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Original Research

Improved clinical documentation leads to superior reportable outcomes: An accurate representation of patient's clinical status☆

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ABSTRACT

Introduction: Clinical documentation can be an underappreciated. Trauma Centers (TCs) are now routinely evaluated for quality performance. TCs with poor documentation may not accurately reflect actual injury burden or comorbidities and can impact accuracy of mortality measures. Markers exist to adjust crude death rates for injury severity: observed over expected deaths (O/E) adjust for injury; Case Mix Index (CMI) reflects disease burden, and Severity of Illness (SOI) measures organ dysfunction. We aim to evaluate the impact of implementing a Clinical Documentation Improvement Program (CDIP) on reported outcomes.

Methods: Review of 2-years of prospectively collected data for trauma patients, during the implementation of CDIP. A two-group prospective observational study design was used to evaluate the pre-implementation and the post-implementation phase of improved clinical documentation. T-test and Chi-Squared were used with significance defined as $p < 0.05$.

Results: In the pre-implementation period, there were 49 deaths out of 1419 (3.45%), while post-implementation period, had 38 deaths out of 1454 (2.61%), (non-significant). There was however, a significant difference between O/E ratios. In the pre-phase, the O/E was 1.36 and 0.70 in the post-phase ($p < 0.001$). The two groups also differed on CMI with a pre-group mean of 2.48 and a post-group of 2.87 ($p < 0.001$), indicating higher injury burden in the post-group. SOI started at 2.12 and significantly increased to 2.91, signifying more organ system dysfunction ($p < 0.018$).

Conclusion: Improved clinical documentation results in improved accuracy of measures of mortality, injury severity, and comorbidities and a more accurate reflection in O/E mortality ratios, CMI, and SOI.

1. Introduction

Administrative metrics, generated from clinical documentation are used to compare providers and hospitals. Trauma Centers are now routinely evaluated for quality performance and comparison among centers is becoming common. These outcome data are used by regulatory agencies for quality assurance. The importance of accurate clinical documentation may result in more accurate reflection or determination of observed/expected mortality, Case Mix Index (CMI), and Severity of Illness (SOI) and not merely improve or worsen clinical outcomes.

Trauma centers mandatorily report mortality rates to regulatory agencies as part of their quality of care assessment. There are variety of mechanisms to adjust crude death rates for injury severity. Coders review the clinical documentation to create these markers. The number of observed deaths over the expected deaths is defined as the O/E ratio. Values less than one indicate performance above average, expressing less deaths than expected. Values greater than one indicate suboptimal performance, with more deaths than expected. Another commonly reported marker of disease burden is the Case Mix Index (CMI). CMI reflects the grade -or complexity of injury of a patient to provide a basis for needed hospital resources to treat the patient [1]. A third marker of disease burden, Severity of Illness (SOI), is a measure of organ system dysfunction. When O/E, CMI, and SOI are viewed together, they can be an indication of resources needed to deliver quality care and expected outcomes [1–3]. Trauma centers with poor documentation may not accurately reflect their patient's actual injury burden, comorbidities, and organ dysfunction and can lead some system evaluations to

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determine poor quality of care, when poor documentation of care would be a more accurate.

Descriptor [3]. In recent years the number of clinical documentation improvement programs (CDIPs) have seen an exponential increase [4]. Literature exists to guide hospitals on how to improve clinical documentation diagnosis specificity in order to capture accurate severity of illness (SOI), risk of mortality (ROM), and reimbursement [5–7].

This is the first study to evaluate the impact of implementing a clinical documentation improvement program on reported patient outcomes including but not limited to observed/expected death ratio, case mix index, and severity of illness on trauma patients.

2. Methods

This study is a retrospective review of a prospectively collected dataset for adult trauma patients, defined as > 15 years old, for a 2 year period from January 2012 through December 2013 utilizing our institution's Trauma Registry following the implementation of CDIP. A retrospective review was performed using the Crimson Continuum of Care Dataset (CCCD) and the Trauma Injury Severity Scores (TRISS) for the year prior to implementation of CDIP (2012), compared to the year after (2013). Severity and risk adjusted performance measures included O/E mortality, CMI, and SOI. Using TRISS, actual and predicted mortality was also compared.

The CDIP was implemented on January 2013 to improve inpatient record documentation by establishing a 5 step coordinated, systematic process utilizing:

1. Structured notes including separate sections for diagnosis, comorbidities, procedures, and incidental findings;
2. All trauma providers underwent an educational session explaining-the components of the chart used to evaluate their performance;
3. Monthly individual review session were utilized to -peruse the chart for documentation accuracy;
4. A Physician Advisor was identified, proficient in documentation, billing and coding, and designated to provide input and serve as a resource; and,
5. Random weekly evaluations of provider notes by the Physician Advisor.

Variables that were evaluated included the Observed to expected (O/E) mortality, which compares the ratio of actual deaths to deaths that were expected using the injury diagnosis combined with the comorbid conditions. The O/E was calculated using a proprietary software program from Crimson Advisory Group (Advisory Group, Washington DC, London UK, Guindy, Chennai). CMI reflects the grade or complexity of injury and has been used in the United States since 1982. CMI was originally developed by Fetter et al. [8]. This scoring system uses the diagnosis and procedures needed and combines this with the variables of age, sex, discharge status, complications and comorbid conditions. The CMI can be used to grade complexity of injury among groups of patients. A third marker of disease burden, Severity of Illness (SOI), is measure of organ system dysfunction and can also be determined by proprietary software (3M, St. Paul, MN). SOI has 4 categories of physiologic decompensation, which are 1) Minor, 2) Moderate, 3) Major, and 4) Extreme. For this study the O/E, CMI, and SOI were all calculated by the Crimson software platform (The Advisory Board Company, Washington, DC). Crimson continuum of care is a web-based service used to obtain aggregated performance data to provide information about quality outcomes and compare them to other participating trauma centers.

The goal of the CDIP was to improve clinical documentation in the medical record by the physicians and advanced practitioners to accurately reflect the diagnoses, CMI, and SOI of the patient. Using the our database, a two-group prospective observational study design was used for detailed analysis to evaluate pre-implementation and post-implementation markers in consecutive years, 2012 the year prior to CDIP and 2013 the year of the CDIP. A total of 2873 patient records were reviewed over the two phases, 1419 in the 2012 pre-phase group and 1454 in 2013 post-phase group. Records from all patients were available in the Registry. Any trauma provider exhibiting a trend towards coding variance was advised of it and underwent remediation training.

Demographic and outcome variables were compared between the different groups based on calendar year. Our primary outcome included observed/expected mortality ratio, CMI and SOI. Our main hypothesis was whether implementing A CDIP would result in reduction of O/E mortality and improvement in both CMI and SOI.

Although comparison groups were treated at different time periods, confounders such as Injury Severity Score (ISS), co-morbidities and mechanism of injury were accounted for to avoid bias. Paired-sample *t*-test and Chi Squared analyses were used with significance defined as $p < 0.05$.

3. Results

A total of 2873 patient records were reviewed using our institution's trauma registry and the Crimson Database, over the 24-month study period from 2012 through 2013. All patients admitted to the trauma service were reviewed. The two cohorts were similar in terms of gender, mean age, ethnicity, mechanism of injury and Injury Severity Score (ISS) as shown in Table 1. In the initial pre-implementation period, there were 49 deaths out of 1419 patients for a crude morality of 3.45%. In the post-implementation period, there were 38 deaths out of 1454 patients, for a crude mortality rate of 2.61%. Analysis showed no statistical difference in the crude mortality rates between the pre- and post-implementation phases ($p = 0.18$, chi square). The O/E ratio did however significantly improve from 1.36 in 2012 (pre-implementation) to 0.70 in 2013 (post-implementation) ($p < 0.02$) as shown in Table 2. While the number of actual or observed deaths did not significantly change, there was a significant increase in predicted deaths from pre-to post-implementation. The predicted number of deaths in the pre-implementation phase was 36.0, while in the post-phase the predicted number of deaths was 54.3 ($p < 0.001$, chi squared). A significant statistical difference was also found between the pre-phase mean CMI of 2.48 and post-phase mean CMI of 2.87 ($p < 0.001$, *t*-test), indicating that the post-group had a higher documented injury burden. Mean SOI also changed with a significant increase from 2.12 in pre-phase to 2.91

Table 1
Demographic data comparison between pre-implementation (2012) vs post-implementation (2013) phase.

	2012	2013	p-value
Total# of admissions	1419	1454	
Age in years (average)	48	51	> 0.05
Gender (average)	F = 764 (34.9%) M = 1422 (65.1%) Total = 2186	F = 1003 (38.2%) M = 1626 (61.8%) Total = 2629	> 0.05
Ethnicity %	Hispanic = 1530 (70.0%) Non-Hispanic = 652 (29.8%) Unknown = 4 (0.2%)	Hispanic = 1896 (72.1%) Non-Hispanic = 710 (27.0%) Unknown = 23 (0.9%)	> 0.05
Injury Severity Score % (average)	8.7	8.5	0.25
Mechanism of Injury %	1843 (84.3%)	2128 (80.9%)	0.64
Blunt	221 (10.1%)	226 (8.6%)	
Penetrating	122 (5.6%)	275 (10.5%)	
Others			

Table 2
Outcome data comparison between pre-implementation (2012) vs post-implementation (2013) phase.

	Pre-implementation phase (2012)	Post-implementation phase (2013)	p-value
Mortality rate %	3.90%	2.80%	> 0.05
Actual deaths	49	38	> 0.05
Predicted deaths	36.0	54.3	< 0.001
O/E ratio	1.36	0.70	< 0.001
CMI (mean)	2.48	2.87	< 0.001
SOI (mean)	2.12	2.91	< 0.018

in post-phase ($p < 0.018$, *t*-test), indicating the post-phase documentation revealed patients had worse organ system dysfunction.

4. Discussion

Valid and reliable clinical documentation needs to start in the emergency room at the time of a trauma patient's arrival. An optimized inpatient provider documentation process can result in significant changes in mortality analysis, O/E, CMI, and SOI, and perceived or reported physician performance. Clinical documentation requires technical and end-user education and training. In this evaluation, improved clinical documentation improved our reported outcomes while it did not improve the actual number of deaths.

Improved documentation occurred in specific areas at our level I trauma center. As an example, an improvement in our patients' pressure ulcer incident rates compared to both Trauma Quality Improvement Program (TQIP) and National Trauma Data Bank (NTDB) ratios. TQIP was modelled after the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) and collects data from over 750 trauma centers across the USA to help elevate the quality of trauma care by allowing benchmarking comparative outcome analyses. This allows best practice parameters to be established and duplicated. The NTDB is the repository of the cumulative aggregation of U.S. hospital's trauma registry data. It creates and distributes research data sets that can be used by researchers and its Annual Adult and Pediatric Reports contain descriptive information about trauma patients, including demographics, injury information, and outcomes.

A wound assessment/re-assessment documentation tool and form was created and implemented for more precise wound documentation and daily follow-up utilizing an evidence based examples [9,10]. In 2016 compared to both 2014 and 2015, the average Injury Severity Score (ISS) for our trauma admissions with pressure ulcers increased from 16 to 24 with an average of 20 compared to trauma admissions without pressure ulcers where ISS remained stationary with an average of 8 during the same time period, signifying that we cared for sicker patients, but our pressure ulcer rates declined even more (0.39% in 2016 compared to 1.36% in 2014, p-value = 0.002) as shown in Figure (1). These results validate the benefit of our clinical documentation improvement initiative program.

Although observational studies are unlikely to determine simple cause and effect, our study findings demonstrate that it is likely that differences in O/E mortality ratios, CMI and SOI between the two groups were due to in part improvement in documentation.

To be able to report good outcomes requires both good clinical care and accurate documentation. Good clinical care without good documentation can result in reported outcomes that are worse than expected, perhaps based solely on the documentation component. The coding team must have easy access to all critical data to achieve an accurate picture of the patients' risk. In order to achieve a best practice documentation a physician must specify all the diagnoses, coupled with grading or staging, clearly documented comorbidities that could influence care, linking associated conditions, procedures, and incidental findings. A documentation process used by ethical and competent clinicians, an ongoing evidence-based educational training, operational maintenance, and management is necessary to minimize coding errors and maximize reported effectiveness of healthcare delivery.

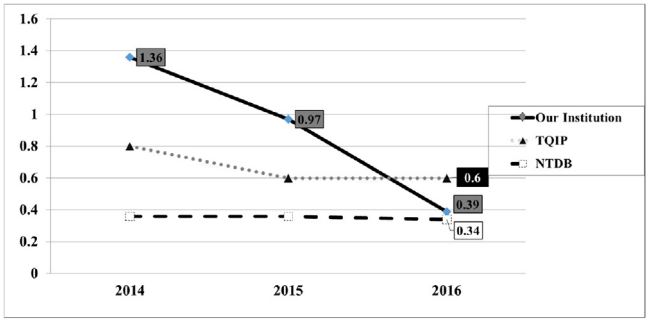

Fig. 1. Pressure Ulcer ≥ Stage 2 incidence rate by year comparing TQIP vs NTDB vs Our Institution 2014 through 2016.

Good surgical care is dependent on accurate, detailed and comprehensive documentation of external lesions or injuries present on the patient's body on admission [11–13]. Appropriate therapeutic planning can only be adequately performed if actual injuries are expeditiously discovered and treated. Inaccurate documentation can lead to incorrect medico-legal interpretations and, inferentially, to potentially avoidable suspicions of malpractice [13,14]. An incomplete or negligently completed record may lead to uncertainty regarding the kinematics of the traumatic force, introduce equivocality about the physio-pathological understanding of the injury not only upon admission but also during hospitalization. Additionally, good documentation allows medico-legal experts to evaluate initial injuries and their evolution over time. In case of a deleterious outcome leading to a trauma fatality, it allows for relevant assessment of the exact cause of death, as well as contribution from pre-existing co-morbid conditions with important legal implications. Therefore, accurate and meticulous coding and documentation of surgical lesions and traumatic injuries is essential from therapeutic, medico-legal, epidemiological and health system management perspectives [11–14].

Our study has its limitations. The first is that although this was a hospital wide initiative, we only analyzed data from patients on the trauma service, a single institution experience, and involvement of a limited number of single-specialty surgeons. Although improved documentation resulted in more accurate reflection or determination of O/E mortality ratios, CMI, and SOI, given the complexity of care of these multisystem trauma patients, it is difficult to establish the direct correlation between clinical documentations and reported or actual outcomes. Therefore, future studies should further investigate other measures that may establish the direct correlation between improved clinical documentation and improved/worsen clinical outcomes.

It is also important to note that although our markers of success utilized administrative data, observed/expected mortality rates improve when the actual number of deaths are minimized and the expected number of deaths are accurately expressed. The expected number of deaths in our study was calculated by proprietary software using diagnoses and comorbidities, –based on the Crimson Database. The CMI is also an important administrative measure, based on the ability to accurately capture the principal and secondary diagnoses, combined with the comorbidities, procedures, and patient age. Although at the time care is being delivered this information may seem obvious, the coding or abstracting team obtains data from a chart review and the information may be difficult to capture. The SOI is defined as the extent of physiologic decompensation or organ dysfunction. Again, this will be obvious to the clinician at the bedside but the data

capture after discharge requires clear documentation. However, it is important to note that although CMI is an important administrative measure, it only reflects the increase in SOI, based on the ability to accurately document presence of comorbidities. It does not provide a comprehensive vision of other quality and safety performance parameters that hospitals may institute. It may be required for emerging pay-for-performance reimbursement models, but cannot fully provide a complete assessment of how care is currently being delivered with a vision of how providers will be reimbursed in the future with respect to number of admissions, patient safety, outcomes and actual mortality rates among others. All health care providers across the continuum of care will need to be fully vested in this value-based, fee for service model for it to be successful.

5. Conclusion

Implementing a Clinical Documentation Improvement Program was associated with a statistically significant improvement in the observed/expected death ratio, Case Mix Index, and Severity of Illness. Improved clinical documentation results in improved accuracy of measures of mortality, injury severity, and comorbidities and a more accurate reflection in O/E mortality ratios, CMI, and SOI.

Declaration of interest

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References

[1] R.B. Fetter, Y. Shin, J.L. Freeman, R.F. Averill, J.D. Thompson, Case mix definition by diagnosis related groups, Med. Care 18 (2) (1980) 1–53 Shine, D. (2012, March 15).

[2] Risk-Adjusted Mortality: Problems and Possibilities. Retrieved October 01, 2017, from https://www.hindawi.com/journals/cmmm/2012/829465/.

[3] C.M. Mendez, D.W. Harrington, P. Christenson, B. Spellberg, Impact of hospital variables on case mix index as a marker of disease severity, Popul. Health Manag. 17 (no. 1) (2014) 28–34.

[4] L.N. Wilson, The Impact of a Clinical Documentation Improvement Program (Unpublished master's thesis), Indiana University, 2009.

[5] Rethinking Clinical Documentation Improvement Maximizing value in the emerging era of risk-based payment (Rep), Retrieved September 22, 2017, from the advisory board Company website, https://www.advisory.com/research/financial-leadership-council/white-papers/2014/rethinking-clinical-documentation-improvement, (2014, October 29).

[6] W. Lo, Document like this, not that: CDI insights from the physician and CDI specialist perspective, J. AHIMA 85 (no.7) (July 2014) 36–40.

[7] American Health Information Management Association, Using CDI programs to improve acute care clinical documentation for ICD-10-CM/PCS, J. AHIMA (2014) 56–61.

[8] B.J. Kittinger, A. Matejicka, R.C. Mahabir, Surgical precision in clinical documentation connects patient safety, quality of care, and reimbursement, Perspect. Health Info. Manag. 13 (2016) (Winter), 1f.

[9] D.L. Young, N. Estocado, M.R. Landers, J. Black, A Pilot study providing evidence for the validity of a new tool to improve assignment of national pressure ulcer advisory panel stage to pressure ulcers, Adv. Skin Wound Care 24 ($) (2011) 168–175, http://dx.doi.org/10.1097/01 ASW.0000396304.90710.EA.

[10] D. Lilly, N. Estocado, J.B. Spencer- Smith, J. Englebright, Validation of the NE1 wound assessment tool to improve staging of pressure ulcers on admission by registered nurses, J. Nurs. Meas. 22 (3) (2014) 438–450.

[11] A. Isik, D. Firat, Bilateral intra-areolar polythelia, Breast J. 24 (1) (2018 Jan) 89–90, http://dx.doi.org/10.1111/tbj.12838 Epub 2017 Jun 7. No abstract available. PMID: 28590581.

[12] A. Isik, H. Eken, M. Soyturk, et al., A rare presentation of accessory breast in axilla, Galician Med. J. 23 (Issue 4) (2016), http://dx.doi.org/10.21802/gmj.2016.4.5 E201645.

[13] S. Mukherjee, C. Pringle, M. Crocker, Anine- year review of medicolegal claims in neurosurgery, Ann. R. Coll. Surg. Engl. 96 (4) (2014 May) 266–270, http://dx.doi.org/10.1308/003588414X13814021679834.

[14] L. Salazar, T.M. Best, B. Hiestand, Incomplete documentation of elements of Ottawa Ankle Rules despite an electronic medical record, Am. J. Emerg. Med. 29 (9) (2011 Nov) 999–1002, http://dx.doi.org/10.1016/j.ajem.2010.05.012 Epub 2010 Aug 1.