



## INFORMS Transactions on Education

Publication details, including instructions for authors and subscription information:  
<http://pubsonline.informs.org>

### Case—A Prescription for Budget Woes at Gracious University Hospital

Karen Hicklin, Julie S. Ivy, Anita R. Vila-Parrish



To cite this article:

Karen Hicklin, Julie S. Ivy, Anita R. Vila-Parrish (2017) Case—A Prescription for Budget Woes at Gracious University Hospital. INFORMS Transactions on Education 17(3):110-115. <https://doi.org/10.1287/ited.2016.0159cs>

Full terms and conditions of use: <http://pubsonline.informs.org/page/terms-and-conditions>

This article may be used only for the purposes of research, teaching, and/or private study. Commercial use or systematic downloading (by robots or other automatic processes) is prohibited without explicit Publisher approval, unless otherwise noted. For more information, contact [permissions@informs.org](mailto:permissions@informs.org).

The Publisher does not warrant or guarantee the article's accuracy, completeness, merchantability, fitness for a particular purpose, or non-infringement. Descriptions of, or references to, products or publications, or inclusion of an advertisement in this article, neither constitutes nor implies a guarantee, endorsement, or support of claims made of that product, publication, or service.

Copyright © 2017, The Author(s)

Please scroll down for article—it is on subsequent pages



INFORMS is the largest professional society in the world for professionals in the fields of operations research, management science, and analytics.

For more information on INFORMS, its publications, membership, or meetings visit <http://www.informs.org>

**Case**

# A Prescription for Budget Woes at Gracious University Hospital

**Karen Hicklin,<sup>a</sup> Julie S. Ivy,<sup>a</sup> Anita R. Vila-Parrish<sup>a</sup>**
<sup>a</sup> Edward P. Fitts Department of Industrial and Systems Engineering, North Carolina State University, Raleigh, North Carolina 27695

**Contact:** [kthickli@ncsu.edu](mailto:kthickli@ncsu.edu) (KH); [jsivy@ncsu.edu](mailto:jsivy@ncsu.edu) (JSI); [arvila@ncsu.edu](mailto:arvila@ncsu.edu) (ARV)

**Received:** December 23, 2014

**Revised:** November 27, 2015; January 15, 2016

**Accepted:** March 15, 2016

**Published Online in Articles in Advance:**

June 13, 2017

<https://doi.org/10.1287/ited.2016.0159cs>
**Copyright:** © 2017 The Author(s)

**Open Access Statement:** This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. You are free to download this work and share with others, but cannot change in any way or use commercially without permission, and you must attribute this work as “*INFORMS Transactions on Education*. Copyright 2017 The Author(s). <https://doi.org/10.1287/ited.2017.0159cs>, used under a Creative Commons Attribution License: [http://creativecommons.org/licenses/by-nc-nd/4.0/.](http://creativecommons.org/licenses/by-nc-nd/4.0/)”

**Keywords:** cases • classroom games • active learning • teaching decision analysis • teaching supply chain management • physical simulation • hospital operations • inventory management

## Background

While celebrating five years of service as the chief financial officer for Gracious University Hospital a few days ago, Sandra Jones was notified that the hospital would need to reduce its operational expenses by an additional 10% on top of the recurring budget cuts already established from years past. When Jones was hired as chief financial officer she was faced with many challenges. Although Gracious University Hospital was once known as one of the most thriving medical centers in the community, mismanagement of funds and poor utilization of resources resulted in Gracious University Hospital becoming one of the worst performing hospitals in the area. The main challenge Jones faced was the development of a sound financial plan to get a now defunct hospital back in good standing. As the chief financial officer, Jones was faced with the task of overseeing all the financial operations for the hospital including all of its departments as well as ensuring hospital operations did not exceed the budget established by the Gracious University Hospital Board of Trustees.

One of the hospital’s ongoing challenges has been establishing a policy for pharmacy operations that satisfies patients and hospital personnel. Over the past couple of years, Jones has been approached many times by physicians and nurses about issues associated with patients not receiving medication in a timely manner in addition to complaints from pharmacists regarding the overwhelming number of rush orders they receive. Although she recognized pharmacy operations as a major ordeal, she had not given much attention to the issue recently. Since the issues seemed to be escalating, Jones realized it was time to develop a better plan. The news of a 10% spending cut compounded with the constant complaints from physicians, nurses and

pharmacists, meant she needed to develop a plan that would keep the hospital working in the black while ensuring all key stakeholders were satisfied.

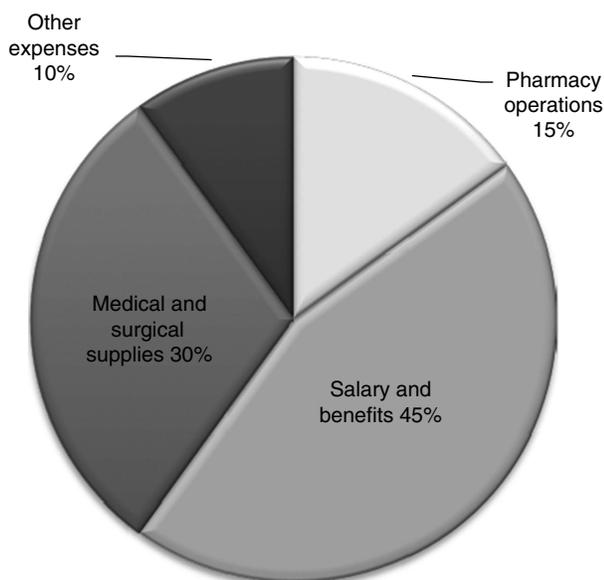
## Gracious University Hospital

Gracious University Hospital is a public, academic medical center and has been serving the public since its opening in 1991. The mission of Gracious University Hospital is to deliver exemplary patient care, advance research through innovative measures, and provide quality health services and facilities to the Gracious University community in which it serves. The hospital has close to 4,300 employees, approximately 700 medical staff, and over 450 resident physicians. With approximately 465 beds, Gracious University Hospital treats nearly 24,000 inpatients each year. The hospital provides medical, surgical, intensive care, obstetric, oncology, orthopedic, and skilled nursing inpatient services in addition to its 24-hour emergency department.

## Financial Crisis

Due to current federal spending cuts affecting most hospitals, the Board of Trustees mandated the hospital reduce its spending by 10% over the next year. The operating budget for the previous fiscal year was approximately \$950 million. Pharmacy operations made up 15% of the budget and had never been the subject of cost scrutiny in the past. However, due to the issues reported by clinicians regarding inefficiency in the pharmacy including the failure to deliver medication to patients in a timely manner, Jones decided the first task in order to improve operations under the new constraints would be to start with the pharmacy. A breakdown of the hospital budget can be found in Figure 1.

**Figure 1.** Breakdown of Hospital Budget for Gracious University Hospital



## Pharmacy Operations

Gracious University Hospital employs 55 pharmacists in the central pharmacy. The pharmacists are the gatekeepers who review all medication orders and ensure the safety of prescriptions. In a workplace survey completed by the pharmacists, there was a resounding theme that pharmacists were not able to focus on their clinical role in patient care and safety but instead spent a significant amount of their time tracking inventory and responding to the floor orders because the automated dispensing cabinets (ADCs) were out of stock.

## Automated Dispensing Cabinets

An automated dispensing cabinet (ADC) is a computerized drug storage system typically located on the resident care unit for nurses to easily access medication. Different types of ADCs are shown in Figure 2 (Pharmacy Purchasing and Products—Buyer's Guide 2006). ADCs not only allow for easy access to medication, but they also improve patient safety and ensure an accurate account of inventory. For many years, ADCs have assisted medical facilities with improving their medication dispensing process. ADCs provide real-time inventory reports which help pharmacies to track expired drugs and the "automated medication charges upon dispensing" feature is useful for billing purposes (Pharmacy Purchasing and Products—Buyer's Guide 2006, p. 1). While ADCs provide detailed information of inventory, they do not provide indications regarding appropriate stocking levels. The use of ADCs decrease wait time and there is less frustration from nursing staff and the speedier access aids in improved patient care. According to a 2013 survey, ADCs were rated among the top pharmacy automation solutions in user

satisfaction along with carousel/robot storage, automated compounding devices, IV workflow management tools, and smart pumps. ADCs received the highest score from health systems pharmacy directors when asked to rate the importance of pharmacy technologies to their operations (Pharmacy Purchasing and Products—Digital Edition 2013). Overall, ADCs have made great improvements in patient and nursing satisfaction.

When Jones started with Gracious University Hospital, all prescription medication was kept in the central pharmacy located on the first floor of the hospital. After a physician placed an order for a prescription, the nurse contacted the pharmacy directly if the prescription was for a patient's first dose. After the first dose was delivered, medication was delivered on a schedule depending on the medication administration times. One of the main contributions Jones made to this process was the introduction of pharmacy ADCs. ADCs were placed on each floor of the hospital and housed a pre-established amount of medication that is easily accessible. The use of the ADCs means physicians are able to place orders for medication with the nurse and the nurse can fill the order with the medication locally from the ADC. This accessibility decreases the time between prescription entry and medication delivery significantly. The only time nurses have to contact the pharmacy is to place a special order for medication or place a rush order when the ADC does not have the appropriate dosage of prescribed medication. The central pharmacy continues to deliver first dose medications directly. (Refer to (UC Davis Health System 2016) for additional background information on pharmacy operations).

Pharmacy technicians maintain the ADCs and are in charge of ensuring the ADCs are adequately stocked. Each morning at 7:00 A.M. the technicians deliver and restock the medications in each ADC up to pre-established stocking levels. In addition to their restocking duties, the technicians are also tasked with cycle counting (an inventory auditing procedure beneficial to inventory management which involves continually validating the accuracy of inventory in the system) and resolving inventory discrepancies. Ensuring the right amount of medication is available in the ADC has been a challenge for the pharmacists and physicians for years. Given the variability in perishability for the different drug types, an appropriate stocking level is desired in order to avoid waste. If an abundance of medication is kept in the ADC, which is not used in a timely manner, the medication expires and the hospital loses money. A further illustration of this issue was experienced by Intermountain Healthcare's pharmacies that historically managed its own drug acquisition and purchased its own bulk medications

**Figure 2.** Different Types of Automated Dispensing Cabinets (Pharmacy Purchasing and Products—Buyer's Guide 2006)AmerisourceBergen® Technology Group  
MedSelect Medication Cabinet

MedDispense™ Automated Dispensing System

Cardinal Health Pyxis®  
MedStation® 3,000

McKesson AcuDose-Rx®



Cardinal Health Pyxis® CII Safe®

MTS™ Medication Technologies  
MedLocker™

(Moore 2014). Within the network, it was not uncommon for a smaller pharmacy to use only five to ten pills from a 100-pill bottle before the medication expired. The pharmacies also experienced additional waste for expired unused specialized drugs, which were needed for emergency situations and rare conditions, due to overstocking (Moore 2014). Alternatively, if there is not enough medication in the ADC, patients run the risks of waiting longer periods of time for medication and

the pharmacists must process rush orders disrupting the flow of the pharmacy.

### Tiger Team

When Jones came on board five years ago, she along with other hospital administrators believed it would be beneficial to get various perspectives regarding how the pharmacy issues should be handled, so she formed a tiger team comprised of a select number of

**Table 1.** Roles and Responsibilities of Each Participant in the Pharmacy Simulation

Role	Responsibilities
Physician	<ul style="list-style-type: none"> <li>• Listens to patient and writes a “prescription” corresponding to patient’s “demand”</li> </ul>
Patient	<ul style="list-style-type: none"> <li>• Visits the physician with his/her “demand”</li> <li>• Receives “medication” from nurse</li> </ul>
Nurse	<ul style="list-style-type: none"> <li>• Receives “prescription” from physician</li> <li>• Checks automated dispensing cabinet (ADC) to fill prescription</li> <li>• Delivers “medication” to patient</li> </ul>
Pharmacy technician	<ul style="list-style-type: none"> <li>• Fills requests from the nurse if there is a “stockout”</li> <li>• Takes order to Central Pharmacy and waits for it to be filled</li> <li>• Delivers order to ADC</li> <li>• Responsible for periodically monitoring the quantity of “drug” in the ADC and replenishing the ADC according to the restocking policy</li> </ul>
Pharmacist	<ul style="list-style-type: none"> <li>• Assembles “medication”</li> <li>• Processes refill requests and gives “medication” to the pharmacy technician</li> </ul>
Recorder/ Timekeeper	<ul style="list-style-type: none"> <li>• Keeps track of how long patients wait to receive medication</li> <li>• Keeps track of nurse and pharmacy technician utilization</li> </ul>

physicians, nurses, pharmacy technicians, and pharmacists. The goal of the team was to develop a plan that the hospital could use to ensure patients receive accurate doses of medication in a timely manner. Although the tiger team had not been meeting recently, Jones felt gathering the team again could really help in devising a new plan for the pharmacy.

As Jones had expected, the news of additional spending cuts was not received well by the tiger team. As she pondered the events that took place during the meeting she recalled some of the concerns that were raised.

A general surgeon, Dr. Alyssa Ramirez, complained “I already have to wait too long for medication to be delivered to my patients. The proper medication is not kept in the right places. We need to address that issue. How do we ensure that the right drugs are kept in the ADC in the right amount?”

One of the nurses, Richard Griffin, chimed in, “I agree. I am constantly running to the ADC on my floor to find it empty or filled with the wrong drugs or expired medication. I place rush orders with the pharmacy but that process takes a long time as well.”

The pharmacy technician, Christopher Roberts, on the team responded by saying, “I stock the medication that I am instructed to stock. There are changes in the medication demand everyday but we don’t have a system to track or plan out the correct combination. We need to think about that issue. I would stock as much medication as available but the hospital would never allow that.”

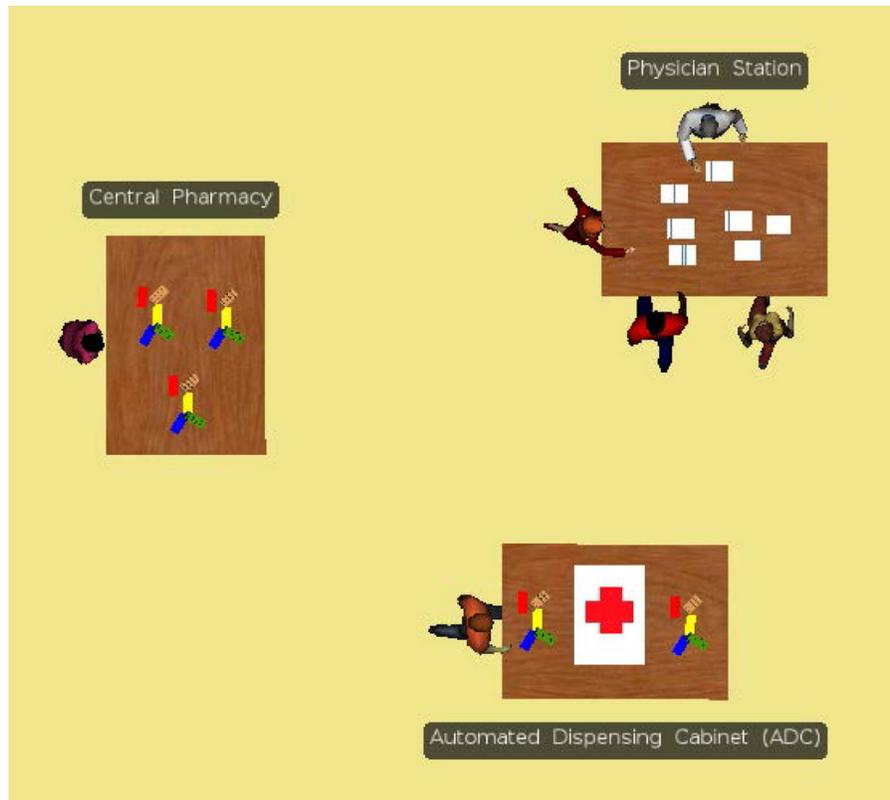
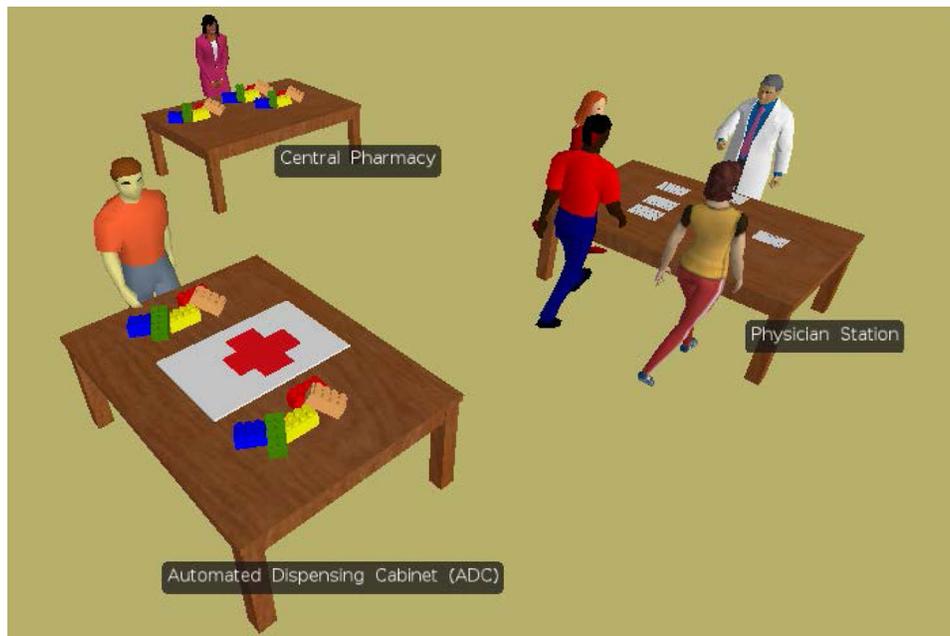
Jones then spoke up saying, “We have learned that traditionally stocking as much as possible in medical cabinets is not the best solution. It is neither feasible nor cost effective to return to such a policy in addition to the waste incurred. The point of the ADC is to have a manageable amount of medication that can be easily accessed by nurses and physicians. I do agree with Chris, in that, we need to focus more on how much of each drug should be kept in the ADCs.”

One of the pharmacists, Dr. William Rice, spoke up saying, “Pharmacy operations have definitely improved through the use of the ADCs. We still have issues when we receive an abundance of rush orders but we try to get medication out as soon as we can. I just find it hard to imagine how operations will function with the new budget cuts.”

Overall, Jones felt the meeting went well. As she thought about all the concerns that were presented, she decided a physical simulation would be a good initial step. She figured if smaller tiger teams were developed on each floor, they could come up with a plan that would improve the pharmacy issues. She was excited and would present this idea to the hospital administration tomorrow.

### Pharmacy Simulation

Having received approval from the administration and the tiger team, Jones began developing a memo to be sent to all hospital personnel notifying them of the upcoming pharmacy simulation competition. The memo explained that each floor would need to develop a tiger team consisting of one physician, two patients, one nurse, one pharmacy technician, one pharmacist, and one timekeeper. For the simulation, each patient would be supplied with a list of ailments that represent a combination of two types of medication to be presented to the physician. Once the physician writes out a prescription, it is handed to the nurse to fill. Nurses then check the floor’s ADC to see if the medication dosage is stocked. If it is not there, the nurse can place an order to the central pharmacy through the pharmacy technician. The pharmacy technician will also be responsible for maintaining the ADC. The duty of the pharmacist will be to fulfill all requests made by the pharmacy technician. When the medication is available, it is given to the patient by the nurse. The timekeeper should keep track of how long

**Figure 3.** Schematic of Room Configuration**Figure 4.** Three-Dimensional Schematic of Room Configuration

patients wait before receiving medication. The roles and responsibility for each participant are also provided in Table 1. The goal of the simulation is to serve as many patients as possible during a run of the simulation by determining the best stocking policy for

the ADC. Three stations are needed for each team. One station is for the physician's office, another for the ADC, and one for the central pharmacy. Sample layouts for the pharmacy simulation are provided in Figures 3 and 4.

Jones believed this simulation fully represented the current situation and was excited to see what kind of recommendation the teams would make.

## References

- Pharmacy Purchasing and Products—Buyer's Guide (2006) *Automated Dispensing Cabinets* Accessed December 23, 2014, <http://www.pppmag.com/documents/V3N6/BuyersGuideP24.pdf>.
- Moore D (2014) Optimizing medication inventory through consolidation. *Pharmacy Purchasing Products Magazine*. Accessed

- November 21, 2015, [http://www.pppmag.com/article/1508/PMay\\_2014/Optimizing\\_Medication\\_Inventory\\_through\\_Consolidation/](http://www.pppmag.com/article/1508/PMay_2014/Optimizing_Medication_Inventory_through_Consolidation/).
- Pharmacy Purchasing and Products—Digital Edition (2013) Accessed August 20, 2013, <http://pppmag.com/digitalmag/Main.php?MagID=2>.
- Special PP&P Buyer's Guide: Automated Dispensing Cabinets (2006) *Pharmacy Purchasing Products Magazine* (31).
- "Technology for Long-Term Care: Automated Medication Dispensing Cabinets," Accessed December 23, 2014, <http://www.techforltc.org/producttype.aspx?id=2702,2511>.
- UC Davis Health System (2016) Pharmaceutical Services. Accessed March 14, 2016, <http://www.ucdmc.ucdavis.edu/pharmacy/inpatient.html>.