

Curriculum Development on Healthcare Information Systems, Healthcare Supply Chain Management and Healthcare Operations Management

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ABSTRACT: This paper presents the foundation for curriculum amendment in the College of Business at Eastern Michigan University to prepare our students for the tremendous job opportunities that are presently available in the healthcare arena. Specifically, this curriculum change incorporates three major areas in healthcare management: Healthcare Information Systems, Healthcare Supply Chain and Healthcare Operations Management. In order to properly chart the changes in the curriculum, research is presented that defines and discusses these components for suitable curriculum building that will enable graduates to effectively perform in the healthcare industry. Additionally, presented in this paper are the detailed objectives and teaching pedagogy of a special topics graduate course in Healthcare Operations Management that recently has been developed at Eastern Michigan University.

INTRODUCTION

In healthcare, a system known as “pay-for-performance” or “P4P” is critical to improve the quality of patient care. This P4P (the “ACT”) program is an outgrowth of the Deficit Reduction Act of 2005 and was passed by the U.S. Congress. It represents attempts by the U.S. government and private enterprise, such as insurance companies and healthcare purchasing consortiums, to require healthcare institutions to meet certain objective criteria that will increase the quality of care, while at the same time reducing healthcare cost. Under this Act hospitals and healthcare systems are eligible to receive higher Medicare and Medical reimbursements if they can demonstrate certain types of operational efficiencies and productivity improvements¹. Increased operational efficiency and healthcare productivity gains can be achieved through healthcare informatics; integrated healthcare delivery supply chain systems; and adapting operations management techniques to the healthcare industry.

Because there is indeed a huge demand for people who excel in these areas of the healthcare field, schools are rethinking on how to teach and apply informatics, supply chain management and operations management techniques (so effectively used in various non-health related industries) for use in the healthcare sector. In consistent fashion, the U.S. Department of Health and Human Services (HITECH) Grant program, issued in 2010, that provides Universities and Community Colleges with funds to develop programs in healthcare information

¹ Based on “Enterprise Integration: Defining the Landscape” (a work product of the HIMSS Enterprise Information Systems Steering Committee and the HIMSS Enterprise Integration Task Force)

technology (HIT) and healthcare operations management is a clear indication for the timely development of such new curriculum.

CHARTING A CURRICULUM FOR HEALTHCARE INFORMATICS

Charting the curriculum for healthcare informatics must be guided by the future need for health information technology (HIT), such as healthcare enterprise integration (the ability to access data across multiple systems using healthcare information technology); the development of semantic web-based systems that make it easier to share and reuse information by people and applications; the explosion of the new imaging and innovative technologies such as RFIDs and mobile computing; privacy and security issues; e-health for convenient medical information exchange; artificial intelligence; and others (Rastogi et al., 2008).

Our initial attempt to develop a sound curriculum was the introduction of a Graduate Certificate in Healthcare Informatics, sponsored by the College of Business Computer Information Systems department and the College of Health and Human Services School of Health Sciences. This program covers the fundamentals of IS/IT applications and introduces the students to IS terminology, structures, applications, and their relationship to managerial functions in healthcare organizations. The graduate certificate brochure states that “ultimately, the program seeks to provide students with an understanding of the basic structures of information systems in health administration; the relationship of these systems to managerial functions, such as communications, coordination, control, strategic and process planning and decision making; and the important policy and ethical issues associated with privacy, confidentiality, and security in information systems.”

Students participate in coursework in Medical Care Organization, Informatics in Healthcare Management, and Web Application Development. They have the choice to take either Health Law or Healthcare Finance and must select two amongst the following four courses: Systems Analysis and Design, Database Management Systems, Enterprise Resource Planning or Systems Intelligence. A total of 18 credit hours is required for this certificate.

CHARTING A CURRICULUM FOR HEALTHCARE SUPPLY CHAIN AND OPERATIONS MANAGEMENT

Background and Components of Healthcare Supply Chain Management

The growth of HIT is fueled by the desire to achieve better integration in the healthcare delivery supply chain. The healthcare supply chain is complex and can broadly be conceptualized to span upstream from the development of care (e.g., equipment and device manufacturers, bio-tech firms, etc.) to the midstream financing of care (e.g., CMS, insurance companies, and other payers), to the downstream delivery of care (e.g., hospitals, physician providers, etc.) (Sinha and Kohnke, 2009). Unpacking and exploring the complexity of the healthcare delivery supply chain is an important aim for future healthcare operations and HIT professionals. Therefore, coursework that prepares these health professionals to better integrate healthcare delivery is well served to address the following unique dimensions of the supply chain.

- *The co-production phenomenon* (Chase and Tansik, 1983; Schmenner, 1986; 2004; Smeltzer and Ramanatha, 2002). In other words, customers participate in the value creation process and have contact with providers in service provision.
- *Actor role ambiguity* (Schneller and Smeltzer, 2006). Suppliers, the focal firm, and customers maintain well defined roles during their interactions aimed at value creation in manufacturing. This is not the case in healthcare, as a physician may serve as a supplier of patients to the hospital (focal firm) when referring patients for admission, but also acts as a customer of the hospital in ordering tests. Likewise, the patient is a customer to the hospital and physician, but is also the material input (with inherent variability) in the input-output transformation process. This calls for curriculum content which emphasizes relational coordination mechanisms in the healthcare delivery supply chain (Shah et al., 2008).

- *Variable demand* (Schneller and Smeltzer, 2006; Shah et al., 2008). The co-production phenomenon and actor role ambiguity mentioned previously drive variation in demand volume and variety that does not often exist in manufacturing. This is exacerbated by the growing size of the customer base in healthcare described in the ‘background section’ previously.
- *Centrality of the physician* (Smeltzer and Ramanatha, 2002; Schneller and Smeltzer, 2006; Ford and Scanlon, 2007; Shah et al., 2008). In manufacturing, the exchanges which occur during value creation are largely directed by the focal firm using contracts and financial arrangements which articulate quality, cost, and delivery specifications. This is not the case in healthcare delivery as physicians, who are commonly employees of the hospital, make many decisions which influence the operational performance of the hospital along the same operational measures of quality, cost, and delivery (Smeltzer and Ramanathan, 2002).
- *Information asymmetries* (Ford and Scanlon 2007). Hospitals have been slow to adopt HIT. While the American Recovery and Reinvestment Act passed under the Obama administration is expected to accelerate HIT adoption, at present asymmetrical information/knowledge stocks exist among providers, negatively impacting operational performance. As these asymmetries quickly diminish, healthcare operations and HIT professionals should be versed in RFID which can be used to track physical assets (materials) (Amini et al., 2007) as well as technologies such as electronic health records are used to manage information (Jha et al., 2009).

These (and other) characteristics make healthcare delivery unique from manufacturing, and lie at the heart of why specialized academic programming is needed. It is not sufficient to simply apply OM and SCM concepts in healthcare (Smeltzer and Ramanathan, 2002). Rather, training programs that are developed with an understanding of the unique context of healthcare delivery will likely yield more effective results. It is with this understanding that the above key course topics have been identified.

Background and Components of Healthcare Operations Management

Heineke's (1995) research suggests that there is an important link between sound healthcare operations management decisions and technical performance in healthcare maintenance organizations. She suggests that technical performance in healthcare will be enhanced when professional work is appropriately managed using Operations Management and Lean principles leading towards sound decisions about organization, strategies, workforce management, inventory management, planning and control. Indeed Healthcare Operations Management uses and adapts traditional Operations Management principles and techniques to reduce cost, improve quality, allow for flexibility, and effectively increase responsiveness to patient care. Research shows that some hospitals and healthcare centers are successfully using Operations Management strategies, techniques and principles such as: lean process and workplace re-engineering (via value stream mapping, kaizen, A3, 5 Whys, 5Ss); quality management to improve patient care and patient safety; inventory management strategies and systems that address variable demand; scheduling techniques for both planned and unplanned admissions and for emergency centers; capacity management of the labor force and capital equipment; facilities planning in terms of location analysis and healthcare facilities layout; and many more. These must be the focal point in developing the Operations Management curriculum for Healthcare professionals.

A Sample Special Topics Graduate Course in Healthcare Operations Management

The initial special topics graduate course in Healthcare Operations and Supply Chain Management, developed at Eastern Michigan University, was designed to provide students with Healthcare Operations Management tools to improve performance in healthcare management; to improve healthcare processes and procedures; to better manage inventories; to improve the quality of healthcare delivery; to more accurately schedule patients and capacities in a dynamic demand environment. Additionally this course covers customer relationship management and health information technology.

Students successfully completing this course should be able to:

1. Understand the role of OM in the healthcare delivery system.
2. Discuss and interpret the six health care operational effectiveness criteria (lowering health care costs; increasing health care productivity; continuous health care process improvement; reduction in health care variability; improving logistics flow; and improving quality of patient services).
3. Master and implement the tools and techniques for re-engineering health care processes (Process Maps; 5Whys; Value Stream Mapping; Go See; A3; Mistake proofing; etc.).
4. Forecast capacity need and patient flow for better scheduling.
5. Create appropriate schedules for patients and hospital personnel requirements.
6. Track systems to improve patient and materials flows.
7. Implement Quality Management
8. Formulate labor and capital productivity improvements through optimal staffing and scheduling models.
9. Illustrate document reduction using the 5S principles of Lean Operations Management.
10. Use project management as a tool to affect change in Healthcare.
11. Debate and examine how change management effectively sustains changes made in health care procedures and processes.
12. Evaluate healthcare decisions, procedures and processes and use appropriate tools to improve systems.
13. Map and examine the supply chain in the healthcare industry.
14. Design and manage inventory and supply systems.
15. Formulate models that are specific to health care location analysis.
16. Design layouts of hospitals and clinics for improving service and patient flows.
17. Assess a hospital's use of technology (e.g., Internet, Personal Health Records, etc.) for patient engagement and select from various alternative technologies used in CRM.
18. Integrate various technologies into hospital operations to better manage cost and quality (e.g., RFID).
19. Develop a technology plan for a hospital and choose among various technologies appropriate for the hospital's specific application.

Eastern Michigan University is not affiliated with a Hospital or Health System. However, its faculty in Computer Information Systems and Operations and Supply Chain Management have existing research relationships with major Hospitals and Health Systems. It is the amalgamation of this research and the course material that will enable students to gain practical knowledge about the implementation of various principles and techniques taught in this healthcare curriculum. In addition, the practical study and analysis of various case studies will aid in placing the theory in unique context of the healthcare delivery system and thus yield practical and effective results. (see figure 1: Summary of an implementation case at the U of M).

Additionally for each major topic discussed in this course, reading(s) specific to healthcare management will be selected from various journals, such as: Production and Inventory Management, Decision Sciences, International Journal of Production Economics, Journal of Operations Management, Production and Operations Management, International Journal of Operations and Production Management, International Journal of Production Research, Management Sciences, Operations Research, and Manufacturing and Service Operations Management. A Readings list for each covered sections is given to the students during the first class meeting. Each student in the class is required to lead the discussion of at least one of the reading assignments. So that all students are participating in the discussion of all reading assignments they must submit a summary of each reading assignment before class discussion takes place. Participation in these discussions is essential to learning, so students are expected to come to class, be prepared, and actively participate.

The U of M Hospital: Re-engineering an Admissions' Process using VSM.

Around 2005 University of Michigan Hospitals began an initiative to bring Lean problem solving methods and culture to the Health System. As part of that initiative grants and Lean coaching support was made available to a number of projects in both the inpatient and outpatient settings. The Department of Physical Medicine and Rehabilitation received such a grant in 2007 to address the issue of timeliness of patient transfer to the rehabilitation floor. The transfer of a patient from an acute medical service to the rehabilitation service requires coordination between both physicians and nurses on the sending and receiving services, housekeeping to prepare the beds, transport, and multiple steps required to obtain insurance approval for the transfer. Delays in transfer resulted in lack of therapies the first day of transfer and both patient and staff dissatisfaction. Additionally, with the rise in acute medical census any delay in discharge of patients to the rehabilitation unit potentially could cause delays in admissions of patients from the emergency department or postoperative holding. The issue of delayed admissions had been a long standing problem, and previous attempts to improve the process were ineffective.

Through the UMHS grant, the Department of PMR received a Lean coach to assist with the process and educate all participants in Lean principles. After an initial scoping phase, a two day workshop was convened to analyze the current process through value stream mapping and to formulate a future state map and develop an implementation plan. The group assembled included representatives from all steps in the transfer process, including physicians, nurses from both the rehabilitation floor and from acute medical floors, therapists, discharge coordinators, and the rehabilitation floor admission coordinator. Key deliverables and metrics were identified to bring the desired process change and specific individuals or groups were tasked with implementation of those changes, with specific time frames and regular progress meetings. At the end of the workshop the findings and implementation plan was presented to hospital administration to get leadership by-in to the project. Another key strategy for process change was close monitoring of key time goals for every admission with analysis of events that fell outside of goal time lines. This allowed daily feedback and early identification of areas for improvement.

Results from the project have been quite dramatic. Prior to initiation of the project in early 2008 only 18% of patients arrived to the floor by 1 pm (average admission time 4:30) and no patients received therapies on the day of admission. By early 2010 65% of patients were physically on the rehabilitation unit by 1 pm and 92% of patients did receive therapies on that day of admission. In addition to achieving the goals set out by this project, it served as an example of the power of Lean process re-engineering to bring meaningful change and became a springboard for other projects in the Department of PMR.

**Figure 1: Summary of an Operations Management Healthcare Implementation Case
(Wu, Parfenyuk, Craig, Craig, 2011)**

CONCLUSIONS AND FUTURE RESEARCH

A need exists for university programming in the area of healthcare informatics, healthcare delivery supply chain, and healthcare operations management. Such programming is necessary in order to prepare healthcare managers to develop and manage organizations which are successful in delivering both high quality as well as cost effective care. This paper has illustrated the initial efforts undertaken by Eastern Michigan University to establish such programming. While this paper has made a contribution to the literature by establishing the need for healthcare programming and describing the key elements thereof, future research should provide additional detail regarding curricular advancements in this area of study. Additionally, studies which address the measurement of learning outcomes in this context would be useful, as Colleges of Business work in a new interdisciplinary fashion with other Colleges such as Health and Human Services.

REFERENCES

- Amini, M., Otundo, R., Janz, B. and Pitts, M. (2007). Simulation modeling and analysis: a collateral application and exposition of RFID technology. *Production and Operations Management*, 16(5), 586-598.
- Chase, R.B. and Tansik, D.A. (1983). The customer contact model for organization design. *Management Science*, 29(9), 1037-50.
- Ford, E. and Scanlon, D. (2007). Promise and problems with supply chain management approaches to healthcare purchasing. *Healthcare Management Review*, 32(3), 192-202.
- Heineke, J. (1995). Strategic Operations Management Decisions and Professional Performance in U.S. HMOs, *Journal of Operations Management*, 13(4), 255-272.
- Jha, A. K., DesRoches, C. M., Campbell, E. G., Donelan, K., Rao, S. R., Ferris, T. G., et al. (2009). Use of Electronic Health Records in U.S. Hospitals. *The New England Journal of Medicine*. 360(16), 1628-1638.
- Rastogi, A., Daim, T. and Tan, J. (2008). Charting Health Information Technology Futures for Healthcare Services Organizations, IGI Global.
- Schmenner, R.W. (1986). "How can service businesses survive and prosper? *Sloan Management Review*, 27(3), 21-32.
- Schmmener, R.W. (2004). Service Businesses and Productivity. *Decision Sciences*, 35(3), 333-347.
- Schneller, E. S., and Smeltzer, L. R. (2006). *Strategic management of the health care supply chain*. San Francisco, CA: Jossey-Bass.
- Shah, R., Goldstein, S., Unger, B., and Henry, T. (2008). Explaining anomalous high performance in a health care supply chain. *Decision Sciences Journal*, 39(4), 759-789.
- Sinha, K. and Kohnke, E. (2009). Health care supply chain design: toward linking the development and delivery of care globally. *Decision Sciences*, 40(2), 197-212.
- Smeltzer, L. and Ramanathan, V. (2002). Supply chain processes that lead to a competitive advantage for a manufacturer compared to a health care provider. *Decision Sciences Institutue 2002 Annual Meeting Proceedings*.
- Wu, L., Parfenyuk, Y., Craig, A., and Craig, M (2011). Guidelines for sustaining high level of success when implementing lean principles in businesses: some successful case summaries. *International Journal of Accounting Information Science and Leadership*, 4(10), 67-85.