

**Discussion of the Vassar Brothers IBM-MIT case study:**  
Understanding key elements in building an enterprise solution  
*The importance of being human*

**Lilian Wu:** IBM University Relations and Innovation

**Tim Kostyk and Doug McDavid:** IBM Global Business Services

Many healthcare systems around the world are in crisis – and not simply from rising costs. Although 16 percent of the U.S. GDP is spent annually on advancing healthcare, large numbers of hospital patients continue to die each year due to medical mistakes. In 1999, a well-known Institute of Medicine report put the number at 97,000 deaths per year. A more recent study by Healthgrades, using 2004 data on U.S. Medicare patients, more than doubles that estimate: as many as 195,000 patients die each year because of preventable errors.

In the face of such harsh figures, healthcare leaders are looking for innovative ways to improve patient safety and operational efficiency by giving doctors and nurses the crucial information they need to treat patients -- where and when they need it. It's a challenging mission. Healthcare information technology (IT) projects can be costly, and, like similar efforts in other industries, often fail to meet targeted goals if they are not properly planned.

In this discussion paper, we will look at one organization, Vassar Brothers Medical Center (VBMC) and its parent organization, HealthQuest<sup>1</sup>, that is making impressive progress transforming to a "digital hospital", providing a roadmap for community hospitals to follow. In particular, we will look at how a "multilingual" approach, which takes into consideration not just technology design but also the ways in which the business investment model and social/organizational structures affect change management – and ultimately, the success of a project.

We will base our discussion on a case study, "*Vassar Brothers: Wireless healthcare delivery: Adapting to tomorrow's needs with mobile processes.*"<sup>2</sup> We will use a framework described in our white paper titled "*Bilingual Enterprise and Solution Architecture*" (BESA)<sup>3</sup> and focus on Vassar's efforts to reduce adverse medical events. We will look at three key elements in building an enterprise solution: 1) business intent of the organization, 2) the social environment; organizational, governance and cultural structures, that is to say, the human systems in which the technology solution will reside, and 3) the enabling technology solution.

## The Challenge

Hospitals are more than just medical facilities – they are extraordinarily complex ecosystems of people, process and technology. Because they deal, quite literally, in life-and-death scenarios, the attention paid to how they function, and what outcomes they deliver, has become more intense. VBMC, like all hospitals, faces six major challenges:

1. **Accountability**—Changes in the provider and payer systems now are making hospitals and physicians more accountable for performance and outcomes.
2. **Transparency**—The underlying culture of unreported mistakes by hospitals is a cause of mistrust by patients and their families. Hospitals need to create a more transparent and non-punitive environment so improvements are hardwired into the system.
3. **Safety**—According to some reports, medical errors are the sixth leading cause of death in U.S. hospitals, and the clamor for change is intensifying.
4. **Capacity**—"Baby Boomers," by their sheer numbers and growing longevity, are expected to inundate the system in the coming years.
5. **Cost**—Total U.S. healthcare spending is greater than \$1.5 trillion annually.
6. **Efficiency**—Estimates are that 1/3 of the healthcare spending or \$500 billion is wasted annually.

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<sup>1</sup> Affiliates of the HealthQuest system include 3 hospitals, ambulance service, homecare, and nursing home care.

<sup>2</sup> Web link for VBMC case study: <http://www.ibm.com/university/scholars/skills/ssme/VSRBFinal1-16.pdf>

<sup>3</sup> Web link for BESA paper: <http://www-304.ibm.com/jct09002c/university/scholars/skills/ssme/bilingual.pdf>

## The Players

Carla Gude (Chair of HealthQuest's IT committee), notes "The CEO (Dr. Daniel Aronzon) is a pediatrician who still sees patients every week. He is passionate about quality healthcare for patients and creating a non-punitive learning culture, and he thinks strategically." His goal is to see VBMC provide the best medical care for patients.

Nicholas Christiano, CIO, thinks not just about what equipment to install, he also thinks strategically, she says. "He understands that technology is an enabler and the users have to be the champions and be the ones to define what is needed and how to use it." At the end of the day, his goal is to put together the best technology solution to improve patient outcomes and patient safety, and improve operating efficiency to reduce cost, waste, and unproductive time. Christiano has described his biggest challenge to making major progress lies not in defining systems, but in changing behavior and culture, and redesigning processes so they are fortified and supported by technology

Along with those key executives, the Chief Medical Officer (CMO), Dr. Stephen Katz, is challenged with helping doctors who are not employees of the hospital build stronger bonds with VBMC. Today, many primary care doctors have exceedingly little time to spend with patients – often seeing 30 patients a day, with panel of 3,000 patients. One of the CMO's goals is to find ways to give these physicians back the reason they went into medicine -- time to spend with patients.

## Architecting a Solution

Vassar Brothers, already a well-recognized and respected hospital, wants to move to the next level of medical healthcare excellence, while increasing profitability and services to its patient community.

Specifically, the vision embraces several areas of improvement centered on patient safety, communications between nurses and physicians, and optimal utilization of valuable resources (i.e. staff and equipment) to improve operations. These would provide an immediate payback in patient care, reduction of operating costs, and revenue maximization, which then could open the door to the introduction of new services. Early on, the executive team knew this could not be a top-down transformation, but one that would impact all areas of the organization.

Cross-functional teams were organized to identify top problems and redesign processes, and their input became as important as that from the HealthQuest IT and management boards. Two issues arose that the teams realized must be addressed to effect real, repeatable change within the organization.

These were **1) process standardization** and **2) the effective use of technology** to optimize the process model. Rather than defining these strictly in a healthcare model, these were compared to the industrial model of supply chain management (SCM), which looks at the entire chain of players it takes to make, sell and deliver a product to a user or consumer.

### ***CEO Aronzon's first priority: reducing drug errors, from order entry to delivery***

- ***The business intent of patient safety came from the CEO's passion and commitment to provide the best medical care possible for patients.*** Looking at the six challenges he chose reducing drug errors as his first priority.
- ***Examine Vassar's organizational culture/structure and the patient medication process.*** The principal parts of this process consisted of the doctors (who ordered medications), the pharmacy operation (which processed them) and nursing staff (which administered them)<sup>4</sup>. Management recognized that, as a community hospital, Vassar's attending physicians are independent -- not employees -- and, as such, influencing them to change behavior can be more complicated. Computerized physician order entry (CPOE), which many hospitals are now undertaking, is often a

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<sup>4</sup> The sources of preventable drug mistakes are 40% from physician ordering, 40% nurse administration, 10% pharmacy dispensing, and 10% clerk transcribing.

source of irritation to physicians, who believe the manual way is still the easiest; these doctors can be obstacles in the move toward CPOE. The next big source of drug errors can be nurses. As employees, the hospital can influence their processes more easily. If a system could be implemented through the activity of the nurses, it would be worthwhile.

- **Look at how people function in the hospital environment.** A striking impression when visiting a hospital is that everybody – patients, doctors, nurses, and support staff – and everything is in constant motion. In a field study of nurses, it was determined they walk up to five miles a day -- most of it to deal with non-clinical issues, like answering calls at the nursing station. A solution that gets all the right resources and information at the right time and place to administer the right care was deemed the right design point. By looking at other industries with similar logistics, such as the airline industry, VBMC decided the first application to reduce drug errors should be wireless medication (or, “meds”) bar-coding used by nurses, otherwise known as “meds bar-coding.”

CIO Christiano used a little psychology to convince the executives this technology would be appropriate. He took the CEO to the local Home Depot to see that wireless bar-coding not only works but can be used by teenagers and others who are not as professionally trained as the nursing staff.

- **Develop a wireless infrastructure and investment plan.** Christiano realized that to achieve real-time communication in a highly mobile environment, and deliver resources and information where they need to go, a wireless “highway” was the right infrastructure. Applications and information (e.g., meds bar-coding and Voice over IP) could then be easily plugged in. Christiano did not use a traditional ROI as his financial justification. He proposed that cost of this project would be allocated to initiatives that used the infrastructure. In other words, applications and communications services for the next five years will pay a “toll” to leverage the wireless highway.
- **Let business champions who use and benefit from the technology define the solution.** Very often, change and supporting technology are defined at the top of the organization, with the expectation that everyone and everything below simply adjusts and aligns – for example, build large Airbuses and airports and logistics will accommodate. In this case, it was clear that unless the business stakeholders had a voice in the solution, there would be a huge risk of project failure. By matching the social/organizational issues to the business goal, **a direct linkage between business intent and need** can be adequately formed. The stakeholders alone fully understand and can prioritize projects that would populate the roadmap and lead achieving the ultimate vision.

For meds bar-coding, the business champions and project leaders were the Operations Officer of Nursing and the Director of Pharmacy. With a passionate business owner, the CEO, targets were set with the champions, who monitored behavior, understood how culture changed (e.g., workarounds and why). An internal campaign where nurses explained to patients why they were doing meds bar-coding and why it was better for the patients was key to creating buy-in.

### **Adding applications**

Once the infrastructure was in place, and tested with the meds application, Voice over IP was added. The voice application enabled nurses to improve communication without making unnecessary, unproductive trips around the hospital. The third application uses radio-frequency location systems to track high-value, movable assets such as IV pumps which were always “lost” around the hospital. These implementations are described further in our Vassar Brothers case study. This committee used business architecture diagrams (such as fishbone diagrams) for their analysis.

### **Creating a learning institution**

CEO Aronzon believes strongly that Vassar must become the kind of institution that doesn't shy away from its mistakes, but identifies them, and makes sure processes are corrected so they don't keep occurring. He has defined three scenarios when staff errors are punishable: when someone was under the influence, bypassed a safety device/process, or didn't report a mistake.

CMO Katz is passionate about helping doctors understand why new technologies can help improve their outcomes and save time. For example, IT systems could automatically send reminders to female patients

over the age of 50 to get an annual mammogram. These kinds of automatic reminders mean better care; also doctors won't have to be clerks and can spend more time with patients.

CIO Christiano believes the manufacturing industry can teach the hospital many lessons, such as finding more predictable and accurate measurements by automating where possible. One way would be to capture patient data automatically from machines hooked up to patients. This means nurses won't have to be clerks and can spend more time dealing with clinical issues and patient care.

### ***Roadmap of a common vision and shared knowledge reused across the enterprise***

Architecting the Supply Chain Management /CPOE focused restructuring of HealthQuest involved a complex set of activities which resulted in a *Business Architecture* view of the environment that Vassar Brothers and HealthQuest would share. Instead of just one hospital leading the way (Vassar Brothers), the entire HealthQuest organization needed to develop an enterprise-driven initiative using proofs of concept and pilot projects to share knowledge and gather expertise along the way.

### **The Results**

- Meds Bar-coding
  - Statistics are astounding. For all of 2006 VBMC has
    - Administered over 1 million medications -1,385,847
    - Received over 30,155 alerts and warnings
    - Prevented 5,331 medication errors
    - Only 244 errors were reported for all of 2005
    - Prevented 2,067 Category C errors (errors that reached the patient, but did not cause patient harm)
    - Prevented 832 Category D errors (errors that reached the patient and required monitoring to confirm that it resulted in no harm to the patient and/or required intervention to preclude harm)
- Vocera/ Voice over IP
  - Savings of 85 minutes of wasted nurse travel time / shift
  - Cost Avoidance of \$995,000
- Cellular Telephone Service
  - Cingular Wireless and Nextel/Sprint
    - Re-broadcast through our Network
- RFID Tracking of Movable Equipment: IV pumps
  - Piloting one floor. Collected data on movement of pumps. Starting data analysis

### **Lessons Learned**

Our perspective here is described in detail in our white paper titled "*Bilingual Enterprise and Solution Architecture (BESA)*".

The matching of business intent and social structure is probably one of the most fundamental indicators of success that a project can have because this enables a true mapping and understanding of what are the needs driving the project to any potential roadblocks and problem areas of implementation and adoption.

More specifically

- It takes a multilingual approach to understand the three basic elements in building an enterprise solution; *Business Intent*, the *Social /Organization and Governance Structures* and finally the enabling *Technology Solution*.
- Although it is difficult to depict the *Social /Organization and Governance Structures* in terms of architectural precepts, the pay-back is immeasurable since the views produced greatly aid in matching the business needs or intent of a project to the actual environment that it will operate in.
- To relate those structures to processes and eventually technologies requires a new way of thinking and articulating that is Social-Technical in nature. This means a method that articulates the relationships in a

multilingual Rosetta stone approach which can be understood by multiple audiences both technical and non-technical.

- Business intent, roles, expectations, and technologies evolve over time. There is a trade-off between rigorous understanding and adherence to original business intent, and the forces of evolution that inevitably occur within the history of the application and changes and the use of technology in the enterprise. This means it is all the more essential to have **multilingual people** who can clearly connect the evolving **Business Architecture**. Specifically, **Business Intent  $\leftrightarrow$  Human aspects: i.e., Organizational/Governance or Cultural  $\leftrightarrow$  Technological Bridge**
- Finally having evangelists (Senior Management) were critical to the creation and success of SCM/CPOE initiative.

### Some Open Questions

- How can lean manufacturing principles and methods be applied to Vassar's operations? And what are the benefits?
- Would a production computer control system similar to that of a production line work? The notion would be use more machines to capture patient measurements at all the discrete processes and touch points; and a person would intervene only if the measurements are out of limits.
- What lessons learned from the airline industry can be applied to health care?
- How would you design a non-wireless solution instead of Vassar's wireless solution to reduce medication errors? To keep track of IV pumps? To improve communication and collaboration between nurses and doctors?
- How should knowledge be shared throughout HealthQuest?
- Can the introduction of advanced technologies within the hospital setting be done incrementally utilizing the capability maturity model stepping-stone approach?