In Support of Automated Healthcare Business and Decision Support Systems

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Abstract

The United States Army Medical Command (MEDCOM) operates over 32 medical treatment facilities and provides care for over 1.8 million people globally (Army Medical Command, 2014). Due to the complex problems associated with managing such a large business, the MEDCOM struggles with synchronizing manually manipulated business forecasting and clinical decision support systems. Most systems do not communicate with one another, permitting individual decisions as single points of failure in analytical processes. The MEDCOM is very good at developing sophisticated decision support models; however, these models are (generally) stand-alone and require manual manipulation. As a result, these models do not automatically adjust related models when common variables are changed. This paper details a single example of the MEDCOM's decision support and forecasting process, employing the Military Health System performance plan to display the hazard in manual data manipulation. Using evidence from civilian studies and projects, this paper highlights benefits of using automated forecasting tools in business and clinical operations. Successful businesses, whether involved in healthcare or not, find great success using synchronized, automated forecasting tools in daily operations. In this time of resourcing uncertainty, accurate business decisions and quality patient care are critically important to the success of the MEDCOM.

Keywords: business, automation, forecasting

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The Army Medical Command is the principal organization responsible for the health and wellbeing of the Army and its beneficiaries (Army Medical Command, 2014). The soldiers, family members, and other beneficiaries comprise a supported population of over 1.8 million people across the globe (Army Medical Command, 2014). Despite the complexity of the operation, the MEDCOM currently struggles with comprehensive, automated and integrated business planning, clinical decision support systems, and forecasting models at the enterprise level. Integrated and automated systems could improve projecting patient demand, managing key resources (Voudouris, Owusu, Dorne, Ladde, & Virginas, 2006), and analyzing clinical outcomes for the supported population (Musen, Middleton, & Greenes, 2014).

Background and Problem Definition

By describing a few of the MEDCOM's frequently used clinical and business decision support systems, this research supports integrating and automating clinical and business decision support systems across the enterprise. This would dramatically improve forecasting, clinical operations, and resourcing efficiency within the MEDCOM. During the initial review of sources, research shows great benefits, and therefore the requirements, for integrating decision support systems. In rare instances however, there is contradictory evidence regarding the quality of care from using automated decision support systems, including one study that claims no association between quality of care and using clinical decision support systems (Romano & Stafford, 2011). Aside from the occasional dissenter, the evidence overwhelmingly supports the use of integrated decision support systems. This literature review focuses on reasons for integration rather than reasons against integration.

The managers who maintain and operate the MEDCOM's many sophisticated models and systems could benefit from technological integration and automation. While many of these systems use interrelated data, when one system is adjusted, the other systems require manual manipulation to follow suit. Manual manipulation can lead to human error, which is costly in terms of both time and money. To clarify the problem at hand, we must define, simplify, and explain a data-use pathway in a current clinical business process.

To define problems with non-integrated or automated data systems, I focus on a single path for ease of understanding. This path is the flow of information used to forecast patient care. It begins with projected patient populations, moves to staffing, and ends with performance planning (forecasting).

The Medical Treatment Facility (MTF) performance plan is the principal forecasting tool used for predicting patient care. Treatment facility commanders and middle managers use the performance plan to predict workload, and set targets for clinical quality, administrative efficiency, and patient satisfaction. To begin defining the scope of the problem, first we must understand the key driver for all forecasting: the impact of supported populations on military Medical Treatment Facilities.

All calculations used in directing resources to Medical Treatment Facilities begin with the quantity of care demanded. Managers calculate the demand for care by using the supported population and projected utilization rates. The U.S. Army projects soldier populations across the globe using the Army Common Operating Picture, or COP. The MEDCOM then uses data from the COP to populate the Enrollment-Based Stationing Model IV (EBSM IV). Individual MTFs use the EBSM IV to determine projected numbers of patients in their respective areas (Army Medical Command, 2013). These transactions represent the first manual manipulations in the

data chain, and it happens during a critical decision-making process. An error resulting from manually manipulating data during this process has potentially negative implications on a subsequent process that determines authorized staffing levels.

Once populations are determined, the Professional Services Model (PSM) defines corresponding staffing levels. The PSM uses patient enrollment data and productivity expectations[1] to dictate the quantity of staff on the Table of Distributions and Allowances (TDA). The TDA defines authorized staffing levels for each department, clinic, and administrative support section in a MTF. The TDA runs on a biennial cycle, so problems with authorized staffing levels resulting from human error could negatively affect an organization for one or two performance planning iterations[2].

The MTF Performance Plan (business plan) is a five-year planning document that is dependent on accurate data from a variety of sources (Army Medical Command, 2013). The importance of the performance plan cannot be understated. Managers develop the performance plan manually, at the individual MTF level,[3] using data from the PSM and EBSM IV (among many other sources, including clinical workload data from separate systems). While some manual manipulation is understandable and necessary to account for ever-changing variables in the operating environment, errors resulting from poor data entry will result in inaccurate forecasting. Poor forecasting will ultimately influence the quality of care received by patients at the MTFs. Integrating and automating these systems is necessary to improve and standardize the performance planning process across the MEDCOM.

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[1] Productivity is also pulled manually from a separate system called the MTF Management Analysis and Reporting Tool (M2).

[2] Occasionally, off cycle, annual adjustments to the TDA are authorized and often MTFs are allowed to hire additional personnel not authorized on the TDA.

[3] Some argue this places the burden for accurate planning on the individual MTFs. However, automated entry using identical source data would help provide consistent performance projections across the MEDCOM.

Method

The principal method of research for this paper is a qualitative review of existing literature, data, journal articles, and textbooks. Using information from seven journal articles and evidence from 11 separate sources, this review makes the case for improved efficiency and quality by integrating and automating decision support systems. This literature review comprises current, raw EBSM IV data from the Army Command Management System, along with additional supporting documentation found through Google Scholar, with articles sorted by relevance using date-defined searches from 2006-2014. There is no geographical limitation to generalized business findings, however clinical and business findings that are interrelated are limited to the United States.

Findings

This review highlights the benefits of using automated and progressive modeling systems, which allows readers to understand the struggle MEDCOM currently has with forecasting and data integration. Largely, this review displays the importance of automated decision support systems and highlights the need for solutions to the problems MEDCOM faces. Addressing these challenges and finding solutions to MEDCOM's problems brings the chance for enormous rewards in terms of patient care and business operations.

Using data and automation to improve business operations and patient care is not a new concept. Hospitals introduced the first computers in the early 1960s, when a major computer company tried to solve many hospital-based medical care problems by using 96-button punch pads to handle physician orders and intra-hospital communication (Cantrill, 2010). Even then, people were beginning to see the potential usefulness of automation in business practice.

Now that computer technology has become much more sophisticated than the simple punch cards and keypads of the 1960's, algorithms can accurately predict patient demand. A contemporary study highlights the applicability of progressive modeling in forecasting the demand for emergency room visits. This study found it possible to predict emergency room visits one year in advance with an average error rate of 2.6% to 4.8% (Bergs, Heerinckx, & Verelst, 2014). If it is possible for a civilian institution to predict something as chaotic as emergency room visits within single-digit accuracy, imagine the benefit the MEDCOM could derive from similar methods.

Being able to forecast demand with a high degree of accuracy would dramatically improve efficiencies and resource management. Improvements include allocating human resources to clinics with high demand from sections with less demand, thereby increasing efficiencies in both areas. Managers may reduce or extend operating hours, saving capital. Similarly, managers may reschedule maintenance activities to take place during times of decreased volume to avoid patient disruption. This list is not all-inclusive as the possibilities are almost limitless. The key to achieving accurate forecasting is the ability to accurately capture and integrate available data. Using automated data entry and quality checks, the MEDCOM would be able to develop exceptionally accurate forecasting models. Developing these models and automating systems will be difficult, but it is not impossible.

In Florida, over 1,000 separate users across 67 county health departments enter data into the state's reportable disease database. State health officials report this information to the Centers for Disease Control. In early 2012, there were no automated data quality checks in place. After automating error prevention measures, the state experienced a 92% decrease in erroneous data by 2013 (Eisenstein & Hamilton, 2014). There are few logical arguments against

the benefit of reducing data errors by 92%. Increasing data quality through automation will enable the MEDCOM to refine business operations and improve the quality of patient care.

Contributions

Automating and integrating information systems, forecasting models, and decision support systems across the Army MEDCOM will create an environment that enables leaders to have almost instantaneous access to accurate data. Leaders will be able to manipulate variables and develop potential solutions to problems with integrated models. Furthermore, managers will be able to predict outcomes from proposed solutions to staffing, clinical, research, or budget problems.

Discussion and Conclusion

In this age of rapidly evolving technology, many civilian businesses realize the benefits of improving their processes based on automated data systems and forecasting. For example, Netflix increased revenue from $5 million to over $1 billion in seven years by harnessing data and using sophisticated forecasting models (Davenport & Harris, 2007). This practice should not be limited to non-health businesses. In healthcare, after identifying performance improvement as a strategic goal, the first step towards improvement is developing an analytics platform that combines the organization's different data sources (Brown & Hough Falk, 2014).

The Army MEDCOM should rapidly move to integrate clinical and business support systems. Developing the ability to forecast demand and predict outcomes from business and clinical decisions is critical to the MEDCOM's future. The evidence is clear; sophisticated use of data is beneficial in terms of both cost and quality. The MEDCOM has developed very advanced and comprehensive forecasting and management models. There is a great opportunity

from integrating and automating these models. The time to develop this critical capability is now.

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