- What continuity of care issues exist that place patients at risk for readmission or continued morbidity?
- What are optimal care venues and services following hospital treatment for specific conditions?
- Access to which community services may reduce the risk of hospitalization and morbidity from disease?

SAMPLE DESIGN AND CONSIDERATIONS

Because of the longitudinal collection of data for a hospitalized patient cohort, data collection in the absence of an integrated electronic health record will be intensive, limiting the number of patients that could be included. It will be important for the survey to capture a sufficient sampling of patients to afford analyses for at least the most common conditions and possibly other conditions of interest. Data collection efforts that require linking records beyond one site of care (e.g., the hospital) trigger patient confidentiality and privacy issues and are extremely resource intense. Patient informed consent would be required.

DATA LOCATION / RECORDS REQUIRED

Because longitudinal care extends beyond the hospitalization, access to records or information would need to include locations other than the hospitals and their extended services. Consequently, access would potentially be required to ambulatory records, transfer records from and to other facilities, emergency records, home care records and other records associated with the illness but not part of the facility.

DATA ELEMENTS AND AVAILABILITY

Depending on the depth of information that will be part of the survey, data elements are likely to include both administrative and clinical elements. In regard to some patients with complex diseases, the collection effort required to obtain information from all care venues associated with the episode of care could be overwhelming. It may be necessary, therefore, to limit data collection to only those key clinical and administrative elements contained in venues where data systems facilitate such retrieval. Some information may require collection from the patient directly in a format that is similar to the MEPS protocol. Because of the need to collect data across care venues, patient privacy considerations must be addressed.

OPTION DESCRIPTION

OPTION NUMBER: 11

OPTION TITLE: INCORPORATE INPATIENT AND SHORT-STAY ADMISSIONS

OPTION DESCRIPTION AND GENERAL APPROACH

This option seeks to include some of the spectrum of services that were previously considered to be inpatient admissions. Treatment for many conditions that was traditionally provided as inpatient care is now provided as outpatient care in hospital settings. These patients may occupy the same beds as hospital inpatients or may be assigned to a separate "short stay," "24-hour" or "observation" service. Although this classification is primarily driven by payer requirements, the difference shifts the patient's hospital status from inpatient to outpatient, altering the probability that some or all patients with selected conditions (e.g., angina, possible stroke, abdominal pain) would be selected for inclusion in a nationally representative sample using the current National Hospital Discharge Survey.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

If the goal is only to capture these other care statuses, then the requirement would be to identify them as part of the pool from which the representative sample is drawn. Although expanding the sample to identify these patients would generally be possible using hospital billing records, the way in which these services are identified using coded data is different from the way in which hospital inpatients are coded (see below).

TYPES OF QUESTIONS APPROACH WILL ANSWER

This option provides two enhancements to the current National Hospital Discharge Survey:

1. The ability to examine trends in a broader spectrum of conditions over time. At present, patients with many conditions may not be included among the pool from which the NHDS sample is drawn. Importantly, because the requirement to classify patients as "inpatient" or "outpatient" is primarily done for reasons of payment, some short-stay patients with the same presenting situation may be included while others will not (e.g., Blue Cross would expect an overnight coronary angiogram patient to be coded as an inpatient while the same patient would be considered an outpatient [Part B] under Medicare). At present, because of the trend among some payers toward outpatient status, the ability to study specific conditions using the NHDS is restricted to those conditions that are always classified as inpatient (e.g., Coronary Artery Bypass Surgery, Carotid Endarterectomy).
2. The possibility to better examine use of services that have traditionally been performed in acute, short-stay hospitals. Because the NHDS selects inpatients who are discharged from hospitals, the migration of some of these patients to an "outpatient" status results in analyses that could misrepresent the spectrum and intensity of hospital care. For example, some patients move from inpatient to outpatient status even though they use the same resources and services as they had previously. In these cases, analyses derived from a solely inpatient sample would incorrectly suggest that the average cost, patient acuity and lengths of stay were increasing.

SAMPLE DESIGN AND CONSIDERATIONS

This option would expand the sample from which patients are drawn. Because the pool of patients would be larger, the likelihood of selecting any one patient in the current NHDS would be lower. However, many patients in this expanded sample would have been in the pool of patients from which the NHDS sample was drawn in previous years.

There are two primary considerations when implementing this option:

1. Will the sample size be increased?
2. If the number of cases is expanded to retain the same number of "inpatient discharges" one additional choice must be made:
    a. If it is desired that the average number of cases per hospital remain the same, then the number of hospitals would need to be increased proportionally to the increase in the sample size
    b. If the number of hospitals is retained, the number of cases would need to be increased.

The first of these would be the preferable option in order to reduce the clustering effects and lose the precision in the current NHDS. It would also be more expensive due to increased data collection requirements.

DATA LOCATION / RECORDS REQUIRED

This option, like the current NHDS, would not require data or records from outside the hospital entity. However, records of an outpatient nature, whether electronic or paper, would need to be included . These records could be stored separately or differently from hospital inpatient records. All administrative data should generally be available from hospital finance departments.

DATA ELEMENTS AND AVAILABILITY

The data elements required would be those used for hospital-based non-inpatient care. The only major difference requiring some crosswalking will be that outpatient procedures are generally recorded in the United States using the AMA's CPT® Procedural Coding system rather than ICD-9-CM that hospitals use to capture inpatient procedures.

OPTION DESCRIPTION

OPTION NUMBER: 12

OPTION TITLE: INCORPORATE PATIENT CARE ENCOUNTERS THROUGHOUT THE HOSPITAL

OPTION DESCRIPTION AND GENERAL APPROACH

This option seeks to capture the entire spectrum of services that are provided in U.S. hospitals. Although option 11 was confined to incorporating only "hospitalized outpatients," this option captures any patient encounter that occurs within the hospital (e.g., ambulatory surgery, emergency care, hospital outpatient services, rehabilitation, observation, acute inpatient, and hospital based skilled nursing facilities).

With this option, patients would be included in the sample when they are encountered at a participating facility. Unlike option 9 (Episode of Care), patients selected for inclusion in this sample would not require hospitalization services, only services provided within a hospital facility. Sampling patients using this design shifts the focus from hospitalization services to all those services provided in a hospital-based setting or facility.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

If the goal is to capture any encounter, either inpatient or outpatient, then all patients seeking care at the hospital would need to be identified as part of the pool from which the representative sample is drawn. Although expanding the sample to identify these patients would generally be possible using hospital billing records, the way in which these services are identified using coded data is different from the way in which hospital inpatients are coded (see below).

TYPES OF QUESTIONS APPROACH WILL ANSWER

This option differs from the current National Hospital Discharge Survey in that a sample would be drawn from potentially all patients seeking care in the hospital facility. The questions such a survey would be able to answer, depending on sample design and considerations, include:

- What types of services are patients seeking from hospital facilities?
- What are the trends in migration of services between hospital settings (e.g., inpatient to observation, inpatient to ambulatory, ambulatory to emergency)?
- How does utilization of services vary among different hospital services? Are there differences in quality or cost for similar services depending on the encounter type?

Once a patient is identified, consideration must be given to whether all services that the patient received as part of that encounter would be part of the analysis (e.g., incorporating an episode of care consideration similar to Option 9). This would allow examination of how patients move between and among the services provided in hospitals.

SAMPLE DESIGN AND CONSIDERATIONS

The main issue in terms of sample design is an expansion of the sample from which patients are drawn. Because the pool of patients would be larger, the likelihood of selecting any one patient currently in the NHDS would be lower. The ability to generalize about hospitalized or hospital inpatients would require relative maintenance of the sample size of hospitalized patients – requiring additional resources to constitute a complete encounter survey. Stratification of the sample by specific areas (e.g., emergency, rehabilitation, outpatient surgery) would allow focus on specific areas of most interest.

If the current sample size is increased by adding additional patients (so as not to reduce the sample size of inpatient discharges from their current level), the design effect would increase

unless the number of hospitals was also increased proportionately to any increase in total sample size. To avoid loss of current precision, it may be desirable to increase the total sample size in rough proportion to ratio of the volume of the newly added cases to the volume of outpatients, although a smaller increase might also be useful. Combining all NCHS surveys for patients using hospital-based services yields a sample size of about 500,000. Maintaining the sample size at this level would allow this option to match current precision for each of these populations, and weights could combine these to allow inferences to a larger population, such as all utilization of a hospital in a 12-month period. Alternate allocations among types of utilization should also be considered after defining the most important research questions. If this patient frame within hospital could not be constructed directly (a list of all patients with any utilization of that hospital in the last 12 months, including types and frequency of utilization), careful linking would need to be done, so that sampling and design weights properly account for the multiple "opportunities" for a patient to enter a hospital's sample.

Maintaining the same sample of hospitals for the NHDS, hospital-based component of the National Survey of Ambulatory Surgery (NSAS), and the emergency and outpatient components of the National Hospital Ambulatory Medical Care Survey (NHAMCS) would reduce the recruitment costs for the NCHS. However, given the large increase in the sample size as a result of combining the surveys, it may be desirable to increase the number of hospitals to reduce the clustering effects. The surveys could remain as is, but the challenge may be willingness of hospitals to take part if they consider these separate surveys to be excessively burdensome.

DATA LOCATION / RECORDS REQUIRED

This option, like the current NHDS, does not require data or records from outside the hospital entity. However, records of an outpatient nature, whether electronic or paper, would need to be included. These records could be stored separately or differently from hospital inpatient records. All administrative data should generally be available from hospital finance departments. Expanding any one individual hospital's responsibility for data collection dramatically increases the burden on the facility. As the magnitude of the data collection effort increases, facilities unable to absorb the burden may choose not to participate in the surveys.

DATA ELEMENTS AND AVAILABILITY

The data elements required would be those used for hospital-based non-inpatient care. The only major difference requiring some crosswalking will be that outpatient procedures are generally recorded in the United States using the AMA's CPT® Procedural Coding system rather than ICD-9-CM that hospitals use to capture inpatient procedures.

OPTION DESCRIPTION

OPTION NUMBER: 13

OPTION TITLE: TRACK DISEASE-SPECIFIC CARE

OPTION DESCRIPTION AND GENERAL APPROACH

This option seeks to focus evaluation on quality of care for a select group of priority conditions or services that may be of high volume, high cost, or high risk. For this option, specific focus areas would be selected based on identified needs. Identification could come from within NHCS or in response to queries or requests from governmental or non-governmental clients. NCHS could use the trust that has been built with survey hospitals to focus on a limited set of conditions (e.g., cancer care, cardiac surgery, diabetes). The information collected could either parallel the current NHDS while providing a larger sample size from which more granular assessments could be made or extend beyond the NHDS for the selected conditions and incorporate elements of other options.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

This option requires selecting a sample of patients from a list stratified by the condition being investigated. Sampling would be independent of that for the general NHDS database. This would require an additional sampling step beyond that used currently by the NHDS for the disease-specific study. A representative sample could then be drawn from the stratified sample. For example, one could select a series of ICD9 codes for neoplasia (140-239) and then sample patients with these codes as the primary or any existing diagnosis. Similarly, one could examine the types of care for all hospitalized patients with diabetes (250).

TYPES OF QUESTIONS APPROACH WILL ANSWER

This option could provide, when combined with additional clinical (Option 5) and resource (Option 7) data, increased insight into quality of care received by hospitalized patients with selected conditions.

- What variation in procedures and services exist among patients treated for the focus condition?
- Do patients receive appropriate and necessary care?
- Are there geographic differences (assuming a larger number of sample facilities) in outcomes of care for a specific condition?
  - What within-hospital consequences of care are common among patients with a specific condition (e.g., infections, anemia, cardiac events)?
  - Are there differences in lengths of stay among different facilities providing care for the specific condition?
  - Do patients for the focus condition do better in large urban hospitals or smaller rural hospitals?

SAMPLE DESIGN AND CONSIDERATIONS

Given the current sample size of the NHDS, it may not be necessary to over sample or add additional hospital sites for certain common conditions. However, if it were desirable to track or trend less frequent or rare conditions, oversampling would be necessary. Oversampling for rare conditions would likely be insufficient given that the design effects from clustering would become so large. If additional hospital sites were added, decisions about whether or not to maintain the core current NHDS sample size would need to be resolved. In either case, gathering additional (clinical) data for any condition would require efforts such as those noted in Option 5.

DATA LOCATION / RECORDS REQUIRED

This option, like the current NHDS, does not require data or records from outside the hospital entity. All administrative data should generally be available from hospital finance departments.

DATA ELEMENTS AND AVAILABILITY

The data elements would be the same as those contained in the NHDS. The collection of additional clinical variables (Option 5) allows for analysis of quality and appropriateness of care for the selected condition(s) while collecting resource use and cost information (Option 7) allows for more in depth analysis of the cost implications of various services.

OPTION DESCRIPTION

OPTION NUMBER: 14

OPTION TITLE: OBTAIN OUTCOME DATA

OPTION DESCRIPTION AND GENERAL APPROACH

This option seeks to expand the information contained in the NHDS to link hospital-related care to specific health-related outcomes. Some hospital-based outcomes already exist in the data collected by the NHDS (e.g., in hospital mortality, complications). The complexity of this option, however, clearly depends on the outcomes selected for consideration, although in all cases a meaningful assessment of outcomes of care would need to extend beyond the hospital providing care. Links would be needed that uniquely identify patients across all relevant care settings. Even within-hospital measures, such as 30-day readmission, require at a minimum capturing a patient identifier that can link across individual admissions. This option may require patient surveys depending on the outcome information desired.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

For this option to be viable, the NHDS would need to capture an identifier or identifiers that will link the NHDS record to other data sources. For example, it would be relatively easy, once patient confidentiality concerns are addressed, to link the NHDS by social security number with the National Death Index. Such an approach is not beyond the realm of possibility as similar links exist today. For example, hospitals participating in the Hospital Quality Alliance submit quality performance data along with Medicare patient identification (HIC number), allowing CMS to examine performance together with beneficiary claims data. The change required of the NHDS would depend entirely on the outcome measures selected for inclusion under this option.

TYPES OF QUESTIONS APPROACH WILL ANSWER

The main advantage of this option is that it would allow researchers and policymakers to understand in more detail the consequences of hospital care. As noted above, the questions that can be answered would depend on the specific outcomes and the databases identified for linkage that contain those outcome variables. Potential questions that might be answered include:

- What percentage of patients treated for a particular condition die within selected periods following hospitalization? (e.g., National Death Index)
- What types of follow-up services do patients receive following hospitalization? (e.g., from patient surveys)
- What post-hospitalization complications occur among patients who are hospitalized for various procedures?
- Do different services provided to patients with similar conditions result in different outcomes?
- How do patient experiences with care differ by condition treated or region in which the care is received? (e.g., Hospital CAHPS data)

SAMPLE DESIGN AND CONSIDERATIONS

The issues are primarily related to the additional collection of patient identifiers that can track additional care or changes in patient status (e.g., rehospitalization, mortality) and then linking these data sources for selected elements. Patient identifier collection raises concerns regarding patient privacy and data confidentiality. Patient informed consent would be required. If the outcomes are long term, then there would be issues of time lag between the hospitalization and

the period when outcome data would be complete. As the outcome related data extend farther from the hospital encounter, the burden and cost of data collection increases.

DATA LOCATION / RECORDS REQUIRED

Depending on the specific outcomes identified, data may exist in:

- Public records (e.g., Mortality, National Death Index)
- Hospital records (e.g., Patient Readmissions to same facility)
- Claims records (e.g., Services provided irrespective of facility)
- Patient reports (e.g., MEPS, Hospital-CAHPS)

The major concern regarding this option is the collection of a patient identifier within the NHDS that would uniquely link to desired sources of patient outcome data.

DATA ELEMENTS AND AVAILABILITY

The only additional data element that would be required for this option, as part of the NHDS, would be a patient identifier or identifiers to permit linkage between sources of data. The specific data element(s) would either be a universal patient identifier (e.g., social security number) or an institution- or system-specific identifier (e.g., patient medical record number). Although these identifiers are usually readily available from the patient's chart or a hospital's finance systems, the availability would be contingent more on resolving privacy and security concerns than on physically retrieving the data elements.

OPTION DESCRIPTION

OPTION NUMBER: 15

OPTION TITLE: NATIONAL STATISTICAL HOSPITALS

OPTION DESCRIPTION AND GENERAL APPROACH

This option presents a strategy by which to improve hospital based data collection efforts. The intent would be to develop a set of representative hospitals where patients consent at the time of admission to have data collected about their care including pre-and post-hospital stays. Patients could opt out and be excluded from any sample collected from that hospital. Hospitals could be designated as "National Statistical Hospitals," which would be considered a meritorious designation.

CHANGE TO THE NHDS REQUIRED BY THIS APPROACH

While this option might initially be additive, very early on the intent would be to make all hospitals in the NHDS sample National Statistical Hospitals. The changes required would require additional NCHS resources to market these new capabilities and to work with and negotiate IRB issues in hospitals and providers outside the hospital.

TYPES OF QUESTIONS APPROACH WILL ANSWER

This approach would permit the NHDS to develop add-on modules at client or government request that address many of the redesign options discussed above. The consent would allow data collection outside the walls of the hospital and would loosen many of the HIPAA and IRB constraints. The consent would be the facilitator, but certainly not the only requirement that would allow longitudinal data collection to occur.

SAMPLE DESIGN AND CONSIDERATIONS

The sample design and considerations would be specific to the individual study request. Early on the NCHS would need to think about the number and types of hospitals they would wish to recruit to be National Statistical Hospitals.

DATA LOCATION / RECORDS REQUIRED

This would be specific to the individual study request, but in many cases would likely require data collection either pre- or post-hospitalization.

DATA ELEMENTS AND AVAILABILITY

This would be specific to the individual study request, but in many cases would likely require medical record abstraction or electronic record extraction. The level of detail and complexity could require a higher-level abstractor.

Appendix F

Mapping Research Question to Variable Categories

APPENDIX F - Mapping Research Questions to Variable Categories

			CATEGORIES OF DATA ELEMENTS																										
		Data Element Source	*Intake Form*	*Medical Record*																				*Billing Record*						Other
Domain	**Policy Issues**	**Research Questions**	Facility Characteristics	Patient Demographics & Characteristics	Socio-Economic Status	Geographic specificity	Payor	Physician Identifier	Admitting diagnoses	Discharge diagnoses	Procedures	Clinical condition @ admission	Length of stay	Functional Status @ Admission	Functional Stauts @ Discharge	Admission Source	Discharge Status (to where?)	In-hospital Mortality	Do Not Resuciate Order	Mortality after discharge	Drugs Administered	Readmission	Charges	Payment Amount	Cost	Non-Physician Professionals	Diagnostic Tests	Major Equipment Used in Care	Longitudinal Patient Care
			Hospital identifier to link with AHA	Birthdate (or age) Sex Marital status Race Ethnicity Primary language English proficiency Occupation Highest education Birthplace Mother's MRN for newborn	Address Zip Code		Insurance status @ admission Primary payer Secondary payer(s)	National Provider Identifier (2007) Admitting procedure(s) Other physicians (Consultants)	ICD-9-CM --> ICD-10-PCS CPT-4 Code Procedure date & time Anesthesia type			Living Situation @ Admission Admission type Dx present on admission Location of initial care Height/Weight Allergies Clinical test results Vitals Tobacco use Pain assessment ASA classification	Date and time of admission & discharge (ED, OPD, Obs) Critical Care Admits Duration (Gen Acute, ICU, Rehab/ Step Down)	Activities of daily living (NCVHS, NAHDO, and Others Evalulating)		Location before admission Mode of arrival	Discharge disposition & location Observation or acute for initial obs patients Stability @ discharge Palliative care Follow up instructions	Discharge Status = expired	DNR Order & Date	SSN or matching algorithm (patient name)	Med lists Pre-admit meds Meds @ discharge	Patient Identifier (MRN) Date(s) prev hospital care Date(s) subsequent hospital care	Total by revenue center	Reimbur-sement Expected reimburse-ment Covered / non-covered Avoidable days outlier	Actual RCC Level of ccre by day	Hours: Nursing PT OT Consults	By clinical condition	Hospital Bill (MRI, CT, PET)	Visits (MD office, ED, OPD, HH, LTC) Meds, Dx tests, Proced (pre & post)
Cost / Use of Resources	Cost of Care	How much is paid for care and who pays?					X																						
		What is the cost of care for uninsured?					X																		X				
		How do the costs of different treatments compare?	X			X	X	X	X	X	X						X								X				X
		How much is spent on patients in the top decile of utilization?								X	X						X				X			X	X		X	X	
		What are the costs (and benefits) of new services, technologies and treatments?								X	X		X	X	X		X	X		X	X	X		X	X		X	X	X
		What is the optimal allocation for new services, technologies and treatments?	X			X					X		X	X	X			X		X	X	X		X	X		X	X	X
		What improvement in health is received per health care dollar spent?												X	X		X	X		X		X			X				
		What is cost by outcome type?												X	X		X	X		X		X			X				
		How does functional status improve relative to health care investment?												X	X									X	X				
	Mix and Use of Labor (Also included in Quality)	What types of health care providers deliver care to the patient and how much care is delivered?	X					X			X															X			X
		What innovations most affect demand for different types of providers?						X								X	X				X				X	X	X	X
		Is the mix of providers associated with differences in processes or outcomes of care?						X			X		X	X	X		X	X		X	X	X			X	X	X	X
		Do Dx and Px volumes relate to concentrations of different care professionals?						X		X	X														X			X

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	The Use and Value of Techno-logical Change and Innovation	What is the value of one technological innovation over another for treating disease (e.g., drugs and devices)?								x	x		x	x	x		x	x		x	x	x					x	x	x
		What are the trends in treating disease (other than hospitalization)?							x	x	x						x												x
		What is the use and rate of adoption of complex technology?									x										x						x	x	x
	Disease specific care (Also included with Quality)	How can we track and trend the "top 10" diseases (cost or volume)?							x	x						x	x							x	x				x
		How can we track or trend rare diseases?							x	x						x	x							x	x				x
		What are the important markers/indicators to understand severity by condition?		x	x	x	x		x	x		x		x		x					x				x		x		x
	Bench-marks - Standards against which perfor mance can be measured (Also included w/ Quality & Care W/hin & Beyond the Hospital	What are benchmarks at different levels in the health care system - local, regional, national, global?	x			x		x	x	x	x		x	x	x	x	x	x		x	x	x			x	x	x	x	x
		What comparisons can we draw about care delivered in instutions by size, ownership, teaching status, geography or other factors?	x			x		x	x	x	x		x	x	x	x	x	x		x	x	x			x	x	x	x	
	Waste	Are there differences in resource use by provider type?	x					x	x	x	x		x								x					x	x	x	x
		Does resource use vary by geographic area?	x			x			x	x	x		x								x						x	x	x

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		Are the resources being used to care for patients providing greater benefit than harm?	This question requires appropriateness criteria. The variables mapped depend on the specific metrics that are part of those criteria.																										
	Infrastructure	What will be required to update and renovate our aging hospitals?	This survey is not designed to address this question.																										
	Capacity Plan	Do we have sufficient bed capacity to meet the needs of our changing population demographic?	X	X		X			X	X	X																		
		How should capital investment be most wisely spent by geographic region?	This survey is not designed to address this question.																										
Quality / Safety Also see Benchmarks Mix and Use of Labor, Disease Specific Care	Quality of Care and Patient Safety	What is the quality (including appropriateness) of care across care settings?							X	X	X			X	X		X	X		X	X	X					X		X
		What is the rate of readmission?																				X							
		Does quality affect functional status?							X	X	X			X	X		X	X		X		X							
		Does risk-adjusted mortality vary?							X			X						X	X	X									X
		How does procedural volume affect procedural and provider outcomes?						X			X		X	X	X		X	X	X	X		X				X			X
		What conditions and comorbidities are present at admission?							X			X																		
		What are the rates of in-hospital complications ?							X	X								X			X						X		
		Which patterns of preventable adverse events are occurring?							X	X	X							X			X						X		X
	Continuity of Care / Patient Transition Between Care Settings	What is an episode of care?							X	X	X	X	X				X	X		X		X					X		X

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		How does hospitalization impact patient functional status?												x	x		x	x											
		Do patient characteristics impact the number and type of transitions of care?	x	x	x	x	x		x	x						x	x		x			x							x
		How does home care or longer hospitalization affect cost and quality?								x	x		x				x	x		x		x							x
		How are chronic disease patients tracked (particularly the elderly)?		x	x				x	x		x	x	x	x	x	x	x	x	x		x							x
		How do patients move through the system?						x					x			x	x	x	x	x		x	x							x
		Which providers are seen, when and by whom?						x	x	x	x																x			x
		How do patients access the health care system over time?	This survey is not designed to adress this question.																											x
		Are there differences in hospital utilization by various SES characteristics?		x	x	x	x	x	x	x	x												x	x	x				
	Disparities / Access	Are there SES differences across patients by disease or procedures?		x	x	x			x	x	x																			
		Are there SES differences in outcomes of care?		x	x	x								x	x		x	x	x	x					x				
		Do rates of utilization vary by insurance status?					x		x	x	x		x				x				x		x			x	x	x	x
	End of Life Care	How much is spent on patients in the last few days of care?	`				x		x	x								x	x	x			x	x	x				x
		Which physicians provide care for the patient during hospitalization?							x									x	x	x									

APPENDIX F - Mapping Research Questions to Variable Categories

			CATEGORIES OF DATA ELEMENTS																										
		Data Element Source	*Intake Form*	*Medical Record*																			*Billing Record*						Other
Domain	**Policy Issues**	**Research Questions**	Facility Characteristics	Patient Demographics & Characteristics	Socio-Economic Status	Geographic specificity	Payor	Physician Identifier	Admitting diagnoses	Discharge diagnoses	Procedures	Clinical condition @ admission	Length of stay	Functional Status @ Admission	Functional Stauts @ Discharge	Admission Source	Discharge Status (to where?)	In-hospital Mortality	Do Not Resuciate Order	Mortality after discharge	Drugs Administered	Readmission	Charges	Payment Amount	Cost	Non-Physician Professionals	Diagnostic Tests	Major Equipment Used in Care	Longitudinal Patient Care
			Hospital identifier to link with AHA	Birthdate (or age) Sex Marital status Race Ethnicity Primary language English proficiency Occupation Highest education Birthplace Mother's MRN for newborn	Address Zip Code		Insurance status @ admission Primary payer Secondary payer(s)	National Provider Identifier (2007) Admitting procedure(s) Other physicians (Consultants)	ICD-9-CM --> ICD-10-PCS CPT-4 Code Procedure date & time Anesthesia type			Living Situation @ Admission Admission type Dx present on admission Location of initial care Height/Weight Allergies Clinical test results Vitals Tobacco use Pain assessment ASA classification	Date and time of admission & discharge (ED, OPD, Obs) Critical Care Admits Duration (Gen Acute, ICU, Rehab/ Step Down)	Activities of daily living (NCVHS, NAHDO, and Others Evalulating)		Location before admission Mode of arrival	Discharge disposition & location Observation or acute for initial obs patients Stability @ discharge Palliative care Follow up instructions	Discharge Status = expired	DNR Order & Date	SSN or matching algorithm (patient name)	Med lists Pre-admit meds Meds @ discharge	Patient Identifier (MRN) Date(s) prev hospital care Date(s) subsequent hospital care	Total by revenue center	Reimbur-sement Expected reimburse-ment Covered / non-covered Avoidable days outlier	Actual RCC Level of ccre by day	Hours: Nursing PT OT Consults	By clinical condition	Hospital Bill (MRI, CT, PET)	Visits (MD office, ED, OPD, HH, LTC) Meds, Dx tests, Proced (pre & post)
Care Within and Beyond the Hospital See also Benchmarks	Care Delivered Within the Hospital	What are the patterns of drug utilization (drugs prescribed, when administered)?							X	X	X	X									X								
		Which diagnostic tests are ordered and provided (laboratory, radiology, other)?							X	X	X	X															X	X	
		Are inpatient care guidelines followed?							X	X											X		X	X			X	X	
		What patient care is provided in all hospital-based care settings - ED, OPD, Observation, Rehabilitation, SNF (if available)?																			X		X	X	X		X	X	X
		How consistent are admission and discharge diagnoses?							X	X		X																	
		What are the differences in severity, care and outcomes in specialty hospitals?	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X	
	Movement of Care from IP to Other Care Settings (megatrends)	Which procedures are being done in what care settings?	X								X																X		X
		How is this changing over time?	X								X																X	X	X
		Which diagnoses are treated in what care settings? How is this changing over time?	X						X	X																			X
		What burden of illness do patients bring to each care setting? How is this changing over time?	X						X		X	X		X		X	X	X	X									X
		What are the characteristics of surgeries that are moving out of the hospital?	X								X																		X

APPENDIX F - Mapping Research Questions to Variable Categories

			CATEGORIES OF DATA ELEMENTS																										
		Data Element Source	***Intake Form***	***Medical Record***																			***Billing Record***						**Other**
Domain	**Policy Issues**	**Research Questions**	Facility Characteristics	Patient Demographics & Characteristics	Socio-Economic Status	Geographic specificity	Payor	Physician Identifier	Admitting diagnoses	Discharge diagnoses	Procedures	Clinical condition @ admission	Length of stay	Functional Status @ Admission	Functional Stauts @ Discharge	Admission Source	Discharge Status (to where?)	In-hospital Mortality	Do Not Resuciate Order	Mortality after discharge	Drugs Administered	Readmission	Charges	Payment Amount	Cost	Non-Physician Professionals	Diagnostic Tests	Major Equipment Used in Care	Longitudinal Patient Care
			Hospital identifier to link with AHA	Birthdate (or age) Sex Marital status Race Ethnicity Primary language English proficiency Occupation Highest education Birthplace Mother's MRN for newborn	Address Zip Code		Insurance status @ admission Primary payer Secondary payer(s)	National Provider Identifier (2007) Admitting procedure(s) Other physicians (Consultants)	ICD-9-CM --> ICD-10-PCS CPT-4 Code Procedure date & time Anesthesia type			Living Situation @ Admission Admission type Dx present on admission Location of initial care Height/Weight Allergies Clinical test results Vitals Tobacco use Pain assessment ASA classification	Date and time of admission & discharge (ED, OPD, Obs) Critical Care Admits Duration (Gen Acute, ICU, Rehab/ Step Down)	Activities of daily living (NCVHS, NAHDO, and Others Evalulating)		Location before admission Mode of arrival	Discharge disposition & location Observation or acute for initial obs patients Stability @ discharge Palliative care Follow up instructions	Discharge Status = expired	DNR Order & Date	SSN or matching algorithm (patient name)	Med lists Pre-admit meds Meds @ discharge	Patient Identifier (MRN) Date(s) prev hospital care Date(s) subsequent hospital care	Total by revenue center	Reimbur-sement Expected reimburse-ment Covered / non-covered Avoidable days outlier	Actual RCC Level of ccre by day	Hours: Nursing PT OT Consults	By clinical condition	Hospital Bill (MRI, CT, PET)	Visits (MD office, ED, OPD, HH, LTC) Meds, Dx tests, Proced (pre & post)
Public Health	Public health and surveil-lance	What public health interventions occurred before a person contracted the disease causing hospitalized (e.g., vaccinations)	This survey is not designed to address this question.																										**X**
		What environmental factors contributed to this hospitalization?				**X**			**X**																				
		Do increased rates of pneumococcal vaccines lead to changes in rates of hospitalization?	This survey is not designed to address this question.																										**X**
		How prepared are providers for health care emergencies (e.g., processes, systems, surge capacity)	**X**																										
Globalization See also Technolo-gical Change and Innovation	Impact of Globali-zation	What are the characteristics of care that could be obtained outside the United States?	This survey is not designed to address global health issues.																										
		How would this ease demands on the US healthcare system for workforce and beds?																											
		Which measures should be used to compare the US system to that in other countries? (cost, disease specific measures, quality, safety?)																											

Appendix G

Patient Abstract Form

Feasibility Study 2006

NOTICE: All information which would permit identification of an individual or an establishment will be held confidential, will be used only by persons engaged in or for the purposes of the study, and will not be disclosed or released to other persons or for any other purposes.

PATIENT ABSTRACT – NATIONAL HOSPITAL DISCHARGE SURVEY
2006 PILOT TEST

A. PATIENT PROTECTED HEALTH INFORMATION

1. AHA Hospital # _____ _____ _____ _____	**2. HDS #:** _____ _____ _____ _____	**3. HIC #:** ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ☐ Not applicable

4. Patient Name

_____	_____	_____
Last	*First*	*Middle Name or Initial*

5. Medical Record Number:	**5a. For newborns, mother's record number:**
6. Billing Number:	**7. Visit or Encounter Number:**
8. Birth date: MM ___ ___ DD___ ___ YYYY ___ ___ ___ ___	**9. Social Security Number** ___ ___ ___ - ___ ___ - ___ ___ ___ ___ ☐ Not Available
10. Patient street address:	**11. Zip:** _____ _____ _____ _____ _____ - _____ _____ _____ _____

We are requesting the following printouts for this abstraction:

1) Final diagnoses including ICD-9-CM codes, description and whether it was present on admission. (Question 46)
2) All surgical and diagnostic procedures by ICD-9-CM or CPT-4, description, procedure date, provider UPIN/NPI and type of Anesthesia if given. (Question 47)
3) A list of charges and totals by revenue center ID including dates and times (if available) when these charges were generated. (Question 51)
4) A list of all medications the patient received during this admission as recorded in the pharmacy system/record including the route, date and time of first administration. (Question 54)

If printouts are not available, there are manual abstraction instructions included within the attached pages.

NOTICE: All information which would permit identification of an individual or an establishment will be held confidential, will be used only by persons engaged in or for the purposes of the study, and will not be disclosed or released to other persons or for any other purposes.

PATIENT ABSTRACT – NATIONAL HOSPITAL DISCHARGE SURVEY
2006 PILOT TEST

B. PATIENT RECORD IDENTIFICATION

1. AHA Hospital #	2. HDS #:
_____ _____ _____ _____	_____ _____ _____ _____

12. If initial presentation is to the Emergency Department, provide date and time of ED presentation:
MM ___ ___ DD ___ ___YY___ ___ Arrival Time (24 hr time) ___ ___ : ___ ___
☐ Patient not seen in ED immediately prior to this hospital stay

13. If the patient was placed in Observation Status, whether or not they were subsequently admitted, provide date and time of admission to observation:
MM ___ ___ DD ___ ___YY___ ___ Adm to Obs Time (24 hr time) ___ ___ : ___ ___
☐ Patient not on observation status during this hospital stay

14. If the patient was an acute inpatient, whether or not initially on observation status, provide date and time of acute admission or status change to acute:
MM ___ ___ DD ___ ___YY___ ___ Adm to Acute Time (24 hr time) ___ ___ : ___ ___
☐ Patient not an acute inpatient during this hospital stay

15. If Acute Inpatient Admission, identify type:
☐ Emergency ☐ Urgent ☐ Elective ☐ Newborn ☐ Unable to tell ☐ Not Applicable

16. If patient was admitted to a critical care bed, provide date and in and out time of first admission. If admitted to critical care more than once, record date/time for first and total critical care admissions.
1st Adm: MM ___ ___ DD ___ ___YY___ ___ Discharge MM ___ ___ DD ___ ___YY___ ___
Time (24 hr time): Admission ___ ___ : ___ ___ Discharge ___ ___ : ___ ___
☐ Patient not admitted to a critical care bed / Unknown | Total critical care admits ____

17. Date and time of final discharge either from observation or acute admission:
MM ___ ___ DD ___ ___YY___ ___ Discharge Time (24 hr time) ___ ___ : ___ ___

C. PATIENT IDENTIFICATION and DEMOGRAPHICS

18. City	19. State	20. Age	21. Sex
	_____ _____	(if no DOB) ___ ___ ___	☐ Male ☐ Female ☐ Not stated

22. Marital status
☐ Married ☐ Widowed ☐ Separated
☐ Single ☐ Divorced ☐ Not stated

23. Living Situation at Admission
☐ Alone, private residence ☐ Skilled Nursing Facility ☐ Incarcerated
☐ Share private residence ☐ Other Long Term Care ☐ Other / not stated
☐ Psychiatric facility ☐ Homeless

24. Race
Mark all that apply
☐ White
☐ Black/African American
☐ Asian
☐ Native Hawaiian/Other Pacific Islander
☐ American Indian/ Alaska Native
☐ Other:_____
☐ Unknown

25. Ethnicity
☐ Hispanic
☐ Not Hispanic
☐ Unknown

26. Mode of Arrival
☐ Ambulance (air/ground)
☐ Public service (non ambulance)
☐ Personal transportation
☐ Unknown

27. Source of admission
☐ Physician referral
☐ Acute → acute transfer
☐ Other ED → acute transfer
☐ Court / law enforcement
☐ Other transfer
☐ Unknown

28. Education
(If patient is < 18, education of parent/ caregiver)
☐ Not HS grad ☐ HS grad/GED ☐ Some college ☐ College grad ☐ Post grad ☐ Not stated

29. Occupation:
(if patient is < 18, note occupation of each parent/caregiver)

☐ _____	☐ _____
☐ Student	☐ Student
☐ Retired	☐ Retired
☐ Unemployed	☐ Unemployed
☐ Unknown	☐ Unknown

30. English Proficient:

Patient (if patient is > 7)	*Also include parent / caregiver if patient is < 18)*
☐ Yes	☐ Yes
☐ Unknown	☐ Unknown
☐ No - Primary language is:	☐ No - Primary language is:
_____	_____

D. PATIENT CLINICAL VARIABLES (Obtained from Medical Record)

31. Vital Signs Value On First Presentation

		Check if not done within first 24 hours
Blood Pressure:	___ ___ ___/___ ___ ___ mmHg	☐
Heart Rate:	___ ___ ___ per minute	☐
Respiratory Rate:	___ ___ per minute	☐
Temperature:	___ ___ ___.___ ☐ °C ☐°F	☐
Specify route:	_____ ☐ not noted	
Oxygen saturation:	___ ___ ___% ☐RA ☐Suppl O_2	☐
Height:	___ ___ ___ ☐inches ☐cm	☐
Weight:	___ ___ ___.___ ☐pounds ☐kg	☐

32. Clinical Laboratory Results Initial results

		Check if not done within first 24 hours
Hematocrit (Hct):	___ ___.___%	☐
White Cell Count (WBC):	___ ___ ___.___ x1000/μL	☐
Platelet Count (Plt):	___ ___ ___.___ x1000/μL	☐
Creatinine (Cr):	___ ___.___ mg/dL	☐
Urea Nitrogen (BUN):	___ ___ ___ mg/dL	☐
Potassium (K):	___ ___.___ mmol/L	☐
Sodium (Na):	___ ___ ___ mmol/L	☐

33. Activities of Daily Living

Does the medical record indicate that the patient has difficulty with any one of the following:

	On Admission	At Discharge
Bathing	☐	☐
Dressing	☐	☐
Toileting	☐	☐
Transfer	☐	☐
Continence	☐	☐
Feeding	☐	☐
OR	- - - -	- - - -
Independent	☐	☐
No data	☐	☐
Not applicable (patient expired)	--	☐

34. Pain Assessment (within first 24 hours):

☐Severe ☐Moderate ☐Mild ☐Unknown

OR

Pain scale: _____ _____ of 10 or _____ of 5

35. ASA Classification for Surgical Patients

☐ Class 1 ☐ Class 2 ☐ Class 3 ☐ Class 4

☐ Class 5 ☐ Class 6 ☐ No data ☐ Not applicable

36. Drug Allergies

☐ Yes (specify):_____

_____

☐ None ☐ Unknown/Not stated

37. Tobacco use:

	Cigarette	Other
Never	☐	☐
Current user	☐	☐
Quit ≤ 1 year ago	☐	☐
Quit >1 year ago/ unknown	☐	☐

38. For current/past cigarette smokers:

___ ___ ___ Pack years

☐ Not available/applicable

39. DNR Order For This Admission?

☐ No

☐ Yes, date of 1st order:

MM ___ ___ DD ___ ___

40. Stability at discharge (if patient discharged to home)

*On the **day prior to or day of discharge**, were any of the following noted?*

☐ Temperature > 37.8°C (100.0°F)

☐ Heart rate > 100

☐ Respiratory rate > 24

☐ Systolic BP < 90mm Hg

☐ Oxygen Saturation < 90% on room air OR < 95% on suppl O_2

☐ Not applicable (patient not discharged to home)

41. Status/Disposition of the patient at discharge:

Alive

☐ Home (check boxes below if appropriate)
- ☐ Home health services
- ☐ IV medication
- ☐ Patient instructed to call MD for follow-up
- ☐ Follow-up MD appointment date in chart
- ☐ Other tests/treatments scheduled

☐ Transfer to another acute hospital

☐ Transfer to acute rehabilitation

☐ Transfer to psychiatric facility

☐ Transfer to skilled nursing facility

☐ Transferred to other long-term care institution

☐ Other disposition

☐ Left against medical advice

☐ Disposition unknown

☐ Died – Where:
- ☐ ED ☐ Observation Unit ☐ Med/Surg Unit
- ☐ Critical Care ☐ OR/Procedure Room
- ☐ Unknown/Not stated

☐ Unknown

42. Palliative / Terminal Care Arranged at Discharge

☐ Hospice

☐ Not hospice, but palliative care

☐ Neither / Can't tell

E. MEDICAL RECORD CODED DATA

43. Attending Physician UPIN/NPI:____________________

44. DRG Assigned To This Admission: ___ ___ ___

45. Admitting Diagnosis: ___ ___ ___.___ ___ **ICD-9-CM** ____**Description**

46. Final Diagnoses (including E-Codes) (up to 20)

	ICD-9-CM Code	Description	Present at Admission?
Prin Dx			☐Y ☐N ☐Unk
Oth Dx			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk
			☐Y ☐N ☐Unk

47. Surgical and Diagnostic Procedures (up to 20) ☐ Check box if none

	ICD-9-CM or CPT-4 Code*	Description	Procedure Date	Provider UPIN/NPI	Anesthesia Type (if given)
Prin Px			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
Oth Px			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk
			MM ___ ___ DD ___ ___ YY ___ ___		☐Loc ☐Reg ☐Gen ☐Unk

* Use CPT-4 Code for Hospital Observation (Medicare Part B) Admissions

F. FINANCIAL AND BILLING RECORD DATA ELEMENTS

48. Expected Source of Payment	Primary	Other Sources
☐ No source indicated		
Worker's compensation	☐	☐
Medicaid / SCHIP	☐	☐
Medicare	☐	☐
Other Gov't (e.g., CHAMPUS, Tricare, VA)	☐	☐
Private / commercial insurance	☐	☐
Self-pay	☐	☐
No charge	☐	☐
Other	☐	☐

49. Payment Type for Primary Insurance *(if applicable)*

☐ Indemnity/Fee for Service
☐ Preferred Provider (PPO)/Point of Service (POS)
☐ HMO/Other Managed Care
☐ Unknown, unable to tell
☐ Not applicable

50. Charges, Expected Reimbursement, Actual Payment	Duration Of Care	Expected Reimbursement	Actual Payment
Emergency Care			
Observation Care			
Inpatient Care – Intensive Care	_____ days		
Inpatient Care – General Acute	_____ days		
Rehabilitation/Step Down Care	_____ days		
Total for This Hospital Encounter			

51. Charges allocated by revenue center ID: Please provide a print out of all charges and totals allocated by revenue center ID for this admission. With this printout include the date and time (if available) when charges were incurred.

G. INFORMATION FROM OTHER HOSPITAL CARE WITHIN 30 DAYS

52. If the patient was treated at the hospital as an acute inpatient, observation status or in the emergency department within the 30 days *prior* to this hospital stay (index admission) or 30 days *following* discharge, provide the following information about the hospital encounter. If the patient was seen more than three times in any of these settings pre or post the abstracted admission, please list the three that were closest to the admission.

	Admission Date	Discharge Date	Care Location	Principal Diagnosis ICD-9-CM	Principal Procedure ICD-9-CM/CPT-4*	DRG (If Inpatient)
30 days prior to admission	Check here if: ☐ None OR ☐ Unknown / Not Stated					
1	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			
2	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			
3	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			
Index Admission	____/____/____	____/____/____				
30 days post discharge	Check here if: ☐ None OR ☐ Unknown / Not Stated					
1	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			
2	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			
3	____/____/____	____/____/____	☐ ED ☐ Obs ☐ IP			

* Use most significant CPT procedure for previous observation status admissions.

G. MEDICATIONS

53. Medications at Admission and Discharge: *(list only 20)*

	Medications the Patient Was Taking Immediately Preceding Admission	Medications Prescribed for the Patient at Discharge
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
	☐ None	☐ None
	☐ Unknown / Not Stated	☐ Unknown / Not Stated

54. Medications Received During the Admission:
Please attach a printout of all medications the patient received during this admission as an inpatient, emergency department or observation status patient. Do not include medications recorded on the operative or procedure forms. Include the route along with the date and time the patient received (or started to receive in the case of infusions) the medications. Drugs should be specified by the following, in order of preference: NDC codes, HCPCS codes (e.g., J Codes), Drug Generic Name, Drug Trade Name, Other. Indicate the source below:

Source:

- ☐ Medication Administration Record (printout attached or utilize 54A manual abstraction sheet)
- ☐ Billing Records (printout attached)
- ☐ Pharmacy Information System (printout attached)
- ☐ Electronic Medical Record (printout attached)
- ☐ Other (specify):

Check here if:

- ☐ None
- ☐ Unknown / Not Stated

If a printout can not be generated, please complete 54A using the medication administration record.

54A. Inpatient / Observation Status / Emergency Department Manual Medication Abstraction form
List each drug administered the inpatient unit / emergency department or to an observation status patient at time of first administration only. Do not list multiple doses or changes in doses. *(Use additional sheets as needed)*

Medication Name	Date	Time of first administration	Route
	MM __ __ DD __ __	__ __ : __ __	
	MM __ __ DD __ __	__ __ : __ __	
	MM __ __ DD __ __	__ __ : __ __	

CLINICAL MODULE FOR PATIENTS PRESENTING WITH ACUTE MYOCARDIAL INFARCTION / ACUTE CORONARY SYNDROME

Include only patients with principal diagnosis of Acute Myocardial Infarction or Acute Coronary Syndrome/Angina (ICD-9-CM Codes 410.x0, 410.x1 or 411.1)

C1) Date and time of first ECG associated with this hospital presentation/encounter
(not more than 1 hour prior to arrival)
Date _____/_____/____ ____ Time ___ ___:___ ___

☐ Check if no ECG performed

C2) ST elevation or LBBB on Initial ECG associated with this hospital presentation/encounter
(not more than 1 hour prior to arrival)

☐ No
☐ Yes

C3) First three troponin Levels following patient presentation/encounter.

☐ Check if no troponin levels were obtained
☐ Check if only CK-MB is reported

	Date	Time	Level	Lab Reference Range
First	__ __ / __ __ /__ __	___ ___:___ ___	_____ng/mL	_____ng/mL
Second	__ __ / __ __ /__ __	___ ___:___ ___	_____ng/mL	
Third	__ __ / __ __ /__ __	___ ___:___ ___	_____ng/mL	

C4) Did the patient receive a beta blocker within 24 hours after hospital arrival?

☐ No
☐ Yes (skip to question 6)

C5) If a beta blocker was not given within 24 hours of arrival, is there a documented beta blocker contraindication at arrival?

☐ No
☐ Yes

C6) Did the patient receive a beta blocker at discharge?

☐ No
☐ Yes (Do not answer question 7)

C7) If no beta blocker was given at discharge, is there a documented beta blocker contraindication in the last 48 hours before discharge?

☐ No
☐ Yes

CLINICAL MODULE FOR PATIENTS WITH PSYCHIATRIC ADMISSION

Include only patients with primary diagnosis in ICD-9-CM range 290.0 – 299.9

P1) Patient admission to:

☐ Dedicated psychiatric unit
☐ General Acute Care bed

P2) Was a global assessment of functioning score conducted at admission?

☐ No
☐ Yes – Score: ___ ___ ___

P3) Was a global assessment of functioning score conducted at discharge?

☐ No
☐ Yes – Score: ___ ___ ___

P4) Was this a voluntary admission on the part of the patient?

☐ No
☐ Yes
☐ Unknown / Not stated

P5) Did this patient express suicidal ideations on admission?

☐ No
☐ Yes
☐ Unknown / Not stated

CLINICAL MODULE FOR PATIENTS PRESENTING WITH ASTHMA

Include only patients with primary diagnoses of ICD-9-CM codes 493.0 – 493.9

A1) Oxygen/Respiratory assistance initially given in the emergency room, or (if no emergency room stay) upon acute or observation admission (but not more than 8 hours following presentation).

Type of oxygen supplementation
- ☐ Oxygen given by "blow by"
- ☐ Oxygen given by nasal cannula
- ☐ Oxygen given by facemask
- ☐ Oxygen given by non-rebreather facemask
- ☐ Patient was intubated during the first 8 hours

☐ No supplemental oxygen required (skip to question A2)

If oxygen was given:

Concentration of oxygen given: ___ ___ ___ % ☐ Not available

Oxygen flow rate: ___ ___ . ___ liters per minute ☐ Not available

A2) Frequency of albuterol (Proventil®, Volmax®, Ventolin®, AccuNeb®) or levalbuterol HCl (Xopenex®) treatments indicated on the first physician order following admission to the hospital (regardless of ER stay time)

- ☐ Continuous administration of albuterol or levalbuterol
- ☐ Every 2 hours
- ☐ Every 3 hours
- ☐ Every 4 hours
- ☐ No order/no data

A3) Was patient intubated at any time during this hospitalization?
- ☐ No
- ☐ Yes

A4) Was a home management plan of care discussed with the patient/family?
- ☐ No
- ☐ Yes

Appendix H

Pilot Site Recruitment

Contact Tracking Sheet

APPENDIX H

NHDS FEASIBILITY STUDY **RECRUITER:_____**
PILOT SITE RECRUITMENT CONTACT TRACKING

HOSPITAL:_____

#	Date	Time	Person Spoken To	Discussion	Follow up
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

PILOT SITE RECRUITMENT CONTACT TRACKING **Page 2**

HOSPITAL:_____

#	Date	Time	Person Spoken To	Discussion	Follow up
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Appendix I

Facility Induction Form

Feasibility Study 2006

APPENDIX I

National Hospital Discharge Survey
Facility Induction Form – Feasibility Study 2006

Hospital Background Information for Contract Staff

To be completed as preparatory work in advance of the visit. Some information will be redundant to the Facility Form, but will provide background and context for the surveyor before they enter the facility. This information can be validated during the interview process.

Hospital Name:			
CEO Name:			
Primary Contact:			
Phone:		E-mail:	
Fax:		Room number:	
Address:	Street:		
	City:	State	
	Zip:		

☐ Mapquest directions are attached from the hotel or most recent destination to the hospital

PLEASE OBTAIN GENERAL HOSPITAL STATISTICS FROM THE MOST CURRENT AHA GUIDE:

A. General Demographics (Year 20__ __)

Current Staffed Beds: _____ Total Admissions: _____

Births _____ Emergency Room ☐ Yes ☐ No

Teaching Hospital ☐ Yes ☐ No Primary teaching hospital for:_____

B. Type of Hospital (i.e., ownership):

☐ Government ☐ Proprietary ☐ Non-profit ☐ Church related or other religious affiliation

☐ Public Health Service ☐ Other, specify:_____

C. Primary Hospital Service:

☐ General (Excluded services):_____

☐ Children's	☐ Orthopedic	☐ Maternity	☐ Cancer
☐ Eye, ear, nose, & throat	☐ Heart	☐ Substance abuse	☐ Psychiatric
☐ Rehabilitation	☐ Other, specify: _____		

D. Check list of items for contract staff to bring to the hospital:

- ☐ Introductory packet – 1 for each member of the staff present (bring only 1 copy of the multi-year CD ROM)
- ☐ Feasibility Study Field Manual
- ☐ Sample products produced from the NHDS survey:
  - A sample report produced from NHDS data
  - A CD-ROM containing multiple years of NHDS data

On Site Interview

Introduction
Thank you for arranging this meeting and taking the time to meet with us today. As you know, we are here to talk with you about participating in a feasibility study to redesign the National Hospital Discharge Survey, which we will call the NHDS. We are from RAND and are collaborating with the Centers for Disease Control and Prevention's National Center for Health Statistics in this important endeavor.

Perhaps we could all introduce ourselves before we get started. I am Name / Title / Institution, and continue through the room.

You should have received a package in the mail prior to this visit that contained the following materials:
- Introduction letters from Dr. Ed Sondick of the NCHS and RAND
- A description of the National Center for Health Statistics, the NHDS, the feasibility test upon which we are about to embark and its purpose
- Frequently Asked Questions related to this feasibility test
- CDC IRB Approval Letter
- The Patient Sampling Plan
- RAND's Data Safeguarding Plan
- A Facility Questionnaire
- A Patient Abstraction Form

You may not have had the opportunity to read through the package, so we would like to discuss each of these with you or the appropriate parties during our time here today.

Background on the National Center for Health Statistics and the NHDS
Among other things, the National Center for Health Statistics (NCHS) is responsible for a family of surveys, referred to collectively as the National Health Care Survey (NHCS), which are designed to measure utilization of the health care delivery system, and are used for a variety of purposes in the public and private sector. A key component in the suite of surveys is the National Hospital Discharge Survey (NHDS). First conducted in 1965, the NHDS has been an important source of information on inpatient utilization in short-stay non-federal hospitals in the United States for many users. Although the NHDS focuses specifically on hospital inpatient care, it fits in a broader portfolio of surveys covering outpatient care, emergency room care, nursing home care, home health and hospice care, and ambulatory surgery center care. Your hospital may in fact participate in one or more of these studies, but RAND is not privy to that information.

About the Current NHDS: The current NHDS produces national estimates of the use of non-federal short-stay U.S. hospitals. The survey provides information on:
- Patient characteristics
- Lengths of stay
- Diagnoses and major surgical and diagnostic procedures
- Patterns of use of care in hospitals of different size and ownership and in various regions of the country.

These data are publicly available for researchers in federal and states government, hospitals, academia, and other institutions. The public use files do not allow identification of hospitals or patients. They are used for health services research, public health, to inform health care policy and for many other areas of study of the U.S. inpatient population.

Description and Purpose of the Study and Feasibility Test

We are here to request your assistance in testing a redesigned NHDS. RAND has been asked to collaborate with the CDC in this redesign process. In order to do so, we sought input regarding issues that our health care system will face over the foreseeable future (e.g., 20 years) from economists, clinicians, researchers, insurers, policy makers, and others - in government, academic institutions, and private business. Based on the input, RAND and NCHS determined the data elements to be included in this feasibility study and created the facility questionnaire and the patient abstraction form that we sent in the introduction package prior to our visit and that we would like to use in your hospital for the abstraction of 20 medical records.

The feasibility test will evaluate and refine the preliminary design of the framework and content of the redesigned NHDS by testing field procedures in nine hospitals, including yours. The feasibility study will gain insight into any problems or issues that need to be addressed or corrected in the final set of materials and procedures. Based on the results of the feasibility study, RAND and NCHS will develop a final well-defined set of field procedures that will allow for consistent data collection from a national sample of hospitals.

Data to be Collected

As you have seen from the survey instrument, this survey will collect data in the following categories:

- Where a patient was first admitted to the hospital
- Patient identification and demographics that contain such detailed questions as education, English proficiency and occupation
- Patient clinical variables
- Discharge diagnoses and surgical and diagnostic procedures
- Charges, expected reimbursement, actual payment
- Limited disease specific modules

We recognize that all the data elements may not be available at your facility. That is part of what we want to learn from this feasibility study.

Confidentiality

We will be collecting protected health information or PHI in this survey. We recognize the hospital's legal obligations to protect PHI and would like to discuss the guarantee of confidentiality that RAND and the CDC-NCHS provide to hospitals participating in the NHDS redesign feasibility study.

First let's discuss Health Insurance Portability and Accountability Act (HIPAA) issues. HIPAA and its Privacy Rule ensure the privacy of the study participants. HIPAA permits Protected Health Information (PHI) disclosures without written patient authorization for specified public health purposes to public health authorities legally authorized to collect and receive the information for such purposes. The Centers for Disease Control and Prevention (CDC), including the National Center for Health Statistics, is an authorized public health entity. RAND, as a contractor for the NCHS is considered to be a public health authority under the Privacy Rule with respect to the activities RAND will conduct related to the feasibility study. This study has been reviewed and approved by the CDC IRB. They have particularly examined the issues of PHI and the methods RAND and the NCHS will use to protect this information. You are permitted by law to rely on a CDC IRB review and approval.

The second primary topic of interest is how patient and facility information will be used. Information on patients and facilities will be used only for statistical purposes as required by the Public Health Service Act. Published documents resulting from this feasibility test will not include any hospital or patient data. All published summaries will be presented in such a way that no individual facility or patient can be identified. The documents will focus only on the feasibility of collecting the data.

Process and Timeline

The process and timeline we will follow will consist of the following steps:

1) We will conduct a brief training session with your staff via the phone using the Field Manual as the training tool (within 1 week of this meeting) or alternatively we could do it prior to leaving the hospital today
2) You pull records according to the record sampling plan provided (within 2 week of this meeting)
3) Your staff abstracts the 20 records prior to RAND staff arrival (within 3 weeks of this meeting)
4) RAND abstractors come on site for up to 2 days to abstract the same 20 records (within 4 weeks of this meeting)
5) We debrief you while on site at the end of the 2-day RAND abstraction process
6) We will hold a follow up debrief with all sites upon completion of the feasibility study (around January).

Before we begin

Do you have any questions based on what we have talked about above?
Record Questions:

1._____

2._____

3._____

4._____

5._____

6._____

7._____

8._____

9._____

10._____

We would like now to proceed with conducting the study in your hospital.

- ❑ Hospital agrees to participate (go to page 6, question 13)
- ❑ Hospital objects to participating (go to Question 1)

The hospital may outline more than one of the following concerns. The skip pattern assumes that only one is articulated. If more than one concern is raised, please follow the questions for each concern raised by the hospital.

1. What concerns do you have about participating in this feasibility test?
   - ❑ Our financial situation does not permit us to dedicate time to this effort (Go to question 2)
   - ❑ We are concerned about collecting PHI and will need to review this with our IRB and/or privacy officer (Go to question 3)
   - ❑ We have too many other priorities at this point in time (Go to question 7)
   - ❑ Other:_____

2. If we were able to offer a stipend to cover your participation costs, would that enable you to participate?
   - ❑ No
   - ❑ Yes – Do you have a sense of what would be required financially to reimburse you for your time and effort?
     - □ < $500
     - □ $500 - $1000
     - □ $1001-$5000
     - □ > $5000

3. How long will your internal IRB/HSPC privacy review process take?
   - ❑ Less than or equal to 2 weeks (Go to question 5)
   - ❑ More than 2 weeks (Go to question 4)

4. Given the resource and time constraints of this feasibility test, with your permission, we would still like to work with your hospital and test hospital level logistics and the collection of the majority of the data elements on the form that are non-PHI. May we do so?
   - ❑ Yes (Go to page 6, question 13)
   - ❑ No (Go to question 7)

5. Is there anything we can provide you that would make you comfortable participating in this study?
   Note to contract staff: It may not be necessary to ask all these sub-questions, please use your judgment.
   a) Would you be interested in speaking with the CDC IRB to better understand the protection they provide?
      - ❑ Yes, hospital contact person: _____
      - ❑ No

   b) Can we provide you or someone of your choice with any written documentation such as the law and its exemption provisions?
      - ❑ No
      - ❑ Yes, hospital contact person: _____

      Specify materials requested:_____

      _____

   c) Other?
      - ❑ No
      - ❑ Yes, specify:_____ _____

      _____

   d) Nothing – Go to Question 7

6. We are disappointed that we will not be able to work further with your hospital but we very much appreciate the time you spent with us today. We would like to take this opportunity to learn a little more about your IRB processes.

7. What is the process for approving research studies that are of a public health nature in your hospital?

_____

_____

_____

_____

8. Do you have your own IRB/HSPC or do you rely on an IRB/HSPC at another institution?
   - ❑ Yes, we have our own IRB/HSPC.
   - ❑ We do not have our own IRB/HSPC; we rely on an IRB/HSPC at another institution.

     Please specify the name of the other institution: _____

9. How often does the IRB/HSPC meet?
   - ❑ Weekly
   - ❑ Monthly
   - ❑ Every other month
   - ❑ As needed
   - ❑ Other frequency-- Please describe: _____

10. What is the "typical" turnaround for your hospital IRB/HSPC?
    - ❑ 2 Weeks
    - ❑ One Month
    - ❑ 6 weeks
    - ❑ Two months
    - ❑ Longer than two months

    Comments: _____

    _____

11. Does your IRB/HSPC require an in-house Principal Investigator (PI)?
    - ❑ No (Go to Closing Remarks)
    - ❑ Yes (Go to Closing Remarks)

Hospital Basics and Logistics

12. Confirm information from Page 1 above and note any changes on that page

Record Sampling and Identification

Please refer to the Record Sampling Plan provided in the introductory package

13. An important aspect of the proposed redesign is the linkage of clinical, financial, medical records, pharmacy, laboratory, radiology and other data both from the study admission and from any admissions within 30 days before admission or after discharge. We suspect that you likely do this for other studies and projects and would appreciate your discussing briefly how you link your systems and records to obtain a complete picture of any individual patient's care.

13a. If your process for gathering or compiling the information above differs for patients on observation status, please describe those differences.

14. Are your clinical records complete at the time of patient discharge (i.e., medical records, laboratory, pharmacy, radiology)?
    - ❑ Yes
    - ❑ No

    After how long do you consider these systems to accurately reflect the patient's stay? _____Days

15. After how many days do you consider a month closed in order to generate a list of discharged patients by ICD-9 code for that month?_____ Days

16. After how many days are you able to close the (financial) books for a given month? _____ Days

17. So it seems that data from all clinical and financial systems should accurately reflect patient's discharged after _____ Days. That would mean that we could use patients discharged from the month of _____ (use answer to Q16 and subtract from October 30) for this study.

18. For how many months do you retain information in your system for each of the following:
    - Clinical systems _____ months
    - Laboratory systems _____ months
    - Pharmacy systems _____ months
    - Billing / financial systems _____ months

19. Let's review the requirements for pulling the sample of 20 patient records
Utilizing the Patient Record Selection sampling instructions from the Field Manual, the surveyor should review the sampling instructions with the responsible party by step and record any issues / concerns / questions that arise for each topic.

General Guidelines	1. Discharge range: Month end _____ (fill in financial month end) 2. Length of stay exclusion (> 10 days) _____ 3. Data required on the record list pulled: ☐ Patient name _____ ☐ Date of birth_____ ☐ Admitting & discharge date_____ ☐ Medical record number_____ ☐ Visit number (note if applicable)_____ ☐ Link to billing information_____ ☐ Link to pharmacy information_____ ☐ Link to clinical information_____ 3. The number of medical records to be pulled:_____ 4. Selecting a simple "random sample":_____ 5. Reallocating patients if one "Group" is null:_____ 6. Ordering / Identifying the records for the RAND abstractor:_____

Group A: Observation Patients

20. How will you generate a list of observation status patients for the study period?

_____

_____

_____

21. In what format is your observation patient list available?
- ❑ Electronic
- ❑ Paper-based
- ❑ Other:_____

Groups B – G

22. We presume these groups are well-defined, but please identify any issues in our instructions or in how you would identify these patients. Utilize the spaces to the right to note and comments / concerns / questions raised in the discussion

Group B Normal Newborns	❑ We do not have a maternity service Notes:
Group C: Pediatrics	❑ We do not care for pediatric patients Notes:
Group D: AMI / ACS	❑ We do not care for AMI / ACS patients Notes:
Group E: Asthma	❑ We do not care for asthma patients Notes:
Group F: Psychiatric	❑ We do not care for psychiatric patients Notes:
Group G: All Others	Notes:

Financial and Billing Information

23. We are interested in the following information for each patient discharge:
    - Duration of care for intensive care, general acute care, rehabilitation / step down care
    - Expected Reimbursement for ED and Total stay
    - Actual payment for total stay
    - Charges allocated by revenue center ID with date and time stamp

24. How will you calculate duration of care in each of the specified sites of care?

We are assuming this will be captured in your billing system, however, please advise if there is a better place to capture duration of care. _____

_____

Care Site	Method for calculating duration of care
Intensive care (all critical care units)	
General acute care	
Rehabilitation / Step down	

25. Charges and reimbursement

	Total Charges	Expected Reimbursement	Actual Payment
a) What is the process for obtaining this information from your systems?			
b1) What form is it in?	❑ Electronic ❑ Paper-based Other:_____	❑ Electronic ❑ Paper-based Other:_____	❑ Electronic ❑ Paper-based Other:_____
b2) Is this for all insurers?	❑ Yes ❑ No (specify) _____ _____	❑ Yes ❑ No (specify) _____ _____	❑ Yes ❑ No (specify) _____ _____
c) Please describe the financial systems in which this information resides			
d) How do you link this information to clinical systems and medical records?			

Medications

26. What is the best source for generating a list of medications for a patient upon discharge?
    - ❑ Medication Administration Record
    - ❑ Pharmacy Dispensing System
    - ❑ Medical Record
    - ❑ Billing System
    - ❑ Other:_____

27. If a patient is admitted from the Emergency Department, how do you identify medications provided to them in the Emergency Department?
    - ❑ The same pharmacy system also serves the Emergency Department
    - ❑ Records will need to be matched manually
        - What identifier will be used to match the records?_____

28. If a patient is admitted from Observation status, how do you identify medications provided to them while in Observation Status?
    - ❑ The same pharmacy system also serves patients in Observation status
    - ❑ Records will need to be matched manually
        - What identifier will be used to match the records?_____

29. Key Contacts:

a) Inpatient Data

	Sampling	Medical Record Abstraction	Pharmacy	Laboratory	Financial/ Billing	Other Data in Electronic From
Name:						
Title:						
Phone Number:						
E-mail:						
Room #:						

b) Please describe if these processes and contacts will differ for observation patients

Observation Data

	Sampling	Medical Record Abstraction	Pharmacy	Laboratory	Financial/ Billing	Other Data in Electronic From
Name:						
Title:						
Phone Number:						
E-mail:						
Room #:						

*c) **Primary Hospital Contact for Feasibility Study** (individual responsible for discussion with RAND and for coordination of individuals involved in component activities)*

Name:	*Title:*
Phone:	*Pager:*
E-mail:	*Fax:*
Room #:	
Assistant Name:	*Assistant Phone:*
Assistant e-mail:	

Data Abstraction Experience and Submission of Required Hospital Data and Measures

30. Can the UB92 data be printed or exported to a data file?
    - ❑ No
    - ❑ Yes printed only
    - ❑ Yes, only exported to a data file
    - ❑ Yes, printed or exported to a data file

31. Do you have standardized discharge forms and processes across the hospital for all inpatients?
    - ❑ No
    - ❑ Yes, since (please provide year): _____

32. How do your standardized discharge forms and processes differ for observation patients?
    - ❑ We don't have standardized discharge forms and processes for observation patients
    - ❑ The forms and processes are the same as for our inpatients
    - ❑ We have separate forms to be used for observation patients

33. Do you have a policy and related standards that allows your nurses to "chart by exception"
    - ❑ Yes
    - ❑ No

34. When you need to abstract data from medical records for study purposes, how do you do this?
    - ❑ Internal staff abstract records
    - ❑ Hire per diems
    - ❑ Subscribe to a private abstraction service
    - ❑ Other: Describe_____

      _____

35. Please indicate the department(s) in your hospital responsible for submitting data for CMS' Hospital Quality Alliance program and for JCAHO for core measures.

    Departments: _____

    _____

    _____

Confirmation of Discussion

36. Using the information collected above outline the steps to confirm our understanding of how the hospital is going to link patient information between the clinical, laboratory, pharmacy and billing/financial systems through both inpatient and observation status patients.

    _____

    _____

    _____

37. Records for the month of: _____will be sampled by (date) _____

38. Do you think that it will be possible to have the 20 records pulled and abstracted by _____ (3 weeks from the meeting)?
    - ❑ Yes
    - ❑ No

    What do you foresee as your major hurdles to accomplishing this task in the allotted time?

    _____

    _____

39. By when will you have completed the records (date):_____

Closing

Thank you for your time today. This has been very helpful to us. The sampling process we have discussed today is also included in the Field Manual along with detailed abstraction instructions.

The RAND abstractor will be _____.

Given the timing discussed above, she would like to return on approximately _____ (date) to abstract the 20 records also completed by your staff.

Would those dates be alright with you? We will discuss these dates with her and confirm with you within a couple days.

We are extremely appreciative of your willingness to work with us and the CDC in developing these processes and procedures. This is truly a feasibility test and we are honestly seeking your comments and input into learning about what works and doesn't, which is why we have scheduled the debriefing with you at the end of the abstraction process and then again with all the hospitals after we have had a chance to gather and aggregate all of your feedback. We are very much looking forward to working with you to refine this survey which will provide a basis for health policy and research over the next decades.

Appendix J

Key Contacts List

Feasibility Study - Key Contacts

Appendix J

Key Contacts – Hospital Name

a) Inpatient and Observation Data

	Sampling	Medical Record Abstraction	Pharmacy	Laboratory	Financial/ Billing	Other Data in Electronic From
Name:						
Title:						
Phone Number:						
E-mail:						
Room #:						

*b) **Primary Hospital Contact for Feasibility Study** (individual responsible for discussion with RAND and for coordination of individuals involved in component activities)*

Name:		*Title*	
Phone:		*Pager:*	
E-mail:		*Fax:*	
Cell:		*Room (if applicable)*	
Assistant's Name:		*Assistant's Phone:*	
Assistant's e-mail			

Appendix K

Feasibility Study
On-Site Debrief Questions

Appendix K

Feasibility Test On-Site Debrief Questions
Sample Selection and Abstraction

1a) Please list who is at the debriefing meeting and the role they played in the process:
(You may wish to ask the prime contact to complete this before the meeting)

Name	Title	Role played	First time in this role?
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

1b) Please note those who are missing who played a substantive role

Name	Title	Role played	First time in this role?
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

General

2) What did you need to do to prepare for this process?
- **a) Permissions / Approvals (Executive Level, IRB, etc.)**
- **b) Special Room / Accommodations for storage or abstracting**
- **c) Special Programming**
- **d) Recruit different / additional staff to help**
- **e) Training**
- **f) Other**

3) How long did the entire process take? Please state in hours per task.
- **a) Sampling**
- **b) Retrieval**
- **c) Abstraction**
  - **i) How long did the clinical module take over and above the general abstraction?**

Sampling - Please describe your experience

4) What skills and experience are required to complete this survey? What types of personnel would you recommend for the future?

Sampling	
Position	
Experience	

5) **Specifically (in detail) how did you generate a random sample and pick the records to be abstracted?**

6) **Were there things about the sampling instructions that were confusing, difficult to interpret or difficult to carry out?**

7) **Did you have trouble identifying the cases by group?**

8) **For any "groups" were there any records that you were uncertain if they should be included? Please describe the scenario.**

9) **This was a test of the process. If you actually needed to draw a sample for 20 charts per month, how would the process differ? What support and resources would you need?**

10) **Please provide your feedback on the training.**
    a) **How helpful or unhelpful did you find the training call prior to your sampling process?**
    b) **Could you have done this without the call?**
    c) **What training or preparation might have been more helpful?**
    d) **If it was unhelpful, how could it have been improved?**

11) **Please provide your feedback on the manual.**
    a) **Overall how helpful / useful was it to you?**
    b) **How helpful were the sampling instructions (Chapter 3)?**
    c) **How would you change the manual?**

Abstraction - Please describe your experience

12) **What skills and experience are required to complete this survey? What types of personnel would you recommend for the future?**

	Abstraction – General	Abstraction – Clinical Modules
Position		
Experience		

13) **How many missing charts did you encounter when you went to retrieve the sample?**

14) **Please describe how you approached this abstraction process (e.g., abstracted data elements sequentially; aggregated data elements that came from the same part of the medical record; utilized different people for different parts of the abstraction).**

15) **Please provide your feedback on the manual.**
    a) **Overall how helpful / useful was it to you?**
    b) **How helpful were the abstraction instructions (Chapter 4)?**
    c) **How would you change the manual?**

16) **What sections of the abstraction form were you able to obtain electronically?**
    a) **Can you estimate the relative level of effort this would take manually vs. electronically?**

17) **This was a test of the process. If you actually needed abstract 20 charts per month, how would the process differ? What support and resources would you need?**

18) **Please provide your feedback on the training.**
    a) **How helpful or unhelpful did you find the training call prior to your abstraction process?**
    b) **Could you have done this without the call?**
    c) **What training or preparation might have been more helpful?**
    d) **If it was unhelpful, how could it have been improved?**

Reviewing Data Elements

19) Given the medical record is a combination of paper and a variety of electronic files, did any issues come up regarding linking/finding the different parts of the record?

20) Did every record have all the information you needed to complete the abstract? If not, what parts were incomplete?

21) Were there data elements that were:
- **a) Very time consuming to get**
- **b) Not reliable or not easily aggregated?**
- **c) Operationally difficult to define / categorize**
- **d) Other problems (specify)**

22) RAND Abstractors – review and clarify any areas where you had problems:

Summary

23) If you could advise someone who was going to do this again, what advice would you give them?
- **a) What suggestions would you give them to make it easier?**
- **b) What would you warn them about?**

24) Given the plans your hospital has for electronic records / systems, how do you see this changing the process?

25) If you were going to need to abstract 20 records per month on a permanent basis , what would your reaction be to that? Would you consider it? Would you agree to it?

26) Is there something we didn't capture in the feasibility form or haven't talked about today that we or the NCHS should know?

Feasibility Test Questions – Recruitment and Induction

Please complete for both those facilities that cooperated and those that didn't

1) What would have been the most effective way to reach out to you to request your participation?

2) In all cases we began by contacting the CEO of the hospital, is there someone that it would have been better to contact first other than the CEO?

3) How did your hospital make the decision to participate / not participate? Please tell us all the steps and approvals that were required.

4) What interaction did you need to have with your IRB / legal department / privacy officer?
- **a) What was the interaction about, what problem or aspect of the survey?**
- **b) What specific questions or concerns did each of these individuals / areas have?**
- **c) To what extent were these concerns resolved? How were they resolved?**

5) Would it have been useful to you to also get the materials electronically?
- **a) Introductory letter?**
- **b) Information package?**
- **c) Field Manual?**

Appendix L

Statistical Tables

Tables Summarizing 16 Designs
and 80 Outcome Scenarios

Table A.1.1. Designs with 125 Hospitals and 25 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	25.0	1.24	20	2520	0.0100	0.020	0	0
0.50	1.00	0.05	25.0	2.20	11	1420	0.0133	0.027	0	0
0.50	1.00	0.15	25.0	4.60	5	679	0.0192	0.038	0	0
0.50	1.00	0.30	25.0	8.20	3	381	0.0256	0.051	0	0
0.50	0.50	0.01	12.5	1.12	11	1401	0.0134	0.027	0	0
0.50	0.50	0.05	12.5	1.58	8	992	0.0159	0.032	0	0
0.50	0.50	0.15	12.5	2.73	5	573	0.0209	0.042	0	0
0.50	0.50	0.30	12.5	4.45	3	351	0.0267	0.053	0	0
0.50	0.20	0.01	5.0	1.04	5	601	0.0204	0.041	0	0
0.50	0.20	0.05	5.0	1.20	4	521	0.0219	0.044	0	0
0.50	0.20	0.15	5.0	1.60	3	391	0.0253	0.051	0	0
0.50	0.20	0.30	5.0	2.20	2	284	0.0297	0.059	0	0
0.50	0.05	0.01	1.3	1.00	1	156	0.0400	0.080	0	0
0.50	0.05	0.05	1.3	1.01	1	154	0.0402	0.080	0	0
0.50	0.05	0.15	1.3	1.04	1	151	0.0407	0.081	0	0
0.50	0.05	0.30	1.3	1.08	1	145	0.0415	0.083	0	0
0.25	1.00	0.01	25.0	1.24	20	2520	0.0086	0.035	0	0
0.25	1.00	0.05	25.0	2.20	11	1420	0.0115	0.046	0	0
0.25	1.00	0.15	25.0	4.60	5	679	0.0166	0.066	0	0
0.25	1.00	0.30	25.0	8.20	3	381	0.0222	0.089	0	0
0.25	0.50	0.01	12.5	1.12	11	1401	0.0116	0.046	0	0
0.25	0.50	0.05	12.5	1.58	8	992	0.0137	0.055	0	0
0.25	0.50	0.15	12.5	2.73	5	573	0.0181	0.072	0	0
0.25	0.50	0.30	12.5	4.45	3	351	0.0231	0.092	0	0
0.25	0.20	0.01	5.0	1.04	5	601	0.0177	0.071	0	0
0.25	0.20	0.05	5.0	1.20	4	521	0.0190	0.076	0	0
0.25	0.20	0.15	5.0	1.60	3	391	0.0219	0.088	0	0
0.25	0.20	0.30	5.0	2.20	2	284	0.0257	0.103	0	1
0.25	0.05	0.01	1.3	1.00	1	156	0.0347	0.139	0	1
0.25	0.05	0.05	1.3	1.01	1	154	0.0349	0.139	0	1
0.25	0.05	0.15	1.3	1.04	1	151	0.0353	0.141	0	1
0.25	0.05	0.30	1.3	1.08	1	145	0.0359	0.144	0	1
0.10	1.00	0.01	25.0	1.24	20	2520	0.0060	0.060	0	0
0.10	1.00	0.05	25.0	2.20	11	1420	0.0080	0.080	0	0
0.10	1.00	0.15	25.0	4.60	5	679	0.0115	0.115	0	1
0.10	1.00	0.30	25.0	8.20	3	381	0.0154	0.154	0	1
0.10	0.50	0.01	12.5	1.12	11	1401	0.0080	0.080	0	0
0.10	0.50	0.05	12.5	1.58	8	992	0.0095	0.095	0	0
0.10	0.50	0.15	12.5	2.73	5	573	0.0125	0.125	0	1
0.10	0.50	0.30	12.5	4.45	3	351	0.0160	0.160	0	1
0.10	0.20	0.01	5.0	1.04	5	601	0.0122	0.122	0	1
0.10	0.20	0.05	5.0	1.20	4	521	0.0131	0.131	0	1
0.10	0.20	0.15	5.0	1.60	3	391	0.0152	0.152	0	1
0.10	0.20	0.30	5.0	2.20	2	284	0.0178	0.178	0	1
0.10	0.05	0.01	1.3	1.00	1	156	0.0240	0.240	0	1
0.10	0.05	0.05	1.3	1.01	1	154	0.0241	0.241	0	1
0.10	0.05	0.15	1.3	1.04	1	151	0.0244	0.244	0	1
0.10	0.05	0.30	1.3	1.08	1	145	0.0249	0.249	0	1
0.05	1.00	0.01	25.0	1.24	20	2520	0.0043	0.087	0	0
0.05	1.00	0.05	25.0	2.20	11	1420	0.0058	0.116	0	1
0.05	1.00	0.15	25.0	4.60	5	679	0.0084	0.167	0	1

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	25.0	8.20	3	381	0.0112	0.223	0	1
0.05	0.50	0.01	12.5	1.12	11	1401	0.0058	0.116	0	1
0.05	0.50	0.05	12.5	1.58	8	992	0.0069	0.138	0	1
0.05	0.50	0.15	12.5	2.73	5	573	0.0091	0.182	0	1
f0.05	0.50	0.30	12.5	4.45	3	351	0.0116	0.233	0	1
0.05	0.20	0.01	5.0	1.04	5	601	0.0089	0.178	0	1
0.05	0.20	0.05	5.0	1.20	4	521	0.0095	0.191	0	1
0.05	0.20	0.15	5.0	1.60	3	391	0.0110	0.221	0	1
0.05	0.20	0.30	5.0	2.20	2	284	0.0129	0.259	0	1
0.05	0.05	0.01	1.3	1.00	1	156	0.0175	0.349	1	1
0.05	0.05	0.05	1.3	1.01	1	154	0.0175	0.351	1	1
0.05	0.05	0.15	1.3	1.04	1	151	0.0178	0.355	1	1
0.05	0.05	0.30	1.3	1.08	1	145	0.0181	0.362	1	1
0.01	1.00	0.01	25.0	1.24	20	2520	0.0020	0.198	0	1
0.01	1.00	0.05	25.0	2.20	11	1420	0.0026	0.264	0	1
0.01	1.00	0.15	25.0	4.60	5	679	0.0038	0.382	1	1
0.01	1.00	0.30	25.0	8.20	3	381	0.0051	0.510	1	1
0.01	0.50	0.01	12.5	1.12	11	1401	0.0027	0.266	0	1
0.01	0.50	0.05	12.5	1.58	8	992	0.0032	0.316	1	1
0.01	0.50	0.15	12.5	2.73	5	573	0.0042	0.416	1	1
0.01	0.50	0.30	12.5	4.45	3	351	0.0053	0.531	1	1
0.01	0.20	0.01	5.0	1.04	5	601	0.0041	0.406	1	1
0.01	0.20	0.05	5.0	1.20	4	521	0.0044	0.436	1	1
0.01	0.20	0.15	5.0	1.60	3	391	0.0050	0.503	1	1
0.01	0.20	0.30	5.0	2.20	2	284	0.0059	0.590	1	1
0.01	0.05	0.01	1.3	1.00	1	156	0.0080	0.797	1	1
0.01	0.05	0.05	1.3	1.01	1	154	0.0080	0.801	1	1
0.01	0.05	0.15	1.3	1.04	1	151	0.0081	0.811	1	1
0.01	0.05	0.30	1.3	1.08	1	145	0.0083	0.825	1	1

Table A.1.2. Designs with 125 Hospitals and 50 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	50.0	1.49	34	4195	0.0077	0.015	0	0
0.50	1.00	0.05	50.0	3.45	14	1812	0.0117	0.023	0	0
0.50	1.00	0.15	50.0	8.35	6	749	0.0183	0.037	0	0
0.50	1.00	0.30	50.0	15.70	3	398	0.0251	0.050	0	0
0.50	0.50	0.01	25.0	1.24	20	2520	0.0100	0.020	0	0
0.50	0.50	0.05	25.0	2.20	11	1420	0.0133	0.027	0	0
0.50	0.50	0.15	25.0	4.60	5	679	0.0192	0.038	0	0
0.50	0.50	0.30	25.0	8.20	3	381	0.0256	0.051	0	0
0.50	0.20	0.01	10.0	1.09	9	1147	0.0148	0.030	0	0
0.50	0.20	0.05	10.0	1.45	7	862	0.0170	0.034	0	0
0.50	0.20	0.15	10.0	2.35	4	532	0.0217	0.043	0	0
0.50	0.20	0.30	10.0	3.70	3	338	0.0272	0.054	0	0
0.50	0.05	0.01	2.5	1.02	2	308	0.0285	0.057	0	0
0.50	0.05	0.05	2.5	1.08	2	291	0.0293	0.059	0	0
0.50	0.05	0.15	2.5	1.23	2	255	0.0313	0.063	0	0
0.50	0.05	0.30	2.5	1.45	2	216	0.0341	0.068	0	0
0.25	1.00	0.01	50.0	1.49	34	4195	0.0067	0.027	0	0
0.25	1.00	0.05	50.0	3.45	14	1812	0.0102	0.041	0	0
0.25	1.00	0.15	50.0	8.35	6	749	0.0158	0.063	0	0
0.25	1.00	0.30	50.0	15.70	3	398	0.0217	0.087	0	0
0.25	0.50	0.01	25.0	1.24	20	2520	0.0086	0.035	0	0
0.25	0.50	0.05	25.0	2.20	11	1420	0.0115	0.046	0	0
0.25	0.50	0.15	25.0	4.60	5	679	0.0166	0.066	0	0
0.25	0.50	0.30	25.0	8.20	3	381	0.0222	0.089	0	0
0.25	0.20	0.01	10.0	1.09	9	1147	0.0128	0.051	0	0
0.25	0.20	0.05	10.0	1.45	7	862	0.0147	0.059	0	0
0.25	0.20	0.15	10.0	2.35	4	532	0.0188	0.075	0	0
0.25	0.20	0.30	10.0	3.70	3	338	0.0236	0.094	0	0
0.25	0.05	0.01	2.5	1.02	2	308	0.0247	0.099	0	0
0.25	0.05	0.05	2.5	1.08	2	291	0.0254	0.102	0	1
0.25	0.05	0.15	2.5	1.23	2	255	0.0271	0.108	0	1
0.25	0.05	0.30	2.5	1.45	2	216	0.0295	0.118	0	1
0.10	1.00	0.01	50.0	1.49	34	4195	0.0046	0.046	0	0
0.10	1.00	0.05	50.0	3.45	14	1812	0.0070	0.070	0	0
0.10	1.00	0.15	50.0	8.35	6	749	0.0110	0.110	0	1
0.10	1.00	0.30	50.0	15.70	3	398	0.0150	0.150	0	1
0.10	0.50	0.01	25.0	1.24	20	2520	0.0060	0.060	0	0
0.10	0.50	0.05	25.0	2.20	11	1420	0.0080	0.080	0	0
0.10	0.50	0.15	25.0	4.60	5	679	0.0115	0.115	0	1
0.10	0.50	0.30	25.0	8.20	3	381	0.0154	0.154	0	1
0.10	0.20	0.01	10.0	1.09	9	1147	0.0089	0.089	0	0
0.10	0.20	0.05	10.0	1.45	7	862	0.0102	0.102	0	1
0.10	0.20	0.15	10.0	2.35	4	532	0.0130	0.130	0	1
0.10	0.20	0.30	10.0	3.70	3	338	0.0163	0.163	0	1
0.10	0.05	0.01	2.5	1.02	2	308	0.0171	0.171	0	1
0.10	0.05	0.05	2.5	1.08	2	291	0.0176	0.176	0	1
0.10	0.05	0.15	2.5	1.23	2	255	0.0188	0.188	0	1
0.10	0.05	0.30	2.5	1.45	2	216	0.0204	0.204	0	1
0.05	1.00	0.01	50.0	1.49	34	4195	0.0034	0.067	0	0
0.05	1.00	0.05	50.0	3.45	14	1812	0.0051	0.102	0	1
0.05	1.00	0.15	50.0	8.35	6	749	0.0080	0.159	0	1

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	50.0	15.70	3	398	0.0109	0.218	0	1
0.05	0.50	0.01	25.0	1.24	20	2520	0.0043	0.087	0	0
0.05	0.50	0.05	25.0	2.20	11	1420	0.0058	0.116	0	1
0.05	0.50	0.15	25.0	4.60	5	679	0.0084	0.167	0	1
0.05	0.50	0.30	25.0	8.20	3	381	0.0112	0.223	0	1
0.05	0.20	0.01	10.0	1.09	9	1147	0.0064	0.129	0	1
0.05	0.20	0.05	10.0	1.45	7	862	0.0074	0.148	0	1
0.05	0.20	0.15	10.0	2.35	4	532	0.0094	0.189	0	1
0.05	0.20	0.30	10.0	3.70	3	338	0.0119	0.237	0	1
0.05	0.05	0.01	2.5	1.02	2	308	0.0124	0.248	0	1
0.05	0.05	0.05	2.5	1.08	2	291	0.0128	0.256	0	1
0.05	0.05	0.15	2.5	1.23	2	255	0.0136	0.273	0	1
0.05	0.05	0.30	2.5	1.45	2	216	0.0148	0.297	0	1
0.01	1.00	0.01	50.0	1.49	34	4195	0.0015	0.154	0	1
0.01	1.00	0.05	50.0	3.45	14	1812	0.0023	0.234	0	1
0.01	1.00	0.15	50.0	8.35	6	749	0.0036	0.364	1	1
0.01	1.00	0.30	50.0	15.70	3	398	0.0050	0.499	1	1
0.01	0.50	0.01	25.0	1.24	20	2520	0.0020	0.198	0	1
0.01	0.50	0.05	25.0	2.20	11	1420	0.0026	0.264	0	1
0.01	0.50	0.15	25.0	4.60	5	679	0.0038	0.382	1	1
0.01	0.50	0.30	25.0	8.20	3	381	0.0051	0.510	1	1
0.01	0.20	0.01	10.0	1.09	9	1147	0.0029	0.294	0	1
0.01	0.20	0.05	10.0	1.45	7	862	0.0034	0.339	1	1
0.01	0.20	0.15	10.0	2.35	4	532	0.0043	0.431	1	1
0.01	0.20	0.30	10.0	3.70	3	338	0.0054	0.541	1	1
0.01	0.05	0.01	2.5	1.02	2	308	0.0057	0.567	1	1
0.01	0.05	0.05	2.5	1.08	2	291	0.0058	0.584	1	1
0.01	0.05	0.15	2.5	1.23	2	255	0.0062	0.623	1	1
0.01	0.05	0.30	2.5	1.45	2	216	0.0068	0.678	1	1

Table A.1.3. Designs with 125 Hospitals and 100 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	100.0	1.99	50	6281	0.0063	0.013	0	0
0.50	1.00	0.05	100.0	5.95	17	2101	0.0109	0.022	0	0
0.50	1.00	0.15	100.0	15.85	6	789	0.0178	0.036	0	0
0.50	1.00	0.30	100.0	30.70	3	407	0.0248	0.050	0	0
0.50	0.50	0.01	50.0	1.49	34	4195	0.0077	0.015	0	0
0.50	0.50	0.05	50.0	3.45	14	1812	0.0117	0.023	0	0
0.50	0.50	0.15	50.0	8.35	6	749	0.0183	0.037	0	0
0.50	0.50	0.30	50.0	15.70	3	398	0.0251	0.050	0	0
0.50	0.20	0.01	20.0	1.19	17	2101	0.0109	0.022	0	0
0.50	0.20	0.05	20.0	1.95	10	1282	0.0140	0.028	0	0
0.50	0.20	0.15	20.0	3.85	5	649	0.0196	0.039	0	0
0.50	0.20	0.30	20.0	6.70	3	373	0.0259	0.052	0	0
0.50	0.05	0.01	5.0	1.04	5	601	0.0204	0.041	0	0
0.50	0.05	0.05	5.0	1.20	4	521	0.0219	0.044	0	0
0.50	0.05	0.15	5.0	1.60	3	391	0.0253	0.051	0	0
0.50	0.05	0.30	5.0	2.20	2	284	0.0297	0.059	0	0
0.25	1.00	0.01	100.0	1.99	50	6281	0.0055	0.022	0	0
0.25	1.00	0.05	100.0	5.95	17	2101	0.0094	0.038	0	0
0.25	1.00	0.15	100.0	15.85	6	789	0.0154	0.062	0	0
0.25	1.00	0.30	100.0	30.70	3	407	0.0215	0.086	0	0
0.25	0.50	0.01	50.0	1.49	34	4195	0.0067	0.027	0	0
0.25	0.50	0.05	50.0	3.45	14	1812	0.0102	0.041	0	0
0.25	0.50	0.15	50.0	8.35	6	749	0.0158	0.063	0	0
0.25	0.50	0.30	50.0	15.70	3	398	0.0217	0.087	0	0
0.25	0.20	0.01	20.0	1.19	17	2101	0.0094	0.038	0	0
0.25	0.20	0.05	20.0	1.95	10	1282	0.0121	0.048	0	0
0.25	0.20	0.15	20.0	3.85	5	649	0.0170	0.068	0	0
0.25	0.20	0.30	20.0	6.70	3	373	0.0224	0.090	0	0
0.25	0.05	0.01	5.0	1.04	5	601	0.0177	0.071	0	0
0.25	0.05	0.05	5.0	1.20	4	521	0.0190	0.076	0	0
0.25	0.05	0.15	5.0	1.60	3	391	0.0219	0.088	0	0
0.25	0.05	0.30	5.0	2.20	2	284	0.0257	0.103	0	1
0.10	1.00	0.01	100.0	1.99	50	6281	0.0038	0.038	0	0
0.10	1.00	0.05	100.0	5.95	17	2101	0.0065	0.065	0	0
0.10	1.00	0.15	100.0	15.85	6	789	0.0107	0.107	0	1
0.10	1.00	0.30	100.0	30.70	3	407	0.0149	0.149	0	1
0.10	0.50	0.01	50.0	1.49	34	4195	0.0046	0.046	0	0
0.10	0.50	0.05	50.0	3.45	14	1812	0.0070	0.070	0	0
0.10	0.50	0.15	50.0	8.35	6	749	0.0110	0.110	0	1
0.10	0.50	0.30	50.0	15.70	3	398	0.0150	0.150	0	1
0.10	0.20	0.01	20.0	1.19	17	2101	0.0065	0.065	0	0
0.10	0.20	0.05	20.0	1.95	10	1282	0.0084	0.084	0	0
0.10	0.20	0.15	20.0	3.85	5	649	0.0118	0.118	0	1
0.10	0.20	0.30	20.0	6.70	3	373	0.0155	0.155	0	1
0.10	0.05	0.01	5.0	1.04	5	601	0.0122	0.122	0	1
0.10	0.05	0.05	5.0	1.20	4	521	0.0131	0.131	0	1
0.10	0.05	0.15	5.0	1.60	3	391	0.0152	0.152	0	1
0.10	0.05	0.30	5.0	2.20	2	284	0.0178	0.178	0	1
0.05	1.00	0.01	100.0	1.99	50	6281	0.0027	0.055	0	0

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.05	100.0	5.95	17	2101	0.0048	0.095	0	0
0.05	1.00	0.15	100.0	15.85	6	789	0.0078	0.155	0	1
0.05	1.00	0.30	100.0	30.70	3	407	0.0108	0.216	0	1
0.05	0.50	0.01	50.0	1.49	34	4195	0.0034	0.067	0	0
0.05	0.50	0.05	50.0	3.45	14	1812	0.0051	0.102	0	1
0.05	0.50	0.15	50.0	8.35	6	749	0.0080	0.159	0	1
0.05	0.50	0.30	50.0	15.70	3	398	0.0109	0.218	0	1
0.05	0.20	0.01	20.0	1.19	17	2101	0.0048	0.095	0	0
0.05	0.20	0.05	20.0	1.95	10	1282	0.0061	0.122	0	1
0.05	0.20	0.15	20.0	3.85	5	649	0.0086	0.171	0	1
0.05	0.20	0.30	20.0	6.70	3	373	0.0113	0.226	0	1
0.05	0.05	0.01	5.0	1.04	5	601	0.0089	0.178	0	1
0.05	0.05	0.05	5.0	1.20	4	521	0.0095	0.191	0	1
0.05	0.05	0.15	5.0	1.60	3	391	0.0110	0.221	0	1
0.05	0.05	0.30	5.0	2.20	2	284	0.0129	0.259	0	1
0.01	1.00	0.01	100.0	1.99	50	6281	0.0013	0.126	0	1
0.01	1.00	0.05	100.0	5.95	17	2101	0.0022	0.217	0	1
0.01	1.00	0.15	100.0	15.85	6	789	0.0035	0.354	1	1
0.01	1.00	0.30	100.0	30.70	3	407	0.0049	0.493	1	1
0.01	0.50	0.01	50.0	1.49	34	4195	0.0015	0.154	0	1
0.01	0.50	0.05	50.0	3.45	14	1812	0.0023	0.234	0	1
0.01	0.50	0.15	50.0	8.35	6	749	0.0036	0.364	1	1
0.01	0.50	0.30	50.0	15.70	3	398	0.0050	0.499	1	1
0.01	0.20	0.01	20.0	1.19	17	2101	0.0022	0.217	0	1
0.01	0.20	0.05	20.0	1.95	10	1282	0.0028	0.278	0	1
0.01	0.20	0.15	20.0	3.85	5	649	0.0039	0.390	1	1
0.01	0.20	0.30	20.0	6.70	3	373	0.0052	0.515	1	1
0.01	0.05	0.01	5.0	1.04	5	601	0.0041	0.406	1	1
0.01	0.05	0.05	5.0	1.20	4	521	0.0044	0.436	1	1
0.01	0.05	0.15	5.0	1.60	3	391	0.0050	0.503	1	1
0.01	0.05	0.30	5.0	2.20	2	284	0.0059	0.590	1	1

Table A.1.4. Designs with 125 Hospitals and 600 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	600.0	6.99	86	10730	0.0048	0.010	0	0
0.50	1.00	0.05	600.0	30.95	19	2423	0.0102	0.020	0	0
0.50	1.00	0.15	600.0	90.85	7	826	0.0174	0.035	0	0
0.50	1.00	0.30	600.0	180.70	3	415	0.0245	0.049	0	0
0.50	0.50	0.01	300.0	3.99	75	9398	0.0052	0.010	0	0
0.50	0.50	0.05	300.0	15.95	19	2351	0.0103	0.021	0	0
0.50	0.50	0.15	300.0	45.85	7	818	0.0175	0.035	0	0
0.50	0.50	0.30	300.0	90.70	3	413	0.0246	0.049	0	0
0.50	0.20	0.01	120.0	2.19	55	6849	0.0060	0.012	0	0
0.50	0.20	0.05	120.0	6.95	17	2158	0.0108	0.022	0	0
0.50	0.20	0.15	120.0	18.85	6	796	0.0177	0.035	0	0
0.50	0.20	0.30	120.0	36.70	3	409	0.0247	0.049	0	0
0.50	0.05	0.01	30.0	1.29	23	2907	0.0093	0.019	0	0
0.50	0.05	0.05	30.0	2.45	12	1531	0.0128	0.026	0	0
0.50	0.05	0.15	30.0	5.35	6	701	0.0189	0.038	0	0
0.50	0.05	0.30	30.0	9.70	3	387	0.0254	0.051	0	0
0.25	1.00	0.01	600.0	6.99	86	10730	0.0042	0.017	0	0
0.25	1.00	0.05	600.0	30.95	19	2423	0.0088	0.035	0	0
0.25	1.00	0.15	600.0	90.85	7	826	0.0151	0.060	0	0
0.25	1.00	0.30	600.0	180.70	3	415	0.0213	0.085	0	0
0.25	0.50	0.01	300.0	3.99	75	9398	0.0045	0.018	0	0
0.25	0.50	0.05	300.0	15.95	19	2351	0.0089	0.036	0	0
0.25	0.50	0.15	300.0	45.85	7	818	0.0151	0.061	0	0
0.25	0.50	0.30	300.0	90.70	3	413	0.0213	0.085	0	0
0.25	0.20	0.01	120.0	2.19	55	6849	0.0052	0.021	0	0
0.25	0.20	0.05	120.0	6.95	17	2158	0.0093	0.037	0	0
0.25	0.20	0.15	120.0	18.85	6	796	0.0154	0.061	0	0
0.25	0.20	0.30	120.0	36.70	3	409	0.0214	0.086	0	0
0.25	0.05	0.01	30.0	1.29	23	2907	0.0080	0.032	0	0
0.25	0.05	0.05	30.0	2.45	12	1531	0.0111	0.044	0	0
0.25	0.05	0.15	30.0	5.35	6	701	0.0164	0.065	0	0
0.25	0.05	0.30	30.0	9.70	3	387	0.0220	0.088	0	0
0.10	1.00	0.01	600.0	6.99	86	10730	0.0029	0.029	0	0
0.10	1.00	0.05	600.0	30.95	19	2423	0.0061	0.061	0	0
0.10	1.00	0.15	600.0	90.85	7	826	0.0104	0.104	0	1
0.10	1.00	0.30	600.0	180.70	3	415	0.0147	0.147	0	1
0.10	0.50	0.01	300.0	3.99	75	9398	0.0031	0.031	0	0
0.10	0.50	0.05	300.0	15.95	19	2351	0.0062	0.062	0	0
0.10	0.50	0.15	300.0	45.85	7	818	0.0105	0.105	0	1
0.10	0.50	0.30	300.0	90.70	3	413	0.0148	0.148	0	1
0.10	0.20	0.01	120.0	2.19	55	6849	0.0036	0.036	0	0
0.10	0.20	0.05	120.0	6.95	17	2158	0.0065	0.065	0	0
0.10	0.20	0.15	120.0	18.85	6	796	0.0106	0.106	0	1
0.10	0.20	0.30	120.0	36.70	3	409	0.0148	0.148	0	1
0.10	0.05	0.01	30.0	1.29	23	2907	0.0056	0.056	0	0
0.10	0.05	0.05	30.0	2.45	12	1531	0.0077	0.077	0	0
0.10	0.05	0.15	30.0	5.35	6	701	0.0113	0.113	0	1
0.10	0.05	0.30	30.0	9.70	3	387	0.0153	0.153	0	1
0.05	1.00	0.01	600.0	6.99	86	10730	0.0021	0.042	0	0
0.05	1.00	0.05	600.0	30.95	19	2423	0.0044	0.089	0	0
0.05	1.00	0.15	600.0	90.85	7	826	0.0076	0.152	0	1

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	600.0	180.70	3	415	0.0107	0.214	0	1
0.05	0.50	0.01	300.0	3.99	75	9398	0.0022	0.045	0	0
0.05	0.50	0.05	300.0	15.95	19	2351	0.0045	0.090	0	0
0.05	0.50	0.15	300.0	45.85	7	818	0.0076	0.152	0	1
0.05	0.50	0.30	300.0	90.70	3	413	0.0107	0.214	0	1
0.05	0.20	0.01	120.0	2.19	55	6849	0.0026	0.053	0	0
0.05	0.20	0.05	120.0	6.95	17	2158	0.0047	0.094	0	0
0.05	0.20	0.15	120.0	18.85	6	796	0.0077	0.155	0	1
0.05	0.20	0.30	120.0	36.70	3	409	0.0108	0.216	0	1
0.05	0.05	0.01	30.0	1.29	23	2907	0.0040	0.081	0	0
0.05	0.05	0.05	30.0	2.45	12	1531	0.0056	0.111	0	1
0.05	0.05	0.15	30.0	5.35	6	701	0.0082	0.165	0	1
0.05	0.05	0.30	30.0	9.70	3	387	0.0111	0.222	0	1
0.01	1.00	0.01	600.0	6.99	86	10730	0.0010	0.096	0	0
0.01	1.00	0.05	600.0	30.95	19	2423	0.0020	0.202	0	1
0.01	1.00	0.15	600.0	90.85	7	826	0.0035	0.346	1	1
0.01	1.00	0.30	600.0	180.70	3	415	0.0049	0.488	1	1
0.01	0.50	0.01	300.0	3.99	75	9398	0.0010	0.103	0	1
0.01	0.50	0.05	300.0	15.95	19	2351	0.0021	0.205	0	1
0.01	0.50	0.15	300.0	45.85	7	818	0.0035	0.348	1	1
0.01	0.50	0.30	300.0	90.70	3	413	0.0049	0.489	1	1
0.01	0.20	0.01	120.0	2.19	55	6849	0.0012	0.120	0	1
0.01	0.20	0.05	120.0	6.95	17	2158	0.0021	0.214	0	1
0.01	0.20	0.15	120.0	18.85	6	796	0.0035	0.353	1	1
0.01	0.20	0.30	120.0	36.70	3	409	0.0049	0.492	1	1
0.01	0.05	0.01	30.0	1.29	23	2907	0.0018	0.185	0	1
0.01	0.05	0.05	30.0	2.45	12	1531	0.0025	0.254	0	1
0.01	0.05	0.15	30.0	5.35	6	701	0.0038	0.376	1	1
0.01	0.05	0.30	30.0	9.70	3	387	0.0051	0.506	1	1

Table A.2.1. Designs with 250 Hospitals and 25 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	25.0	1.24	20	5040	0.0070	0.014	0	0
0.50	1.00	0.05	25.0	2.20	11	2841	0.0094	0.019	0	0
0.50	1.00	0.15	25.0	4.60	5	1359	0.0136	0.027	0	0
0.50	1.00	0.30	25.0	8.20	3	762	0.0181	0.036	0	0
0.50	0.50	0.01	12.5	1.12	11	2803	0.0094	0.019	0	0
0.50	0.50	0.05	12.5	1.58	8	1984	0.0112	0.022	0	0
0.50	0.50	0.15	12.5	2.73	5	1147	0.0148	0.030	0	0
0.50	0.50	0.30	12.5	4.45	3	702	0.0189	0.038	0	0
0.50	0.20	0.01	5.0	1.04	5	1202	0.0144	0.029	0	0
0.50	0.20	0.05	5.0	1.20	4	1042	0.0155	0.031	0	0
0.50	0.20	0.15	5.0	1.60	3	781	0.0179	0.036	0	0
0.50	0.20	0.30	5.0	2.20	2	568	0.0210	0.042	0	0
0.50	0.05	0.01	1.3	1.00	1	312	0.0283	0.057	0	0
0.50	0.05	0.05	1.3	1.01	1	309	0.0285	0.057	0	0
0.50	0.05	0.15	1.3	1.04	1	301	0.0288	0.058	0	0
0.50	0.05	0.30	1.3	1.08	1	291	0.0293	0.059	0	0
0.25	1.00	0.01	25.0	1.24	20	5040	0.0061	0.024	0	0
0.25	1.00	0.05	25.0	2.20	11	2841	0.0081	0.032	0	0
0.25	1.00	0.15	25.0	4.60	5	1359	0.0117	0.047	0	0
0.25	1.00	0.30	25.0	8.20	3	762	0.0157	0.063	0	0
0.25	0.50	0.01	12.5	1.12	11	2803	0.0082	0.033	0	0
0.25	0.50	0.05	12.5	1.58	8	1984	0.0097	0.039	0	0
0.25	0.50	0.15	12.5	2.73	5	1147	0.0128	0.051	0	0
0.25	0.50	0.30	12.5	4.45	3	702	0.0163	0.065	0	0
0.25	0.20	0.01	5.0	1.04	5	1202	0.0125	0.050	0	0
0.25	0.20	0.05	5.0	1.20	4	1042	0.0134	0.054	0	0
0.25	0.20	0.15	5.0	1.60	3	781	0.0155	0.062	0	0
0.25	0.20	0.30	5.0	2.20	2	568	0.0182	0.073	0	0
0.25	0.05	0.01	1.3	1.00	1	312	0.0245	0.098	0	0
0.25	0.05	0.05	1.3	1.01	1	309	0.0246	0.099	0	0
0.25	0.05	0.15	1.3	1.04	1	301	0.0249	0.100	0	0
0.25	0.05	0.30	1.3	1.08	1	291	0.0254	0.102	0	1
0.10	1.00	0.01	25.0	1.24	20	5040	0.0042	0.042	0	0
0.10	1.00	0.05	25.0	2.20	11	2841	0.0056	0.056	0	0
0.10	1.00	0.15	25.0	4.60	5	1359	0.0081	0.081	0	0
0.10	1.00	0.30	25.0	8.20	3	762	0.0109	0.109	0	1
0.10	0.50	0.01	12.5	1.12	11	2803	0.0057	0.057	0	0
0.10	0.50	0.05	12.5	1.58	8	1984	0.0067	0.067	0	0
0.10	0.50	0.15	12.5	2.73	5	1147	0.0089	0.089	0	0
0.10	0.50	0.30	12.5	4.45	3	702	0.0113	0.113	0	1
0.10	0.20	0.01	5.0	1.04	5	1202	0.0087	0.087	0	0
0.10	0.20	0.05	5.0	1.20	4	1042	0.0093	0.093	0	0
0.10	0.20	0.15	5.0	1.60	3	781	0.0107	0.107	0	1
0.10	0.20	0.30	5.0	2.20	2	568	0.0126	0.126	0	1
0.10	0.05	0.01	1.3	1.00	1	312	0.0170	0.170	0	1
0.10	0.05	0.05	1.3	1.01	1	309	0.0171	0.171	0	1
0.10	0.05	0.15	1.3	1.04	1	301	0.0173	0.173	0	1
0.10	0.05	0.30	1.3	1.08	1	291	0.0176	0.176	0	1
0.05	1.00	0.01	25.0	1.24	20	5040	0.0031	0.061	0	0
0.05	1.00	0.05	25.0	2.20	11	2841	0.0041	0.082	0	0
0.05	1.00	0.15	25.0	4.60	5	1359	0.0059	0.118	0	1

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	25.0	8.20	3	762	0.0079	0.158	0	1
0.05	0.50	0.01	12.5	1.12	11	2803	0.0041	0.082	0	0
0.05	0.50	0.05	12.5	1.58	8	1984	0.0049	0.098	0	0
0.05	0.50	0.15	12.5	2.73	5	1147	0.0064	0.129	0	1
0.05	0.50	0.30	12.5	4.45	3	702	0.0082	0.164	0	1
0.05	0.20	0.01	5.0	1.04	5	1202	0.0063	0.126	0	1
0.05	0.20	0.05	5.0	1.20	4	1042	0.0068	0.135	0	1
0.05	0.20	0.15	5.0	1.60	3	781	0.0078	0.156	0	1
0.05	0.20	0.30	5.0	2.20	2	568	0.0091	0.183	0	1
0.05	0.05	0.01	1.3	1.00	1	312	0.0123	0.247	0	1
0.05	0.05	0.05	1.3	1.01	1	309	0.0124	0.248	0	1
0.05	0.05	0.15	1.3	1.04	1	301	0.0126	0.251	0	1
0.05	0.05	0.30	1.3	1.08	1	291	0.0128	0.256	0	1
0.01	1.00	0.01	25.0	1.24	20	5040	0.0014	0.140	0	1
0.01	1.00	0.05	25.0	2.20	11	2841	0.0019	0.187	0	1
0.01	1.00	0.15	25.0	4.60	5	1359	0.0027	0.270	0	1
0.01	1.00	0.30	25.0	8.20	3	762	0.0036	0.360	1	1
0.01	0.50	0.01	12.5	1.12	11	2803	0.0019	0.188	0	1
0.01	0.50	0.05	12.5	1.58	8	1984	0.0022	0.223	0	1
0.01	0.50	0.15	12.5	2.73	5	1147	0.0029	0.294	0	1
0.01	0.50	0.30	12.5	4.45	3	702	0.0038	0.375	1	1
0.01	0.20	0.01	5.0	1.04	5	1202	0.0029	0.287	0	1
0.01	0.20	0.05	5.0	1.20	4	1042	0.0031	0.308	1	1
0.01	0.20	0.15	5.0	1.60	3	781	0.0036	0.356	1	1
0.01	0.20	0.30	5.0	2.20	2	568	0.0042	0.417	1	1
0.01	0.05	0.01	1.3	1.00	1	312	0.0056	0.564	1	1
0.01	0.05	0.05	1.3	1.01	1	309	0.0057	0.566	1	1
0.01	0.05	0.15	1.3	1.04	1	301	0.0057	0.573	1	1
0.01	0.05	0.30	1.3	1.08	1	291	0.0058	0.584	1	1

Table A.2.2. Designs with 250 Hospitals and 50 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	50.0	1.49	34	8389	0.0055	0.011	0	0
0.50	1.00	0.05	50.0	3.45	14	3623	0.0083	0.017	0	0
0.50	1.00	0.15	50.0	8.35	6	1497	0.0129	0.026	0	0
0.50	1.00	0.30	50.0	15.70	3	796	0.0177	0.035	0	0
0.50	0.50	0.01	25.0	1.24	20	5040	0.0070	0.014	0	0
0.50	0.50	0.05	25.0	2.20	11	2841	0.0094	0.019	0	0
0.50	0.50	0.15	25.0	4.60	5	1359	0.0136	0.027	0	0
0.50	0.50	0.30	25.0	8.20	3	762	0.0181	0.036	0	0
0.50	0.20	0.01	10.0	1.09	9	2294	0.0104	0.021	0	0
0.50	0.20	0.05	10.0	1.45	7	1724	0.0120	0.024	0	0
0.50	0.20	0.15	10.0	2.35	4	1064	0.0153	0.031	0	0
0.50	0.20	0.30	10.0	3.70	3	676	0.0192	0.038	0	0
0.50	0.05	0.01	2.5	1.02	2	616	0.0201	0.040	0	0
0.50	0.05	0.05	2.5	1.08	2	581	0.0207	0.041	0	0
0.50	0.05	0.15	2.5	1.23	2	510	0.0221	0.044	0	0
0.50	0.05	0.30	2.5	1.45	2	431	0.0241	0.048	0	0
0.25	1.00	0.01	50.0	1.49	34	8389	0.0047	0.019	0	0
0.25	1.00	0.05	50.0	3.45	14	3623	0.0072	0.029	0	0
0.25	1.00	0.15	50.0	8.35	6	1497	0.0112	0.045	0	0
0.25	1.00	0.30	50.0	15.70	3	796	0.0153	0.061	0	0
0.25	0.50	0.01	25.0	1.24	20	5040	0.0061	0.024	0	0
0.25	0.50	0.05	25.0	2.20	11	2841	0.0081	0.032	0	0
0.25	0.50	0.15	25.0	4.60	5	1359	0.0117	0.047	0	0
0.25	0.50	0.30	25.0	8.20	3	762	0.0157	0.063	0	0
0.25	0.20	0.01	10.0	1.09	9	2294	0.0090	0.036	0	0
0.25	0.20	0.05	10.0	1.45	7	1724	0.0104	0.042	0	0
0.25	0.20	0.15	10.0	2.35	4	1064	0.0133	0.053	0	0
0.25	0.20	0.30	10.0	3.70	3	676	0.0167	0.067	0	0
0.25	0.05	0.01	2.5	1.02	2	616	0.0174	0.070	0	0
0.25	0.05	0.05	2.5	1.08	2	581	0.0180	0.072	0	0
0.25	0.05	0.15	2.5	1.23	2	510	0.0192	0.077	0	0
0.25	0.05	0.30	2.5	1.45	2	431	0.0209	0.083	0	0
0.10	1.00	0.01	50.0	1.49	34	8389	0.0033	0.033	0	0
0.10	1.00	0.05	50.0	3.45	14	3623	0.0050	0.050	0	0
0.10	1.00	0.15	50.0	8.35	6	1497	0.0078	0.078	0	0
0.10	1.00	0.30	50.0	15.70	3	796	0.0106	0.106	0	1
0.10	0.50	0.01	25.0	1.24	20	5040	0.0042	0.042	0	0
0.10	0.50	0.05	25.0	2.20	11	2841	0.0056	0.056	0	0
0.10	0.50	0.15	25.0	4.60	5	1359	0.0081	0.081	0	0
0.10	0.50	0.30	25.0	8.20	3	762	0.0109	0.109	0	1
0.10	0.20	0.01	10.0	1.09	9	2294	0.0063	0.063	0	0
0.10	0.20	0.05	10.0	1.45	7	1724	0.0072	0.072	0	0
0.10	0.20	0.15	10.0	2.35	4	1064	0.0092	0.092	0	0
0.10	0.20	0.30	10.0	3.70	3	676	0.0115	0.115	0	1
0.10	0.05	0.01	2.5	1.02	2	616	0.0121	0.121	0	1
0.10	0.05	0.05	2.5	1.08	2	581	0.0124	0.124	0	1
0.10	0.05	0.15	2.5	1.23	2	510	0.0133	0.133	0	1
0.10	0.05	0.30	2.5	1.45	2	431	0.0144	0.144	0	1
0.05	1.00	0.01	50.0	1.49	34	8389	0.0024	0.048	0	0
0.05	1.00	0.05	50.0	3.45	14	3623	0.0036	0.072	0	0
0.05	1.00	0.15	50.0	8.35	6	1497	0.0056	0.113	0	1

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	50.0	15.70	3	796	0.0077	0.154	0	1
0.05	0.50	0.01	25.0	1.24	20	5040	0.0031	0.061	0	0
0.05	0.50	0.05	25.0	2.20	11	2841	0.0041	0.082	0	0
0.05	0.50	0.15	25.0	4.60	5	1359	0.0059	0.118	0	1
0.05	0.50	0.30	25.0	8.20	3	762	0.0079	0.158	0	1
0.05	0.20	0.01	10.0	1.09	9	2294	0.0046	0.091	0	0
0.05	0.20	0.05	10.0	1.45	7	1724	0.0052	0.105	0	1
0.05	0.20	0.15	10.0	2.35	4	1064	0.0067	0.134	0	1
0.05	0.20	0.30	10.0	3.70	3	676	0.0084	0.168	0	1
0.05	0.05	0.01	2.5	1.02	2	616	0.0088	0.176	0	1
0.05	0.05	0.05	2.5	1.08	2	581	0.0090	0.181	0	1
0.05	0.05	0.15	2.5	1.23	2	510	0.0096	0.193	0	1
0.05	0.05	0.30	2.5	1.45	2	431	0.0105	0.210	0	1
0.01	1.00	0.01	50.0	1.49	34	8389	0.0011	0.109	0	1
0.01	1.00	0.05	50.0	3.45	14	3623	0.0017	0.165	0	1
0.01	1.00	0.15	50.0	8.35	6	1497	0.0026	0.257	0	1
0.01	1.00	0.30	50.0	15.70	3	796	0.0035	0.353	1	1
0.01	0.50	0.01	25.0	1.24	20	5040	0.0014	0.140	0	1
0.01	0.50	0.05	25.0	2.20	11	2841	0.0019	0.187	0	1
0.01	0.50	0.15	25.0	4.60	5	1359	0.0027	0.270	0	1
0.01	0.50	0.30	25.0	8.20	3	762	0.0036	0.360	1	1
0.01	0.20	0.01	10.0	1.09	9	2294	0.0021	0.208	0	1
0.01	0.20	0.05	10.0	1.45	7	1724	0.0024	0.240	0	1
0.01	0.20	0.15	10.0	2.35	4	1064	0.0031	0.305	1	1
0.01	0.20	0.30	10.0	3.70	3	676	0.0038	0.383	1	1
0.01	0.05	0.01	2.5	1.02	2	616	0.0040	0.401	1	1
0.01	0.05	0.05	2.5	1.08	2	581	0.0041	0.413	1	1
0.01	0.05	0.15	2.5	1.23	2	510	0.0044	0.440	1	1
0.01	0.05	0.30	2.5	1.45	2	431	0.0048	0.479	1	1

Table A.2.3. Designs with 250 Hospitals and 100 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	100.0	1.99	50	12563	0.0045	0.009	0	0
0.50	1.00	0.05	100.0	5.95	17	4202	0.0077	0.015	0	0
0.50	1.00	0.15	100.0	15.85	6	1577	0.0126	0.025	0	0
0.50	1.00	0.30	100.0	30.70	3	814	0.0175	0.035	0	0
0.50	0.50	0.01	50.0	1.49	34	8389	0.0055	0.011	0	0
0.50	0.50	0.05	50.0	3.45	14	3623	0.0083	0.017	0	0
0.50	0.50	0.15	50.0	8.35	6	1497	0.0129	0.026	0	0
0.50	0.50	0.30	50.0	15.70	3	796	0.0177	0.035	0	0
0.50	0.20	0.01	20.0	1.19	17	4202	0.0077	0.015	0	0
0.50	0.20	0.05	20.0	1.95	10	2564	0.0099	0.020	0	0
0.50	0.20	0.15	20.0	3.85	5	1299	0.0139	0.028	0	0
0.50	0.20	0.30	20.0	6.70	3	746	0.0183	0.037	0	0
0.50	0.05	0.01	5.0	1.04	5	1202	0.0144	0.029	0	0
0.50	0.05	0.05	5.0	1.20	4	1042	0.0155	0.031	0	0
0.50	0.05	0.15	5.0	1.60	3	781	0.0179	0.036	0	0
0.50	0.05	0.30	5.0	2.20	2	568	0.0210	0.042	0	0
0.25	1.00	0.01	100.0	1.99	50	12563	0.0039	0.015	0	0
0.25	1.00	0.05	100.0	5.95	17	4202	0.0067	0.027	0	0
0.25	1.00	0.15	100.0	15.85	6	1577	0.0109	0.044	0	0
0.25	1.00	0.30	100.0	30.70	3	814	0.0152	0.061	0	0
0.25	0.50	0.01	50.0	1.49	34	8389	0.0047	0.019	0	0
0.25	0.50	0.05	50.0	3.45	14	3623	0.0072	0.029	0	0
0.25	0.50	0.15	50.0	8.35	6	1497	0.0112	0.045	0	0
0.25	0.50	0.30	50.0	15.70	3	796	0.0153	0.061	0	0
0.25	0.20	0.01	20.0	1.19	17	4202	0.0067	0.027	0	0
0.25	0.20	0.05	20.0	1.95	10	2564	0.0086	0.034	0	0
0.25	0.20	0.15	20.0	3.85	5	1299	0.0120	0.048	0	0
0.25	0.20	0.30	20.0	6.70	3	746	0.0159	0.063	0	0
0.25	0.05	0.01	5.0	1.04	5	1202	0.0125	0.050	0	0
0.25	0.05	0.05	5.0	1.20	4	1042	0.0134	0.054	0	0
0.25	0.05	0.15	5.0	1.60	3	781	0.0155	0.062	0	0
0.25	0.05	0.30	5.0	2.20	2	568	0.0182	0.073	0	0
0.10	1.00	0.01	100.0	1.99	50	12563	0.0027	0.027	0	0
0.10	1.00	0.05	100.0	5.95	17	4202	0.0046	0.046	0	0
0.10	1.00	0.15	100.0	15.85	6	1577	0.0076	0.076	0	0
0.10	1.00	0.30	100.0	30.70	3	814	0.0105	0.105	0	1
0.10	0.50	0.01	50.0	1.49	34	8389	0.0033	0.033	0	0
0.10	0.50	0.05	50.0	3.45	14	3623	0.0050	0.050	0	0
0.10	0.50	0.15	50.0	8.35	6	1497	0.0078	0.078	0	0
0.10	0.50	0.30	50.0	15.70	3	796	0.0106	0.106	0	1
0.10	0.20	0.01	20.0	1.19	17	4202	0.0046	0.046	0	0
0.10	0.20	0.05	20.0	1.95	10	2564	0.0059	0.059	0	0
0.10	0.20	0.15	20.0	3.85	5	1299	0.0083	0.083	0	0
0.10	0.20	0.30	20.0	6.70	3	746	0.0110	0.110	0	1
0.10	0.05	0.01	5.0	1.04	5	1202	0.0087	0.087	0	0
0.10	0.05	0.05	5.0	1.20	4	1042	0.0093	0.093	0	0
0.10	0.05	0.15	5.0	1.60	3	781	0.0107	0.107	0	1
0.10	0.05	0.30	5.0	2.20	2	568	0.0126	0.126	0	1
0.05	1.00	0.01	100.0	1.99	50	12563	0.0019	0.039	0	0
0.05	1.00	0.05	100.0	5.95	17	4202	0.0034	0.067	0	0
0.05	1.00	0.15	100.0	15.85	6	1577	0.0055	0.110	0	1

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	100.0	30.70	3	814	0.0076	0.153	0	1
0.05	0.50	0.01	50.0	1.49	34	8389	0.0024	0.048	0	0
0.05	0.50	0.05	50.0	3.45	14	3623	0.0036	0.072	0	0
0.05	0.50	0.15	50.0	8.35	6	1497	0.0056	0.113	0	1
0.05	0.50	0.30	50.0	15.70	3	796	0.0077	0.154	0	1
0.05	0.20	0.01	20.0	1.19	17	4202	0.0034	0.067	0	0
0.05	0.20	0.05	20.0	1.95	10	2564	0.0043	0.086	0	0
0.05	0.20	0.15	20.0	3.85	5	1299	0.0060	0.121	0	1
0.05	0.20	0.30	20.0	6.70	3	746	0.0080	0.160	0	1
0.05	0.05	0.01	5.0	1.04	5	1202	0.0063	0.126	0	1
0.05	0.05	0.05	5.0	1.20	4	1042	0.0068	0.135	0	1
0.05	0.05	0.15	5.0	1.60	3	781	0.0078	0.156	0	1
0.05	0.05	0.30	5.0	2.20	2	568	0.0091	0.183	0	1
0.01	1.00	0.01	100.0	1.99	50	12563	0.0009	0.089	0	0
0.01	1.00	0.05	100.0	5.95	17	4202	0.0015	0.153	0	1
0.01	1.00	0.15	100.0	15.85	6	1577	0.0025	0.251	0	1
0.01	1.00	0.30	100.0	30.70	3	814	0.0035	0.349	1	1
0.01	0.50	0.01	50.0	1.49	34	8389	0.0011	0.109	0	1
0.01	0.50	0.05	50.0	3.45	14	3623	0.0017	0.165	0	1
0.01	0.50	0.15	50.0	8.35	6	1497	0.0026	0.257	0	1
0.01	0.50	0.30	50.0	15.70	3	796	0.0035	0.353	1	1
0.01	0.20	0.01	20.0	1.19	17	4202	0.0015	0.153	0	1
0.01	0.20	0.05	20.0	1.95	10	2564	0.0020	0.196	0	1
0.01	0.20	0.15	20.0	3.85	5	1299	0.0028	0.276	0	1
0.01	0.20	0.30	20.0	6.70	3	746	0.0036	0.364	1	1
0.01	0.05	0.01	5.0	1.04	5	1202	0.0029	0.287	0	1
0.01	0.05	0.05	5.0	1.20	4	1042	0.0031	0.308	1	1
0.01	0.05	0.15	5.0	1.60	3	781	0.0036	0.356	1	1
0.01	0.05	0.30	5.0	2.20	2	568	0.0042	0.417	1	1

Table A.2.4. Designs with 250 Hospitals and 600 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	600.0	6.99	86	21459	0.0034	0.007	0	0
0.50	1.00	0.05	600.0	30.95	19	4847	0.0072	0.014	0	0
0.50	1.00	0.15	600.0	90.85	7	1651	0.0123	0.025	0	0
0.50	1.00	0.30	600.0	180.70	3	830	0.0174	0.035	0	0
0.50	0.50	0.01	300.0	3.99	75	18797	0.0036	0.007	0	0
0.50	0.50	0.05	300.0	15.95	19	4702	0.0073	0.015	0	0
0.50	0.50	0.15	300.0	45.85	7	1636	0.0124	0.025	0	0
0.50	0.50	0.30	300.0	90.70	3	827	0.0174	0.035	0	0
0.50	0.20	0.01	120.0	2.19	55	13699	0.0043	0.009	0	0
0.50	0.20	0.05	120.0	6.95	17	4317	0.0076	0.015	0	0
0.50	0.20	0.15	120.0	18.85	6	1592	0.0125	0.025	0	0
0.50	0.20	0.30	120.0	36.70	3	817	0.0175	0.035	0	0
0.50	0.05	0.01	30.0	1.29	23	5814	0.0066	0.013	0	0
0.50	0.05	0.05	30.0	2.45	12	3061	0.0090	0.018	0	0
0.50	0.05	0.15	30.0	5.35	6	1402	0.0134	0.027	0	0
0.50	0.05	0.30	30.0	9.70	3	773	0.0180	0.036	0	0
0.25	1.00	0.01	600.0	6.99	86	21459	0.0030	0.012	0	0
0.25	1.00	0.05	600.0	30.95	19	4847	0.0062	0.025	0	0
0.25	1.00	0.15	600.0	90.85	7	1651	0.0107	0.043	0	0
0.25	1.00	0.30	600.0	180.70	3	830	0.0150	0.060	0	0
0.25	0.50	0.01	300.0	3.99	75	18797	0.0032	0.013	0	0
0.25	0.50	0.05	300.0	15.95	19	4702	0.0063	0.025	0	0
0.25	0.50	0.15	300.0	45.85	7	1636	0.0107	0.043	0	0
0.25	0.50	0.30	300.0	90.70	3	827	0.0151	0.060	0	0
0.25	0.20	0.01	120.0	2.19	55	13699	0.0037	0.015	0	0
0.25	0.20	0.05	120.0	6.95	17	4317	0.0066	0.026	0	0
0.25	0.20	0.15	120.0	18.85	6	1592	0.0109	0.043	0	0
0.25	0.20	0.30	120.0	36.70	3	817	0.0151	0.061	0	0
0.25	0.05	0.01	30.0	1.29	23	5814	0.0057	0.023	0	0
0.25	0.05	0.05	30.0	2.45	12	3061	0.0078	0.031	0	0
0.25	0.05	0.15	30.0	5.35	6	1402	0.0116	0.046	0	0
0.25	0.05	0.30	30.0	9.70	3	773	0.0156	0.062	0	0
0.10	1.00	0.01	600.0	6.99	86	21459	0.0020	0.020	0	0
0.10	1.00	0.05	600.0	30.95	19	4847	0.0043	0.043	0	0
0.10	1.00	0.15	600.0	90.85	7	1651	0.0074	0.074	0	0
0.10	1.00	0.30	600.0	180.70	3	830	0.0104	0.104	0	1
0.10	0.50	0.01	300.0	3.99	75	18797	0.0022	0.022	0	0
0.10	0.50	0.05	300.0	15.95	19	4702	0.0044	0.044	0	0
0.10	0.50	0.15	300.0	45.85	7	1636	0.0074	0.074	0	0
0.10	0.50	0.30	300.0	90.70	3	827	0.0104	0.104	0	1
0.10	0.20	0.01	120.0	2.19	55	13699	0.0026	0.026	0	0
0.10	0.20	0.05	120.0	6.95	17	4317	0.0046	0.046	0	0
0.10	0.20	0.15	120.0	18.85	6	1592	0.0075	0.075	0	0
0.10	0.20	0.30	120.0	36.70	3	817	0.0105	0.105	0	1
0.10	0.05	0.01	30.0	1.29	23	5814	0.0039	0.039	0	0
0.10	0.05	0.05	30.0	2.45	12	3061	0.0054	0.054	0	0
0.10	0.05	0.15	30.0	5.35	6	1402	0.0080	0.080	0	0
0.10	0.05	0.30	30.0	9.70	3	773	0.0108	0.108	0	1
0.05	1.00	0.01	600.0	6.99	86	21459	0.0015	0.030	0	0
0.05	1.00	0.05	600.0	30.95	19	4847	0.0031	0.063	0	0
0.05	1.00	0.15	600.0	90.85	7	1651	0.0054	0.107	0	1

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	600.0	180.70	3	830	0.0076	0.151	0	1
0.05	0.50	0.01	300.0	3.99	75	18797	0.0016	0.032	0	0
0.05	0.50	0.05	300.0	15.95	19	4702	0.0032	0.064	0	0
0.05	0.50	0.15	300.0	45.85	7	1636	0.0054	0.108	0	1
0.05	0.50	0.30	300.0	90.70	3	827	0.0076	0.152	0	1
0.05	0.20	0.01	120.0	2.19	55	13699	0.0019	0.037	0	0
0.05	0.20	0.05	120.0	6.95	17	4317	0.0033	0.066	0	0
0.05	0.20	0.15	120.0	18.85	6	1592	0.0055	0.109	0	1
0.05	0.20	0.30	120.0	36.70	3	817	0.0076	0.152	0	1
0.05	0.05	0.01	30.0	1.29	23	5814	0.0029	0.057	0	0
0.05	0.05	0.05	30.0	2.45	12	3061	0.0039	0.079	0	0
0.05	0.05	0.15	30.0	5.35	6	1402	0.0058	0.116	0	1
0.05	0.05	0.30	30.0	9.70	3	773	0.0078	0.157	0	1
0.01	1.00	0.01	600.0	6.99	86	21459	0.0007	0.068	0	0
0.01	1.00	0.05	600.0	30.95	19	4847	0.0014	0.143	0	1
0.01	1.00	0.15	600.0	90.85	7	1651	0.0024	0.245	0	1
0.01	1.00	0.30	600.0	180.70	3	830	0.0035	0.345	1	1
0.01	0.50	0.01	300.0	3.99	75	18797	0.0007	0.073	0	0
0.01	0.50	0.05	300.0	15.95	19	4702	0.0015	0.145	0	1
0.01	0.50	0.15	300.0	45.85	7	1636	0.0025	0.246	0	1
0.01	0.50	0.30	300.0	90.70	3	827	0.0035	0.346	1	1
0.01	0.20	0.01	120.0	2.19	55	13699	0.0009	0.085	0	0
0.01	0.20	0.05	120.0	6.95	17	4317	0.0015	0.151	0	1
0.01	0.20	0.15	120.0	18.85	6	1592	0.0025	0.249	0	1
0.01	0.20	0.30	120.0	36.70	3	817	0.0035	0.348	1	1
0.01	0.05	0.01	30.0	1.29	23	5814	0.0013	0.130	0	1
0.01	0.05	0.05	30.0	2.45	12	3061	0.0018	0.180	0	1
0.01	0.05	0.15	30.0	5.35	6	1402	0.0027	0.266	0	1
0.01	0.05	0.30	30.0	9.70	3	773	0.0036	0.358	1	1

Table A.3.1. Designs with 500 Hospitals and 25 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	25.0	1.24	20	10081	0.0050	0.010	0	0
0.50	1.00	0.05	25.0	2.20	11	5682	0.0066	0.013	0	0
0.50	1.00	0.15	25.0	4.60	5	2717	0.0096	0.019	0	0
0.50	1.00	0.30	25.0	8.20	3	1524	0.0128	0.026	0	0
0.50	0.50	0.01	12.5	1.12	11	5605	0.0067	0.013	0	0
0.50	0.50	0.05	12.5	1.58	8	3968	0.0079	0.016	0	0
0.50	0.50	0.15	12.5	2.73	5	2294	0.0104	0.021	0	0
0.50	0.50	0.30	12.5	4.45	3	1404	0.0133	0.027	0	0
0.50	0.20	0.01	5.0	1.04	5	2404	0.0102	0.020	0	0
0.50	0.20	0.05	5.0	1.20	4	2083	0.0110	0.022	0	0
0.50	0.20	0.15	5.0	1.60	3	1563	0.0126	0.025	0	0
0.50	0.20	0.30	5.0	2.20	2	1136	0.0148	0.030	0	0
0.50	0.05	0.01	1.3	1.00	1	623	0.0200	0.040	0	0
0.50	0.05	0.05	1.3	1.01	1	617	0.0201	0.040	0	0
0.50	0.05	0.15	1.3	1.04	1	602	0.0204	0.041	0	0
0.50	0.05	0.30	1.3	1.08	1	581	0.0207	0.041	0	0
0.25	1.00	0.01	25.0	1.24	20	10081	0.0043	0.017	0	0
0.25	1.00	0.05	25.0	2.20	11	5682	0.0057	0.023	0	0
0.25	1.00	0.15	25.0	4.60	5	2717	0.0083	0.033	0	0
0.25	1.00	0.30	25.0	8.20	3	1524	0.0111	0.044	0	0
0.25	0.50	0.01	12.5	1.12	11	5605	0.0058	0.023	0	0
0.25	0.50	0.05	12.5	1.58	8	3968	0.0069	0.027	0	0
0.25	0.50	0.15	12.5	2.73	5	2294	0.0090	0.036	0	0
0.25	0.50	0.30	12.5	4.45	3	1404	0.0116	0.046	0	0
0.25	0.20	0.01	5.0	1.04	5	2404	0.0088	0.035	0	0
0.25	0.20	0.05	5.0	1.20	4	2083	0.0095	0.038	0	0
0.25	0.20	0.15	5.0	1.60	3	1563	0.0110	0.044	0	0
0.25	0.20	0.30	5.0	2.20	2	1136	0.0128	0.051	0	0
0.25	0.05	0.01	1.3	1.00	1	623	0.0173	0.069	0	0
0.25	0.05	0.05	1.3	1.01	1	617	0.0174	0.070	0	0
0.25	0.05	0.15	1.3	1.04	1	602	0.0176	0.071	0	0
0.25	0.05	0.30	1.3	1.08	1	581	0.0180	0.072	0	0
0.10	1.00	0.01	25.0	1.24	20	10081	0.0030	0.030	0	0
0.10	1.00	0.05	25.0	2.20	11	5682	0.0040	0.040	0	0
0.10	1.00	0.15	25.0	4.60	5	2717	0.0058	0.058	0	0
0.10	1.00	0.30	25.0	8.20	3	1524	0.0077	0.077	0	0
0.10	0.50	0.01	12.5	1.12	11	5605	0.0040	0.040	0	0
0.10	0.50	0.05	12.5	1.58	8	3968	0.0048	0.048	0	0
0.10	0.50	0.15	12.5	2.73	5	2294	0.0063	0.063	0	0
0.10	0.50	0.30	12.5	4.45	3	1404	0.0080	0.080	0	0
0.10	0.20	0.01	5.0	1.04	5	2404	0.0061	0.061	0	0
0.10	0.20	0.05	5.0	1.20	4	2083	0.0066	0.066	0	0
0.10	0.20	0.15	5.0	1.60	3	1563	0.0076	0.076	0	0
0.10	0.20	0.30	5.0	2.20	2	1136	0.0089	0.089	0	0
0.10	0.05	0.01	1.3	1.00	1	623	0.0120	0.120	0	1
0.10	0.05	0.05	1.3	1.01	1	617	0.0121	0.121	0	1
0.10	0.05	0.15	1.3	1.04	1	602	0.0122	0.122	0	1
0.10	0.05	0.30	1.3	1.08	1	581	0.0124	0.124	0	1
0.05	1.00	0.01	25.0	1.24	20	10081	0.0022	0.043	0	0
0.05	1.00	0.05	25.0	2.20	11	5682	0.0029	0.058	0	0
0.05	1.00	0.15	25.0	4.60	5	2717	0.0042	0.084	0	0

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	25.0	8.20	3	1524	0.0056	0.112	0	1
0.05	0.50	0.01	12.5	1.12	11	5605	0.0029	0.058	0	0
0.05	0.50	0.05	12.5	1.58	8	3968	0.0035	0.069	0	0
0.05	0.50	0.15	12.5	2.73	5	2294	0.0046	0.091	0	0
0.05	0.50	0.30	12.5	4.45	3	1404	0.0058	0.116	0	1
0.05	0.20	0.01	5.0	1.04	5	2404	0.0044	0.089	0	0
0.05	0.20	0.05	5.0	1.20	4	2083	0.0048	0.095	0	0
0.05	0.20	0.15	5.0	1.60	3	1563	0.0055	0.110	0	1
0.05	0.20	0.30	5.0	2.20	2	1136	0.0065	0.129	0	1
0.05	0.05	0.01	1.3	1.00	1	623	0.0087	0.175	0	1
0.05	0.05	0.05	1.3	1.01	1	617	0.0088	0.175	0	1
0.05	0.05	0.15	1.3	1.04	1	602	0.0089	0.178	0	1
0.05	0.05	0.30	1.3	1.08	1	581	0.0090	0.181	0	1
0.01	1.00	0.01	25.0	1.24	20	10081	0.0010	0.099	0	0
0.01	1.00	0.05	25.0	2.20	11	5682	0.0013	0.132	0	1
0.01	1.00	0.15	25.0	4.60	5	2717	0.0019	0.191	0	1
0.01	1.00	0.30	25.0	8.20	3	1524	0.0025	0.255	0	1
0.01	0.50	0.01	12.5	1.12	11	5605	0.0013	0.133	0	1
0.01	0.50	0.05	12.5	1.58	8	3968	0.0016	0.158	0	1
0.01	0.50	0.15	12.5	2.73	5	2294	0.0021	0.208	0	1
0.01	0.50	0.30	12.5	4.45	3	1404	0.0027	0.265	0	1
0.01	0.20	0.01	5.0	1.04	5	2404	0.0020	0.203	0	1
0.01	0.20	0.05	5.0	1.20	4	2083	0.0022	0.218	0	1
0.01	0.20	0.15	5.0	1.60	3	1563	0.0025	0.252	0	1
0.01	0.20	0.30	5.0	2.20	2	1136	0.0030	0.295	0	1
0.01	0.05	0.01	1.3	1.00	1	623	0.0040	0.398	1	1
0.01	0.05	0.05	1.3	1.01	1	617	0.0040	0.400	1	1
0.01	0.05	0.15	1.3	1.04	1	602	0.0041	0.405	1	1
0.01	0.05	0.30	1.3	1.08	1	581	0.0041	0.413	1	1

Table A.3.2. Designs with 500 Hospitals and 50 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	50.0	1.49	34	16779	0.0039	0.008	0	0
0.50	1.00	0.05	50.0	3.45	14	7246	0.0059	0.012	0	0
0.50	1.00	0.15	50.0	8.35	6	2994	0.0091	0.018	0	0
0.50	1.00	0.30	50.0	15.70	3	1592	0.0125	0.025	0	0
0.50	0.50	0.01	25.0	1.24	20	10081	0.0050	0.010	0	0
0.50	0.50	0.05	25.0	2.20	11	5682	0.0066	0.013	0	0
0.50	0.50	0.15	25.0	4.60	5	2717	0.0096	0.019	0	0
0.50	0.50	0.30	25.0	8.20	3	1524	0.0128	0.026	0	0
0.50	0.20	0.01	10.0	1.09	9	4587	0.0074	0.015	0	0
0.50	0.20	0.05	10.0	1.45	7	3448	0.0085	0.017	0	0
0.50	0.20	0.15	10.0	2.35	4	2128	0.0108	0.022	0	0
0.50	0.20	0.30	10.0	3.70	3	1351	0.0136	0.027	0	0
0.50	0.05	0.01	2.5	1.02	2	1232	0.0142	0.028	0	0
0.50	0.05	0.05	2.5	1.08	2	1163	0.0147	0.029	0	0
0.50	0.05	0.15	2.5	1.23	2	1020	0.0157	0.031	0	0
0.50	0.05	0.30	2.5	1.45	2	862	0.0170	0.034	0	0
0.25	1.00	0.01	50.0	1.49	34	16779	0.0033	0.013	0	0
0.25	1.00	0.05	50.0	3.45	14	7246	0.0051	0.020	0	0
0.25	1.00	0.15	50.0	8.35	6	2994	0.0079	0.032	0	0
0.25	1.00	0.30	50.0	15.70	3	1592	0.0109	0.043	0	0
0.25	0.50	0.01	25.0	1.24	20	10081	0.0043	0.017	0	0
0.25	0.50	0.05	25.0	2.20	11	5682	0.0057	0.023	0	0
0.25	0.50	0.15	25.0	4.60	5	2717	0.0083	0.033	0	0
0.25	0.50	0.30	25.0	8.20	3	1524	0.0111	0.044	0	0
0.25	0.20	0.01	10.0	1.09	9	4587	0.0064	0.026	0	0
0.25	0.20	0.05	10.0	1.45	7	3448	0.0074	0.029	0	0
0.25	0.20	0.15	10.0	2.35	4	2128	0.0094	0.038	0	0
0.25	0.20	0.30	10.0	3.70	3	1351	0.0118	0.047	0	0
0.25	0.05	0.01	2.5	1.02	2	1232	0.0123	0.049	0	0
0.25	0.05	0.05	2.5	1.08	2	1163	0.0127	0.051	0	0
0.25	0.05	0.15	2.5	1.23	2	1020	0.0136	0.054	0	0
0.25	0.05	0.30	2.5	1.45	2	862	0.0147	0.059	0	0
0.10	1.00	0.01	50.0	1.49	34	16779	0.0023	0.023	0	0
0.10	1.00	0.05	50.0	3.45	14	7246	0.0035	0.035	0	0
0.10	1.00	0.15	50.0	8.35	6	2994	0.0055	0.055	0	0
0.10	1.00	0.30	50.0	15.70	3	1592	0.0075	0.075	0	0
0.10	0.50	0.01	25.0	1.24	20	10081	0.0030	0.030	0	0
0.10	0.50	0.05	25.0	2.20	11	5682	0.0040	0.040	0	0
0.10	0.50	0.15	25.0	4.60	5	2717	0.0058	0.058	0	0
0.10	0.50	0.30	25.0	8.20	3	1524	0.0077	0.077	0	0
0.10	0.20	0.01	10.0	1.09	9	4587	0.0044	0.044	0	0
0.10	0.20	0.05	10.0	1.45	7	3448	0.0051	0.051	0	0
0.10	0.20	0.15	10.0	2.35	4	2128	0.0065	0.065	0	0
0.10	0.20	0.30	10.0	3.70	3	1351	0.0082	0.082	0	0
0.10	0.05	0.01	2.5	1.02	2	1232	0.0085	0.085	0	0
0.10	0.05	0.05	2.5	1.08	2	1163	0.0088	0.088	0	0
0.10	0.05	0.15	2.5	1.23	2	1020	0.0094	0.094	0	0
0.10	0.05	0.30	2.5	1.45	2	862	0.0102	0.102	0	1
0.05	1.00	0.01	50.0	1.49	34	16779	0.0017	0.034	0	0
0.05	1.00	0.05	50.0	3.45	14	7246	0.0026	0.051	0	0
0.05	1.00	0.15	50.0	8.35	6	2994	0.0040	0.080	0	0

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	50.0	15.70	3	1592	0.0055	0.109	0	1
0.05	0.50	0.01	25.0	1.24	20	10081	0.0022	0.043	0	0
0.05	0.50	0.05	25.0	2.20	11	5682	0.0029	0.058	0	0
0.05	0.50	0.15	25.0	4.60	5	2717	0.0042	0.084	0	0
0.05	0.50	0.30	25.0	8.20	3	1524	0.0056	0.112	0	1
0.05	0.20	0.01	10.0	1.09	9	4587	0.0032	0.064	0	0
0.05	0.20	0.05	10.0	1.45	7	3448	0.0037	0.074	0	0
0.05	0.20	0.15	10.0	2.35	4	2128	0.0047	0.094	0	0
0.05	0.20	0.30	10.0	3.70	3	1351	0.0059	0.119	0	1
0.05	0.05	0.01	2.5	1.02	2	1232	0.0062	0.124	0	1
0.05	0.05	0.05	2.5	1.08	2	1163	0.0064	0.128	0	1
0.05	0.05	0.15	2.5	1.23	2	1020	0.0068	0.136	0	1
0.05	0.05	0.30	2.5	1.45	2	862	0.0074	0.148	0	1
0.01	1.00	0.01	50.0	1.49	34	16779	0.0008	0.077	0	0
0.01	1.00	0.05	50.0	3.45	14	7246	0.0012	0.117	0	1
0.01	1.00	0.15	50.0	8.35	6	2994	0.0018	0.182	0	1
0.01	1.00	0.30	50.0	15.70	3	1592	0.0025	0.249	0	1
0.01	0.50	0.01	25.0	1.24	20	10081	0.0010	0.099	0	0
0.01	0.50	0.05	25.0	2.20	11	5682	0.0013	0.132	0	1
0.01	0.50	0.15	25.0	4.60	5	2717	0.0019	0.191	0	1
0.01	0.50	0.30	25.0	8.20	3	1524	0.0025	0.255	0	1
0.01	0.20	0.01	10.0	1.09	9	4587	0.0015	0.147	0	1
0.01	0.20	0.05	10.0	1.45	7	3448	0.0017	0.169	0	1
0.01	0.20	0.15	10.0	2.35	4	2128	0.0022	0.216	0	1
0.01	0.20	0.30	10.0	3.70	3	1351	0.0027	0.271	0	1
0.01	0.05	0.01	2.5	1.02	2	1232	0.0028	0.284	0	1
0.01	0.05	0.05	2.5	1.08	2	1163	0.0029	0.292	0	1
0.01	0.05	0.15	2.5	1.23	2	1020	0.0031	0.311	1	1
0.01	0.05	0.30	2.5	1.45	2	862	0.0034	0.339	1	1

Table A.3.3. Designs with 500 Hospitals and 100 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	100.0	1.99	50	25126	0.0032	0.006	0	0
0.50	1.00	0.05	100.0	5.95	17	8403	0.0055	0.011	0	0
0.50	1.00	0.15	100.0	15.85	6	3155	0.0089	0.018	0	0
0.50	1.00	0.30	100.0	30.70	3	1629	0.0124	0.025	0	0
0.50	0.50	0.01	50.0	1.49	34	16779	0.0039	0.008	0	0
0.50	0.50	0.05	50.0	3.45	14	7246	0.0059	0.012	0	0
0.50	0.50	0.15	50.0	8.35	6	2994	0.0091	0.018	0	0
0.50	0.50	0.30	50.0	15.70	3	1592	0.0125	0.025	0	0
0.50	0.20	0.01	20.0	1.19	17	8403	0.0055	0.011	0	0
0.50	0.20	0.05	20.0	1.95	10	5128	0.0070	0.014	0	0
0.50	0.20	0.15	20.0	3.85	5	2597	0.0098	0.020	0	0
0.50	0.20	0.30	20.0	6.70	3	1493	0.0129	0.026	0	0
0.50	0.05	0.01	5.0	1.04	5	2404	0.0102	0.020	0	0
0.50	0.05	0.05	5.0	1.20	4	2083	0.0110	0.022	0	0
0.50	0.05	0.15	5.0	1.60	3	1563	0.0126	0.025	0	0
0.50	0.05	0.30	5.0	2.20	2	1136	0.0148	0.030	0	0
0.25	1.00	0.01	100.0	1.99	50	25126	0.0027	0.011	0	0
0.25	1.00	0.05	100.0	5.95	17	8403	0.0047	0.019	0	0
0.25	1.00	0.15	100.0	15.85	6	3155	0.0077	0.031	0	0
0.25	1.00	0.30	100.0	30.70	3	1629	0.0107	0.043	0	0
0.25	0.50	0.01	50.0	1.49	34	16779	0.0033	0.013	0	0
0.25	0.50	0.05	50.0	3.45	14	7246	0.0051	0.020	0	0
0.25	0.50	0.15	50.0	8.35	6	2994	0.0079	0.032	0	0
0.25	0.50	0.30	50.0	15.70	3	1592	0.0109	0.043	0	0
0.25	0.20	0.01	20.0	1.19	17	8403	0.0047	0.019	0	0
0.25	0.20	0.05	20.0	1.95	10	5128	0.0060	0.024	0	0
0.25	0.20	0.15	20.0	3.85	5	2597	0.0085	0.034	0	0
0.25	0.20	0.30	20.0	6.70	3	1493	0.0112	0.045	0	0
0.25	0.05	0.01	5.0	1.04	5	2404	0.0088	0.035	0	0
0.25	0.05	0.05	5.0	1.20	4	2083	0.0095	0.038	0	0
0.25	0.05	0.15	5.0	1.60	3	1563	0.0110	0.044	0	0
0.25	0.05	0.30	5.0	2.20	2	1136	0.0128	0.051	0	0
0.10	1.00	0.01	100.0	1.99	50	25126	0.0019	0.019	0	0
0.10	1.00	0.05	100.0	5.95	17	8403	0.0033	0.033	0	0
0.10	1.00	0.15	100.0	15.85	6	3155	0.0053	0.053	0	0
0.10	1.00	0.30	100.0	30.70	3	1629	0.0074	0.074	0	0
0.10	0.50	0.01	50.0	1.49	34	16779	0.0023	0.023	0	0
0.10	0.50	0.05	50.0	3.45	14	7246	0.0035	0.035	0	0
0.10	0.50	0.15	50.0	8.35	6	2994	0.0055	0.055	0	0
0.10	0.50	0.30	50.0	15.70	3	1592	0.0075	0.075	0	0
0.10	0.20	0.01	20.0	1.19	17	8403	0.0033	0.033	0	0
0.10	0.20	0.05	20.0	1.95	10	5128	0.0042	0.042	0	0
0.10	0.20	0.15	20.0	3.85	5	2597	0.0059	0.059	0	0
0.10	0.20	0.30	20.0	6.70	3	1493	0.0078	0.078	0	0
0.10	0.05	0.01	5.0	1.04	5	2404	0.0061	0.061	0	0
0.10	0.05	0.05	5.0	1.20	4	2083	0.0066	0.066	0	0
0.10	0.05	0.15	5.0	1.60	3	1563	0.0076	0.076	0	0
0.10	0.05	0.30	5.0	2.20	2	1136	0.0089	0.089	0	0
0.05	1.00	0.01	100.0	1.99	50	25126	0.0014	0.027	0	0
0.05	1.00	0.05	100.0	5.95	17	8403	0.0024	0.048	0	0
0.05	1.00	0.15	100.0	15.85	6	3155	0.0039	0.078	0	0

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	100.0	30.70	3	1629	0.0054	0.108	0	1
0.05	0.50	0.01	50.0	1.49	34	16779	0.0017	0.034	0	0
0.05	0.50	0.05	50.0	3.45	14	7246	0.0026	0.051	0	0
0.05	0.50	0.15	50.0	8.35	6	2994	0.0040	0.080	0	0
0.05	0.50	0.30	50.0	15.70	3	1592	0.0055	0.109	0	1
0.05	0.20	0.01	20.0	1.19	17	8403	0.0024	0.048	0	0
0.05	0.20	0.05	20.0	1.95	10	5128	0.0030	0.061	0	0
0.05	0.20	0.15	20.0	3.85	5	2597	0.0043	0.086	0	0
0.05	0.20	0.30	20.0	6.70	3	1493	0.0056	0.113	0	1
0.05	0.05	0.01	5.0	1.04	5	2404	0.0044	0.089	0	0
0.05	0.05	0.05	5.0	1.20	4	2083	0.0048	0.095	0	0
0.05	0.05	0.15	5.0	1.60	3	1563	0.0055	0.110	0	1
0.05	0.05	0.30	5.0	2.20	2	1136	0.0065	0.129	0	1
0.01	1.00	0.01	100.0	1.99	50	25126	0.0006	0.063	0	0
0.01	1.00	0.05	100.0	5.95	17	8403	0.0011	0.109	0	1
0.01	1.00	0.15	100.0	15.85	6	3155	0.0018	0.177	0	1
0.01	1.00	0.30	100.0	30.70	3	1629	0.0025	0.247	0	1
0.01	0.50	0.01	50.0	1.49	34	16779	0.0008	0.077	0	0
0.01	0.50	0.05	50.0	3.45	14	7246	0.0012	0.117	0	1
0.01	0.50	0.15	50.0	8.35	6	2994	0.0018	0.182	0	1
0.01	0.50	0.30	50.0	15.70	3	1592	0.0025	0.249	0	1
0.01	0.20	0.01	20.0	1.19	17	8403	0.0011	0.109	0	1
0.01	0.20	0.05	20.0	1.95	10	5128	0.0014	0.139	0	1
0.01	0.20	0.15	20.0	3.85	5	2597	0.0020	0.195	0	1
0.01	0.20	0.30	20.0	6.70	3	1493	0.0026	0.258	0	1
0.01	0.05	0.01	5.0	1.04	5	2404	0.0020	0.203	0	1
0.01	0.05	0.05	5.0	1.20	4	2083	0.0022	0.218	0	1
0.01	0.05	0.15	5.0	1.60	3	1563	0.0025	0.252	0	1
0.01	0.05	0.30	5.0	2.20	2	1136	0.0030	0.295	0	1

Table A.3.4. Designs with 500 Hospitals and 600 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	600.0	6.99	86	42918	0.0024	0.005	0	0
0.50	1.00	0.05	600.0	30.95	19	9693	0.0051	0.010	0	0
0.50	1.00	0.15	600.0	90.85	7	3302	0.0087	0.017	0	0
0.50	1.00	0.30	600.0	180.70	3	1660	0.0123	0.025	0	0
0.50	0.50	0.01	300.0	3.99	75	37594	0.0026	0.005	0	0
0.50	0.50	0.05	300.0	15.95	19	9404	0.0052	0.010	0	0
0.50	0.50	0.15	300.0	45.85	7	3272	0.0087	0.017	0	0
0.50	0.50	0.30	300.0	90.70	3	1654	0.0123	0.025	0	0
0.50	0.20	0.01	120.0	2.19	55	27397	0.0030	0.006	0	0
0.50	0.20	0.05	120.0	6.95	17	8633	0.0054	0.011	0	0
0.50	0.20	0.15	120.0	18.85	6	3183	0.0089	0.018	0	0
0.50	0.20	0.30	120.0	36.70	3	1635	0.0124	0.025	0	0
0.50	0.05	0.01	30.0	1.29	23	11628	0.0046	0.009	0	0
0.50	0.05	0.05	30.0	2.45	12	6122	0.0064	0.013	0	0
0.50	0.05	0.15	30.0	5.35	6	2804	0.0094	0.019	0	0
0.50	0.05	0.30	30.0	9.70	3	1546	0.0127	0.025	0	0
0.25	1.00	0.01	600.0	6.99	86	42918	0.0021	0.008	0	0
0.25	1.00	0.05	600.0	30.95	19	9693	0.0044	0.018	0	0
0.25	1.00	0.15	600.0	90.85	7	3302	0.0075	0.030	0	0
0.25	1.00	0.30	600.0	180.70	3	1660	0.0106	0.043	0	0
0.25	0.50	0.01	300.0	3.99	75	37594	0.0022	0.009	0	0
0.25	0.50	0.05	300.0	15.95	19	9404	0.0045	0.018	0	0
0.25	0.50	0.15	300.0	45.85	7	3272	0.0076	0.030	0	0
0.25	0.50	0.30	300.0	90.70	3	1654	0.0106	0.043	0	0
0.25	0.20	0.01	120.0	2.19	55	27397	0.0026	0.010	0	0
0.25	0.20	0.05	120.0	6.95	17	8633	0.0047	0.019	0	0
0.25	0.20	0.15	120.0	18.85	6	3183	0.0077	0.031	0	0
0.25	0.20	0.30	120.0	36.70	3	1635	0.0107	0.043	0	0
0.25	0.05	0.01	30.0	1.29	23	11628	0.0040	0.016	0	0
0.25	0.05	0.05	30.0	2.45	12	6122	0.0055	0.022	0	0
0.25	0.05	0.15	30.0	5.35	6	2804	0.0082	0.033	0	0
0.25	0.05	0.30	30.0	9.70	3	1546	0.0110	0.044	0	0
0.10	1.00	0.01	600.0	6.99	86	42918	0.0014	0.014	0	0
0.10	1.00	0.05	600.0	30.95	19	9693	0.0030	0.030	0	0
0.10	1.00	0.15	600.0	90.85	7	3302	0.0052	0.052	0	0
0.10	1.00	0.30	600.0	180.70	3	1660	0.0074	0.074	0	0
0.10	0.50	0.01	300.0	3.99	75	37594	0.0015	0.015	0	0
0.10	0.50	0.05	300.0	15.95	19	9404	0.0031	0.031	0	0
0.10	0.50	0.15	300.0	45.85	7	3272	0.0052	0.052	0	0
0.10	0.50	0.30	300.0	90.70	3	1654	0.0074	0.074	0	0
0.10	0.20	0.01	120.0	2.19	55	27397	0.0018	0.018	0	0
0.10	0.20	0.05	120.0	6.95	17	8633	0.0032	0.032	0	0
0.10	0.20	0.15	120.0	18.85	6	3183	0.0053	0.053	0	0
0.10	0.20	0.30	120.0	36.70	3	1635	0.0074	0.074	0	0
0.10	0.05	0.01	30.0	1.29	23	11628	0.0028	0.028	0	0
0.10	0.05	0.05	30.0	2.45	12	6122	0.0038	0.038	0	0
0.10	0.05	0.15	30.0	5.35	6	2804	0.0057	0.057	0	0
0.10	0.05	0.30	30.0	9.70	3	1546	0.0076	0.076	0	0
0.05	1.00	0.01	600.0	6.99	86	42918	0.0011	0.021	0	0
0.05	1.00	0.05	600.0	30.95	19	9693	0.0022	0.044	0	0
0.05	1.00	0.15	600.0	90.85	7	3302	0.0038	0.076	0	0

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	600.0	180.70	3	1660	0.0053	0.107	0	1
0.05	0.50	0.01	300.0	3.99	75	37594	0.0011	0.022	0	0
0.05	0.50	0.05	300.0	15.95	19	9404	0.0022	0.045	0	0
0.05	0.50	0.15	300.0	45.85	7	3272	0.0038	0.076	0	0
0.05	0.50	0.30	300.0	90.70	3	1654	0.0054	0.107	0	1
0.05	0.20	0.01	120.0	2.19	55	27397	0.0013	0.026	0	0
0.05	0.20	0.05	120.0	6.95	17	8633	0.0023	0.047	0	0
0.05	0.20	0.15	120.0	18.85	6	3183	0.0039	0.077	0	0
0.05	0.20	0.30	120.0	36.70	3	1635	0.0054	0.108	0	1
0.05	0.05	0.01	30.0	1.29	23	11628	0.0020	0.040	0	0
0.05	0.05	0.05	30.0	2.45	12	6122	0.0028	0.056	0	0
0.05	0.05	0.15	30.0	5.35	6	2804	0.0041	0.082	0	0
0.05	0.05	0.30	30.0	9.70	3	1546	0.0055	0.111	0	1
0.01	1.00	0.01	600.0	6.99	86	42918	0.0005	0.048	0	0
0.01	1.00	0.05	600.0	30.95	19	9693	0.0010	0.101	0	1
0.01	1.00	0.15	600.0	90.85	7	3302	0.0017	0.173	0	1
0.01	1.00	0.30	600.0	180.70	3	1660	0.0024	0.244	0	1
0.01	0.50	0.01	300.0	3.99	75	37594	0.0005	0.051	0	0
0.01	0.50	0.05	300.0	15.95	19	9404	0.0010	0.103	0	1
0.01	0.50	0.15	300.0	45.85	7	3272	0.0017	0.174	0	1
0.01	0.50	0.30	300.0	90.70	3	1654	0.0024	0.245	0	1
0.01	0.20	0.01	120.0	2.19	55	27397	0.0006	0.060	0	0
0.01	0.20	0.05	120.0	6.95	17	8633	0.0011	0.107	0	1
0.01	0.20	0.15	120.0	18.85	6	3183	0.0018	0.176	0	1
0.01	0.20	0.30	120.0	36.70	3	1635	0.0025	0.246	0	1
0.01	0.05	0.01	30.0	1.29	23	11628	0.0009	0.092	0	0
0.01	0.05	0.05	30.0	2.45	12	6122	0.0013	0.127	0	1
0.01	0.05	0.15	30.0	5.35	6	2804	0.0019	0.188	0	1
0.01	0.05	0.30	30.0	9.70	3	1546	0.0025	0.253	0	1

Table A.4.1. Designs with 1000 Hospitals and 25 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	25.0	1.24	20	20161	0.0035	0.007	0	0
0.50	1.00	0.05	25.0	2.20	11	11364	0.0047	0.009	0	0
0.50	1.00	0.15	25.0	4.60	5	5435	0.0068	0.014	0	0
0.50	1.00	0.30	25.0	8.20	3	3049	0.0091	0.018	0	0
0.50	0.50	0.01	12.5	1.12	11	11211	0.0047	0.009	0	0
0.50	0.50	0.05	12.5	1.58	8	7937	0.0056	0.011	0	0
0.50	0.50	0.15	12.5	2.73	5	4587	0.0074	0.015	0	0
0.50	0.50	0.30	12.5	4.45	3	2809	0.0094	0.019	0	0
0.50	0.20	0.01	5.0	1.04	5	4808	0.0072	0.014	0	0
0.50	0.20	0.05	5.0	1.20	4	4167	0.0077	0.015	0	0
0.50	0.20	0.15	5.0	1.60	3	3125	0.0089	0.018	0	0
0.50	0.20	0.30	5.0	2.20	2	2273	0.0105	0.021	0	0
0.50	0.05	0.01	1.3	1.00	1	1247	0.0142	0.028	0	0
0.50	0.05	0.05	1.3	1.01	1	1235	0.0142	0.028	0	0
0.50	0.05	0.15	1.3	1.04	1	1205	0.0144	0.029	0	0
0.50	0.05	0.30	1.3	1.08	1	1163	0.0147	0.029	0	0
0.25	1.00	0.01	25.0	1.24	20	20161	0.0030	0.012	0	0
0.25	1.00	0.05	25.0	2.20	11	11364	0.0041	0.016	0	0
0.25	1.00	0.15	25.0	4.60	5	5435	0.0059	0.023	0	0
0.25	1.00	0.30	25.0	8.20	3	3049	0.0078	0.031	0	0
0.25	0.50	0.01	12.5	1.12	11	11211	0.0041	0.016	0	0
0.25	0.50	0.05	12.5	1.58	8	7937	0.0049	0.019	0	0
0.25	0.50	0.15	12.5	2.73	5	4587	0.0064	0.026	0	0
0.25	0.50	0.30	12.5	4.45	3	2809	0.0082	0.033	0	0
0.25	0.20	0.01	5.0	1.04	5	4808	0.0062	0.025	0	0
0.25	0.20	0.05	5.0	1.20	4	4167	0.0067	0.027	0	0
0.25	0.20	0.15	5.0	1.60	3	3125	0.0077	0.031	0	0
0.25	0.20	0.30	5.0	2.20	2	2273	0.0091	0.036	0	0
0.25	0.05	0.01	1.3	1.00	1	1247	0.0123	0.049	0	0
0.25	0.05	0.05	1.3	1.01	1	1235	0.0123	0.049	0	0
0.25	0.05	0.15	1.3	1.04	1	1205	0.0125	0.050	0	0
0.25	0.05	0.30	1.3	1.08	1	1163	0.0127	0.051	0	0
0.10	1.00	0.01	25.0	1.24	20	20161	0.0021	0.021	0	0
0.10	1.00	0.05	25.0	2.20	11	11364	0.0028	0.028	0	0
0.10	1.00	0.15	25.0	4.60	5	5435	0.0041	0.041	0	0
0.10	1.00	0.30	25.0	8.20	3	3049	0.0054	0.054	0	0
0.10	0.50	0.01	12.5	1.12	11	11211	0.0028	0.028	0	0
0.10	0.50	0.05	12.5	1.58	8	7937	0.0034	0.034	0	0
0.10	0.50	0.15	12.5	2.73	5	4587	0.0044	0.044	0	0
0.10	0.50	0.30	12.5	4.45	3	2809	0.0057	0.057	0	0
0.10	0.20	0.01	5.0	1.04	5	4808	0.0043	0.043	0	0
0.10	0.20	0.05	5.0	1.20	4	4167	0.0046	0.046	0	0
0.10	0.20	0.15	5.0	1.60	3	3125	0.0054	0.054	0	0
0.10	0.20	0.30	5.0	2.20	2	2273	0.0063	0.063	0	0
0.10	0.05	0.01	1.3	1.00	1	1247	0.0085	0.085	0	0
0.10	0.05	0.05	1.3	1.01	1	1235	0.0085	0.085	0	0
0.10	0.05	0.15	1.3	1.04	1	1205	0.0086	0.086	0	0
0.10	0.05	0.30	1.3	1.08	1	1163	0.0088	0.088	0	0
0.05	1.00	0.01	25.0	1.24	20	20161	0.0015	0.031	0	0
0.05	1.00	0.05	25.0	2.20	11	11364	0.0020	0.041	0	0
0.05	1.00	0.15	25.0	4.60	5	5435	0.0030	0.059	0	0

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	25.0	8.20	3	3049	0.0039	0.079	0	0
0.05	0.50	0.01	12.5	1.12	11	11211	0.0021	0.041	0	0
0.05	0.50	0.05	12.5	1.58	8	7937	0.0024	0.049	0	0
0.05	0.50	0.15	12.5	2.73	5	4587	0.0032	0.064	0	0
0.05	0.50	0.30	12.5	4.45	3	2809	0.0041	0.082	0	0
0.05	0.20	0.01	5.0	1.04	5	4808	0.0031	0.063	0	0
0.05	0.20	0.05	5.0	1.20	4	4167	0.0034	0.068	0	0
0.05	0.20	0.15	5.0	1.60	3	3125	0.0039	0.078	0	0
0.05	0.20	0.30	5.0	2.20	2	2273	0.0046	0.091	0	0
0.05	0.05	0.01	1.3	1.00	1	1247	0.0062	0.123	0	1
0.05	0.05	0.05	1.3	1.01	1	1235	0.0062	0.124	0	1
0.05	0.05	0.15	1.3	1.04	1	1205	0.0063	0.126	0	1
0.05	0.05	0.30	1.3	1.08	1	1163	0.0064	0.128	0	1
0.01	1.00	0.01	25.0	1.24	20	20161	0.0007	0.070	0	0
0.01	1.00	0.05	25.0	2.20	11	11364	0.0009	0.093	0	0
0.01	1.00	0.15	25.0	4.60	5	5435	0.0013	0.135	0	1
0.01	1.00	0.30	25.0	8.20	3	3049	0.0018	0.180	0	1
0.01	0.50	0.01	12.5	1.12	11	11211	0.0009	0.094	0	0
0.01	0.50	0.05	12.5	1.58	8	7937	0.0011	0.112	0	1
0.01	0.50	0.15	12.5	2.73	5	4587	0.0015	0.147	0	1
0.01	0.50	0.30	12.5	4.45	3	2809	0.0019	0.188	0	1
0.01	0.20	0.01	5.0	1.04	5	4808	0.0014	0.143	0	1
0.01	0.20	0.05	5.0	1.20	4	4167	0.0015	0.154	0	1
0.01	0.20	0.15	5.0	1.60	3	3125	0.0018	0.178	0	1
0.01	0.20	0.30	5.0	2.20	2	2273	0.0021	0.209	0	1
0.01	0.05	0.01	1.3	1.00	1	1247	0.0028	0.282	0	1
0.01	0.05	0.05	1.3	1.01	1	1235	0.0028	0.283	0	1
0.01	0.05	0.15	1.3	1.04	1	1205	0.0029	0.287	0	1
0.01	0.05	0.30	1.3	1.08	1	1163	0.0029	0.292	0	1

Table A.4.2. Designs with 1000 Hospitals and 50 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	50.0	1.49	34	33557	0.0027	0.005	0	0
0.50	1.00	0.05	50.0	3.45	14	14493	0.0042	0.008	0	0
0.50	1.00	0.15	50.0	8.35	6	5988	0.0065	0.013	0	0
0.50	1.00	0.30	50.0	15.70	3	3185	0.0089	0.018	0	0
0.50	0.50	0.01	25.0	1.24	20	20161	0.0035	0.007	0	0
0.50	0.50	0.05	25.0	2.20	11	11364	0.0047	0.009	0	0
0.50	0.50	0.15	25.0	4.60	5	5435	0.0068	0.014	0	0
0.50	0.50	0.30	25.0	8.20	3	3049	0.0091	0.018	0	0
0.50	0.20	0.01	10.0	1.09	9	9174	0.0052	0.010	0	0
0.50	0.20	0.05	10.0	1.45	7	6897	0.0060	0.012	0	0
0.50	0.20	0.15	10.0	2.35	4	4255	0.0077	0.015	0	0
0.50	0.20	0.30	10.0	3.70	3	2703	0.0096	0.019	0	0
0.50	0.05	0.01	2.5	1.02	2	2463	0.0101	0.020	0	0
0.50	0.05	0.05	2.5	1.08	2	2326	0.0104	0.021	0	0
0.50	0.05	0.15	2.5	1.23	2	2041	0.0111	0.022	0	0
0.50	0.05	0.30	2.5	1.45	2	1724	0.0120	0.024	0	0
0.25	1.00	0.01	50.0	1.49	34	33557	0.0024	0.009	0	0
0.25	1.00	0.05	50.0	3.45	14	14493	0.0036	0.014	0	0
0.25	1.00	0.15	50.0	8.35	6	5988	0.0056	0.022	0	0
0.25	1.00	0.30	50.0	15.70	3	3185	0.0077	0.031	0	0
0.25	0.50	0.01	25.0	1.24	20	20161	0.0030	0.012	0	0
0.25	0.50	0.05	25.0	2.20	11	11364	0.0041	0.016	0	0
0.25	0.50	0.15	25.0	4.60	5	5435	0.0059	0.023	0	0
0.25	0.50	0.30	25.0	8.20	3	3049	0.0078	0.031	0	0
0.25	0.20	0.01	10.0	1.09	9	9174	0.0045	0.018	0	0
0.25	0.20	0.05	10.0	1.45	7	6897	0.0052	0.021	0	0
0.25	0.20	0.15	10.0	2.35	4	4255	0.0066	0.027	0	0
0.25	0.20	0.30	10.0	3.70	3	2703	0.0083	0.033	0	0
0.25	0.05	0.01	2.5	1.02	2	2463	0.0087	0.035	0	0
0.25	0.05	0.05	2.5	1.08	2	2326	0.0090	0.036	0	0
0.25	0.05	0.15	2.5	1.23	2	2041	0.0096	0.038	0	0
0.25	0.05	0.30	2.5	1.45	2	1724	0.0104	0.042	0	0
0.10	1.00	0.01	50.0	1.49	34	33557	0.0016	0.016	0	0
0.10	1.00	0.05	50.0	3.45	14	14493	0.0025	0.025	0	0
0.10	1.00	0.15	50.0	8.35	6	5988	0.0039	0.039	0	0
0.10	1.00	0.30	50.0	15.70	3	3185	0.0053	0.053	0	0
0.10	0.50	0.01	25.0	1.24	20	20161	0.0021	0.021	0	0
0.10	0.50	0.05	25.0	2.20	11	11364	0.0028	0.028	0	0
0.10	0.50	0.15	25.0	4.60	5	5435	0.0041	0.041	0	0
0.10	0.50	0.30	25.0	8.20	3	3049	0.0054	0.054	0	0
0.10	0.20	0.01	10.0	1.09	9	9174	0.0031	0.031	0	0
0.10	0.20	0.05	10.0	1.45	7	6897	0.0036	0.036	0	0
0.10	0.20	0.15	10.0	2.35	4	4255	0.0046	0.046	0	0
0.10	0.20	0.30	10.0	3.70	3	2703	0.0058	0.058	0	0
0.10	0.05	0.01	2.5	1.02	2	2463	0.0060	0.060	0	0
0.10	0.05	0.05	2.5	1.08	2	2326	0.0062	0.062	0	0
0.10	0.05	0.15	2.5	1.23	2	2041	0.0066	0.066	0	0
0.10	0.05	0.30	2.5	1.45	2	1724	0.0072	0.072	0	0
0.05	1.00	0.01	50.0	1.49	34	33557	0.0012	0.024	0	0
0.05	1.00	0.05	50.0	3.45	14	14493	0.0018	0.036	0	0
0.05	1.00	0.15	50.0	8.35	6	5988	0.0028	0.056	0	0

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	50.0	15.70	3	3185	0.0039	0.077	0	0
0.05	0.50	0.01	25.0	1.24	20	20161	0.0015	0.031	0	0
0.05	0.50	0.05	25.0	2.20	11	11364	0.0020	0.041	0	0
0.05	0.50	0.15	25.0	4.60	5	5435	0.0030	0.059	0	0
0.05	0.50	0.30	25.0	8.20	3	3049	0.0039	0.079	0	0
0.05	0.20	0.01	10.0	1.09	9	9174	0.0023	0.046	0	0
0.05	0.20	0.05	10.0	1.45	7	6897	0.0026	0.052	0	0
0.05	0.20	0.15	10.0	2.35	4	4255	0.0033	0.067	0	0
0.05	0.20	0.30	10.0	3.70	3	2703	0.0042	0.084	0	0
0.05	0.05	0.01	2.5	1.02	2	2463	0.0044	0.088	0	0
0.05	0.05	0.05	2.5	1.08	2	2326	0.0045	0.090	0	0
0.05	0.05	0.15	2.5	1.23	2	2041	0.0048	0.096	0	0
0.05	0.05	0.30	2.5	1.45	2	1724	0.0052	0.105	0	1
0.01	1.00	0.01	50.0	1.49	34	33557	0.0005	0.054	0	0
0.01	1.00	0.05	50.0	3.45	14	14493	0.0008	0.083	0	0
0.01	1.00	0.15	50.0	8.35	6	5988	0.0013	0.129	0	1
0.01	1.00	0.30	50.0	15.70	3	3185	0.0018	0.176	0	1
0.01	0.50	0.01	25.0	1.24	20	20161	0.0007	0.070	0	0
0.01	0.50	0.05	25.0	2.20	11	11364	0.0009	0.093	0	0
0.01	0.50	0.15	25.0	4.60	5	5435	0.0013	0.135	0	1
0.01	0.50	0.30	25.0	8.20	3	3049	0.0018	0.180	0	1
0.01	0.20	0.01	10.0	1.09	9	9174	0.0010	0.104	0	1
0.01	0.20	0.05	10.0	1.45	7	6897	0.0012	0.120	0	1
0.01	0.20	0.15	10.0	2.35	4	4255	0.0015	0.153	0	1
0.01	0.20	0.30	10.0	3.70	3	2703	0.0019	0.191	0	1
0.01	0.05	0.01	2.5	1.02	2	2463	0.0020	0.200	0	1
0.01	0.05	0.05	2.5	1.08	2	2326	0.0021	0.206	0	1
0.01	0.05	0.15	2.5	1.23	2	2041	0.0022	0.220	0	1
0.01	0.05	0.30	2.5	1.45	2	1724	0.0024	0.240	0	1

Table A.4.3. Designs with 1000 Hospitals and 100 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	100.0	1.99	50	50251	0.0022	0.004	0	0
0.50	1.00	0.05	100.0	5.95	17	16807	0.0039	0.008	0	0
0.50	1.00	0.15	100.0	15.85	6	6309	0.0063	0.013	0	0
0.50	1.00	0.30	100.0	30.70	3	3257	0.0088	0.018	0	0
0.50	0.50	0.01	50.0	1.49	34	33557	0.0027	0.005	0	0
0.50	0.50	0.05	50.0	3.45	14	14493	0.0042	0.008	0	0
0.50	0.50	0.15	50.0	8.35	6	5988	0.0065	0.013	0	0
0.50	0.50	0.30	50.0	15.70	3	3185	0.0089	0.018	0	0
0.50	0.20	0.01	20.0	1.19	17	16807	0.0039	0.008	0	0
0.50	0.20	0.05	20.0	1.95	10	10256	0.0049	0.010	0	0
0.50	0.20	0.15	20.0	3.85	5	5195	0.0069	0.014	0	0
0.50	0.20	0.30	20.0	6.70	3	2985	0.0092	0.018	0	0
0.50	0.05	0.01	5.0	1.04	5	4808	0.0072	0.014	0	0
0.50	0.05	0.05	5.0	1.20	4	4167	0.0077	0.015	0	0
0.50	0.05	0.15	5.0	1.60	3	3125	0.0089	0.018	0	0
0.50	0.05	0.30	5.0	2.20	2	2273	0.0105	0.021	0	0
0.25	1.00	0.01	100.0	1.99	50	50251	0.0019	0.008	0	0
0.25	1.00	0.05	100.0	5.95	17	16807	0.0033	0.013	0	0
0.25	1.00	0.15	100.0	15.85	6	6309	0.0055	0.022	0	0
0.25	1.00	0.30	100.0	30.70	3	3257	0.0076	0.030	0	0
0.25	0.50	0.01	50.0	1.49	34	33557	0.0024	0.009	0	0
0.25	0.50	0.05	50.0	3.45	14	14493	0.0036	0.014	0	0
0.25	0.50	0.15	50.0	8.35	6	5988	0.0056	0.022	0	0
0.25	0.50	0.30	50.0	15.70	3	3185	0.0077	0.031	0	0
0.25	0.20	0.01	20.0	1.19	17	16807	0.0033	0.013	0	0
0.25	0.20	0.05	20.0	1.95	10	10256	0.0043	0.017	0	0
0.25	0.20	0.15	20.0	3.85	5	5195	0.0060	0.024	0	0
0.25	0.20	0.30	20.0	6.70	3	2985	0.0079	0.032	0	0
0.25	0.05	0.01	5.0	1.04	5	4808	0.0062	0.025	0	0
0.25	0.05	0.05	5.0	1.20	4	4167	0.0067	0.027	0	0
0.25	0.05	0.15	5.0	1.60	3	3125	0.0077	0.031	0	0
0.25	0.05	0.30	5.0	2.20	2	2273	0.0091	0.036	0	0
0.10	1.00	0.01	100.0	1.99	50	50251	0.0013	0.013	0	0
0.10	1.00	0.05	100.0	5.95	17	16807	0.0023	0.023	0	0
0.10	1.00	0.15	100.0	15.85	6	6309	0.0038	0.038	0	0
0.10	1.00	0.30	100.0	30.70	3	3257	0.0053	0.053	0	0
0.10	0.50	0.01	50.0	1.49	34	33557	0.0016	0.016	0	0
0.10	0.50	0.05	50.0	3.45	14	14493	0.0025	0.025	0	0
0.10	0.50	0.15	50.0	8.35	6	5988	0.0039	0.039	0	0
0.10	0.50	0.30	50.0	15.70	3	3185	0.0053	0.053	0	0
0.10	0.20	0.01	20.0	1.19	17	16807	0.0023	0.023	0	0
0.10	0.20	0.05	20.0	1.95	10	10256	0.0030	0.030	0	0
0.10	0.20	0.15	20.0	3.85	5	5195	0.0042	0.042	0	0
0.10	0.20	0.30	20.0	6.70	3	2985	0.0055	0.055	0	0
0.10	0.05	0.01	5.0	1.04	5	4808	0.0043	0.043	0	0
0.10	0.05	0.05	5.0	1.20	4	4167	0.0046	0.046	0	0
0.10	0.05	0.15	5.0	1.60	3	3125	0.0054	0.054	0	0
0.10	0.05	0.30	5.0	2.20	2	2273	0.0063	0.063	0	0
0.05	1.00	0.01	100.0	1.99	50	50251	0.0010	0.019	0	0
0.05	1.00	0.05	100.0	5.95	17	16807	0.0017	0.034	0	0
0.05	1.00	0.15	100.0	15.85	6	6309	0.0027	0.055	0	0

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	100.0	30.70	3	3257	0.0038	0.076	0	0
0.05	0.50	0.01	50.0	1.49	34	33557	0.0012	0.024	0	0
0.05	0.50	0.05	50.0	3.45	14	14493	0.0018	0.036	0	0
0.05	0.50	0.15	50.0	8.35	6	5988	0.0028	0.056	0	0
0.05	0.50	0.30	50.0	15.70	3	3185	0.0039	0.077	0	0
0.05	0.20	0.01	20.0	1.19	17	16807	0.0017	0.034	0	0
0.05	0.20	0.05	20.0	1.95	10	10256	0.0022	0.043	0	0
0.05	0.20	0.15	20.0	3.85	5	5195	0.0030	0.060	0	0
0.05	0.20	0.30	20.0	6.70	3	2985	0.0040	0.080	0	0
0.05	0.05	0.01	5.0	1.04	5	4808	0.0031	0.063	0	0
0.05	0.05	0.05	5.0	1.20	4	4167	0.0034	0.068	0	0
0.05	0.05	0.15	5.0	1.60	3	3125	0.0039	0.078	0	0
0.05	0.05	0.30	5.0	2.20	2	2273	0.0046	0.091	0	0
0.01	1.00	0.01	100.0	1.99	50	50251	0.0004	0.044	0	0
0.01	1.00	0.05	100.0	5.95	17	16807	0.0008	0.077	0	0
0.01	1.00	0.15	100.0	15.85	6	6309	0.0013	0.125	0	1
0.01	1.00	0.30	100.0	30.70	3	3257	0.0017	0.174	0	1
0.01	0.50	0.01	50.0	1.49	34	33557	0.0005	0.054	0	0
0.01	0.50	0.05	50.0	3.45	14	14493	0.0008	0.083	0	0
0.01	0.50	0.15	50.0	8.35	6	5988	0.0013	0.129	0	1
0.01	0.50	0.30	50.0	15.70	3	3185	0.0018	0.176	0	1
0.01	0.20	0.01	20.0	1.19	17	16807	0.0008	0.077	0	0
0.01	0.20	0.05	20.0	1.95	10	10256	0.0010	0.098	0	0
0.01	0.20	0.15	20.0	3.85	5	5195	0.0014	0.138	0	1
0.01	0.20	0.30	20.0	6.70	3	2985	0.0018	0.182	0	1
0.01	0.05	0.01	5.0	1.04	5	4808	0.0014	0.143	0	1
0.01	0.05	0.05	5.0	1.20	4	4167	0.0015	0.154	0	1
0.01	0.05	0.15	5.0	1.60	3	3125	0.0018	0.178	0	1
0.01	0.05	0.30	5.0	2.20	2	2273	0.0021	0.209	0	1

Table A.4.4. Designs with 1000 Hospitals and 600 Discharges per Hospital

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.50	1.00	0.01	600.0	6.99	86	85837	0.0017	0.003	0	0
0.50	1.00	0.05	600.0	30.95	19	19386	0.0036	0.007	0	0
0.50	1.00	0.15	600.0	90.85	7	6604	0.0062	0.012	0	0
0.50	1.00	0.30	600.0	180.70	3	3320	0.0087	0.017	0	0
0.50	0.50	0.01	300.0	3.99	75	75188	0.0018	0.004	0	0
0.50	0.50	0.05	300.0	15.95	19	18809	0.0036	0.007	0	0
0.50	0.50	0.15	300.0	45.85	7	6543	0.0062	0.012	0	0
0.50	0.50	0.30	300.0	90.70	3	3308	0.0087	0.017	0	0
0.50	0.20	0.01	120.0	2.19	55	54795	0.0021	0.004	0	0
0.50	0.20	0.05	120.0	6.95	17	17266	0.0038	0.008	0	0
0.50	0.20	0.15	120.0	18.85	6	6366	0.0063	0.013	0	0
0.50	0.20	0.30	120.0	36.70	3	3270	0.0087	0.017	0	0
0.50	0.05	0.01	30.0	1.29	23	23256	0.0033	0.007	0	0
0.50	0.05	0.05	30.0	2.45	12	12245	0.0045	0.009	0	0
0.50	0.05	0.15	30.0	5.35	6	5607	0.0067	0.013	0	0
0.50	0.05	0.30	30.0	9.70	3	3093	0.0090	0.018	0	0
0.25	1.00	0.01	600.0	6.99	86	85837	0.0015	0.006	0	0
0.25	1.00	0.05	600.0	30.95	19	19386	0.0031	0.012	0	0
0.25	1.00	0.15	600.0	90.85	7	6604	0.0053	0.021	0	0
0.25	1.00	0.30	600.0	180.70	3	3320	0.0075	0.030	0	0
0.25	0.50	0.01	300.0	3.99	75	75188	0.0016	0.006	0	0
0.25	0.50	0.05	300.0	15.95	19	18809	0.0032	0.013	0	0
0.25	0.50	0.15	300.0	45.85	7	6543	0.0054	0.021	0	0
0.25	0.50	0.30	300.0	90.70	3	3308	0.0075	0.030	0	0
0.25	0.20	0.01	120.0	2.19	55	54795	0.0018	0.007	0	0
0.25	0.20	0.05	120.0	6.95	17	17266	0.0033	0.013	0	0
0.25	0.20	0.15	120.0	18.85	6	6366	0.0054	0.022	0	0
0.25	0.20	0.30	120.0	36.70	3	3270	0.0076	0.030	0	0
0.25	0.05	0.01	30.0	1.29	23	23256	0.0028	0.011	0	0
0.25	0.05	0.05	30.0	2.45	12	12245	0.0039	0.016	0	0
0.25	0.05	0.15	30.0	5.35	6	5607	0.0058	0.023	0	0
0.25	0.05	0.30	30.0	9.70	3	3093	0.0078	0.031	0	0
0.10	1.00	0.01	600.0	6.99	86	85837	0.0010	0.010	0	0
0.10	1.00	0.05	600.0	30.95	19	19386	0.0022	0.022	0	0
0.10	1.00	0.15	600.0	90.85	7	6604	0.0037	0.037	0	0
0.10	1.00	0.30	600.0	180.70	3	3320	0.0052	0.052	0	0
0.10	0.50	0.01	300.0	3.99	75	75188	0.0011	0.011	0	0
0.10	0.50	0.05	300.0	15.95	19	18809	0.0022	0.022	0	0
0.10	0.50	0.15	300.0	45.85	7	6543	0.0037	0.037	0	0
0.10	0.50	0.30	300.0	90.70	3	3308	0.0052	0.052	0	0
0.10	0.20	0.01	120.0	2.19	55	54795	0.0013	0.013	0	0
0.10	0.20	0.05	120.0	6.95	17	17266	0.0023	0.023	0	0
0.10	0.20	0.15	120.0	18.85	6	6366	0.0038	0.038	0	0
0.10	0.20	0.30	120.0	36.70	3	3270	0.0052	0.052	0	0
0.10	0.05	0.01	30.0	1.29	23	23256	0.0020	0.020	0	0
0.10	0.05	0.05	30.0	2.45	12	12245	0.0027	0.027	0	0
0.10	0.05	0.15	30.0	5.35	6	5607	0.0040	0.040	0	0
0.10	0.05	0.30	30.0	9.70	3	3093	0.0054	0.054	0	0
0.05	1.00	0.01	600.0	6.99	86	85837	0.0007	0.015	0	0
0.05	1.00	0.05	600.0	30.95	19	19386	0.0016	0.031	0	0
0.05	1.00	0.15	600.0	90.85	7	6604	0.0027	0.054	0	0

Outcome prevalence	Proportion of cases in applicable subgroup	ICC of discharges within hospitals	Applicable cases per hospital	Design effect from clustering discharges within hospital	ESS per hospital	Total ESS	SE	RSE	RSE>.3	RSE>.1
0.05	1.00	0.30	600.0	180.70	3	3320	0.0038	0.076	0	0
0.05	0.50	0.01	300.0	3.99	75	75188	0.0008	0.016	0	0
0.05	0.50	0.05	300.0	15.95	19	18809	0.0016	0.032	0	0
0.05	0.50	0.15	300.0	45.85	7	6543	0.0027	0.054	0	0
0.05	0.50	0.30	300.0	90.70	3	3308	0.0038	0.076	0	0
0.05	0.20	0.01	120.0	2.19	55	54795	0.0009	0.019	0	0
0.05	0.20	0.05	120.0	6.95	17	17266	0.0017	0.033	0	0
0.05	0.20	0.15	120.0	18.85	6	6366	0.0027	0.055	0	0
0.05	0.20	0.30	120.0	36.70	3	3270	0.0038	0.076	0	0
0.05	0.05	0.01	30.0	1.29	23	23256	0.0014	0.029	0	0
0.05	0.05	0.05	30.0	2.45	12	12245	0.0020	0.039	0	0
0.05	0.05	0.15	30.0	5.35	6	5607	0.0029	0.058	0	0
0.05	0.05	0.30	30.0	9.70	3	3093	0.0039	0.078	0	0
0.01	1.00	0.01	600.0	6.99	86	85837	0.0003	0.034	0	0
0.01	1.00	0.05	600.0	30.95	19	19386	0.0007	0.071	0	0
0.01	1.00	0.15	600.0	90.85	7	6604	0.0012	0.122	0	1
0.01	1.00	0.30	600.0	180.70	3	3320	0.0017	0.173	0	1
0.01	0.50	0.01	300.0	3.99	75	75188	0.0004	0.036	0	0
0.01	0.50	0.05	300.0	15.95	19	18809	0.0007	0.073	0	0
0.01	0.50	0.15	300.0	45.85	7	6543	0.0012	0.123	0	1
0.01	0.50	0.30	300.0	90.70	3	3308	0.0017	0.173	0	1
0.01	0.20	0.01	120.0	2.19	55	54795	0.0004	0.043	0	0
0.01	0.20	0.05	120.0	6.95	17	17266	0.0008	0.076	0	0
0.01	0.20	0.15	120.0	18.85	6	6366	0.0012	0.125	0	1
0.01	0.20	0.30	120.0	36.70	3	3270	0.0017	0.174	0	1
0.01	0.05	0.01	30.0	1.29	23	23256	0.0007	0.065	0	0
0.01	0.05	0.05	30.0	2.45	12	12245	0.0009	0.090	0	0
0.01	0.05	0.15	30.0	5.35	6	5607	0.0013	0.133	0	1
0.01	0.05	0.30	30.0	9.70	3	3093	0.0018	0.179	0	1