

A Logistics Approach to Reorganizing an Operating Room

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Introduction:

In February 2001, test results revealed the presence of mould in the ventilating system of the Operating Rooms at the Royal Victoria Hospital (Sirois, 2001), a McGill University Health Centre hospital in Montreal, Quebec, Canada. To minimize disruption to the surgical schedule, hospital management decided to first disinfect six of the Operating Room's thirteen suites. However, because the tests that followed remained positive, management had no choice but to immediately close the Operating Room and launch a major decontamination program, which was scheduled to run over a 10-week period.

The Operating Room is a key component of the hospital environment. Activities carried out there are crucial and require the careful planning of personnel (Surgeons, Anaesthetists, Nursing staff, etc.) and material resources (medical supplies, instruments and equipment). The closing of an Operating Room therefore serves as a lesson in crisis management. For Carole Duhamel, Associate Director, Materials Management Services for McGill University Health Centre, the incident offered an opportunity to reorganize the Operating Room from a logistics point of view, despite the disruption difficulties.

This document presents a summary of the events that transpired at the Royal Victoria Hospital, with particular emphasis on the logistical aspects of the project. The first section of the paper describes the project context and the organization implemented to support its various stakeholders. The second section presents the reengineering of the Operating Room from a logistics perspective. This process incorporated four key axes: the centralization of storage areas according to product use; the transition to a modular storage system; the introduction of a Double Bin replenishment system; and the reassignment of tasks. In our conclusion we will identify the success factors for such a project.

Project Context:

The Royal Victoria Hospital (RVH) was founded in 1894. The hospital, located in Montreal, Quebec, Canada is one of the hospitals within the McGill University Health Centre (MUHC). The MUHC, which employs 11,000, has an operating budget totalling \$470 million. The RVH maintains 680 beds (more than half of all beds in the MUHC), and the hospital's budget is \$150 million.

In early 2001, when faced with the extent of the contamination problem, the MUHC's management team realized that closing the Operating Room had become inevitable. Simple disinfection had not solved the problem, and hospital management decided that extensive decontamination was required, which would entail a major overhaul of the Operating Room.

Closing the facility required complex logistics planning in order to maintain service to hospital users. Each year, the RVH's Operating Room performs more than 8,300 surgeries, most notably in Cardiology, Ophthalmology, Gynaecology and Urology. It is also a major transplantation centre on call for urgent cases 24 hours a day. To reduce the disruption caused by the shutdown, the RVH established a temporary Operating Room in another wing, while transferring certain surgeries to other MUHC institutions. It should also be noted that in some cases operations were transferred to hospitals outside the MUHC. Despite these upheavals, 88% of the surgeries originally scheduled for the RVH's Operating Room were performed as planned, which considerably lessened the impact of the situation on patients.

The MUHC's Materials Management Services (MMS) played a major role in the implementation of the solution. One MMS priority was to ensure that the medical supplies and equipment required for each surgery were available in the respective RVH Operating Rooms. To meet the new temporary storage needs and facilitate the movement of stocks, some 100 carts were rented, with 350 storage bins and 10 bandage carts purchased outright. Given the sterilization standards of the Operating Room, MMS arranged for a temporary ventilation system to be installed to assure adequate ventilation in the provisional central storage area.

The transfer of surgical procedures to the new rooms necessitated moving storage areas for all products. In addition to familiarizing themselves with these new areas, in some cases Nursing personnel were also obliged to learn how to use new products and supplies. To facilitate this process, MMS staff undertook a major initiative to label carts and bins. Moreover, all equipment had to be removed from the RVH Operating Room to allow space for the renovations to be carried out. These initial temporary measures were all completed within a single week. Because it had an overview of all of the equipment, supplies and instruments required as well as their location, MMS became a key player in the project. In addition to helping Nursing staff locate various items, it also was responsible for the day-to-day management of supplies, creating a replenishment cycle for the temporary storage locations.¹

The role of MMS might have been limited to the first phase of the project, but as the initiative progressed, it became necessary to manage the reintroduction of supplies, equipment and personnel into the newly renovated Operating Room. After receiving a bid from a company that specializes in this type of project, the Associate Director of MMS decided to take on the responsibility of reintroducing the supplies and equipment. *"We were able to accomplish this while generating savings for the hospital through the reduction of Materials Management costs,"* she stated. MMS, in collaboration with the Associate Director of Surgery, established a Materials Management sub-committee (see Box 1). The committee was made responsible for the planning and reorganization of the supply flow in the main Operating Room of the RVH. Committee members represented a variety of departments: MMS,

¹ Moreover, during the decontamination process, the MMS conducted an evaluation of equipment in the Operating Room to ensure it would continue to meet standards once the facility reopened.

Infection Control, Health and Safety, Building Services and Anaesthesia, Medical staff (Nurses and Doctors), as well as members of an outside company, TRIAX Consulting. TRIAX Consulting was selected for its expertise in hospital logistics and process reengineering.

Box 1 – Project Co-ordination:

Co-ordinating a renovation project for the Operating Room of a working hospital represents a major challenge requiring the involvement of numerous stakeholders from various departments of the institution. For this reason, five committees were created to plan and coordinate the project, with a Crisis committee overseeing four sub-committees. These included the sub-committee on Clinical Issues, the Environmental sub-committee, the Technical Services co-ordination sub-committee, and the Materials Management sub-committee. It should be mentioned that of the five committees, the Materials Management sub-committee met most frequently.

Reorganization of the Operating Room:

The logistical reorganization involved reengineering four axes: 1) the centralization of storage areas according to product usage; 2) the transition to a modular storage system; 3) the implementation of Double Bin replenishment system; and 4) the reassignment of tasks. We wish to stress that while these solutions will be presented sequentially to facilitate comprehension, all four initiatives were designed in relation to one another.

Centralization of Storage Areas:

Prior to the shutdown of the Operating Room, supplies (linens, common medical supplies, reusable instruments, direct purchase items) were stored in thirty seven different locations spread over six separate zones. As such, the gathering of supplies needed for a surgery could necessitate a retrieval circuit involving up to six stops. According to Operating Room staff, the preparation of a single case could take from 15 to 45 minutes.² The Materials Management sub-committee agreed that despite the limitations of the building, it was necessary to work towards an increased centralization of storage areas. The number of main storage areas for all supplies and instruments was subsequently reduced to three: an area for specialized supplies and instruments, an area for common, multi-use supplies, and an area for non-sterile supplies. This proposal required changes in how rooms were used and the implementation of storage equipment to allow space to be used to its maximum capacity. To reduce staff movements, the location of specialized Operating Rooms was taken into consideration when storage areas were selected for specialized

² This difference is attributable to the specialization involved and the complexity of the case.

supplies and instruments. The new retrieval cycle now involved no more than three or four stops (specialized products are sometimes stored in more than one location) over a smaller distance, which allowed the time required to prepare for cases to be cut in half.

This relocation of supplies also required the involvement of the hospital's Central Stores. It was decided that certain products would now be stocked in Central Stores rather than only stored in the Operating Room through direct purchase. And while this solution allowed for a reduction in the quantity of products stored in the Operating Room, it also required that storage space be found for the new products in Stores.

Moreover, during preparations for surgery, it is difficult to forecast all of the items that will be required; the patient's condition may result in some additional supplies being needed after the surgery has begun. Therefore, to prevent overstocking the Operating Rooms, high-density carts were introduced containing a variety of products likely to be required during surgery. The choice of carts to use for this purpose was made with full regard for the sterilization standards in effect in the Operating Room. Easily moved, the carts facilitate Operating Room preparation and cleaning. They also come in a variety of dimensions, which allow them to be adapted to each specialization.

High-density Modular Storage:

The second axis involved installing a new storage system for the various supplies, which would allow a maximum amount of space to be used for storage while reducing the number of storage areas and centralizing as much as possible. A vertical high-density modular storage system was selected. In addition to a considerable increase in space compared to the old storage system (a 50% gain was estimated), the modularity offered a great deal of flexibility. This would allow for the storage layout to be changed in accordance with future needs (new products, an increase in consumption, new packaging formats, new space allocations, etc.). The location of the various supplies within the storage units was decided according to ergonomic criteria including allowing increased accessibility to products according to their weight or rate of consumption.

To further maximize space it was necessary to establish the best locations in which to store the various products. These supplies, already delivered to the hospital, had been distributed to the temporary Operating Room. It would therefore be dangerous to have them all sent back to the construction site and risk creating shortages for users. To resolve this dilemma, the sub-committee decided to start from scratch and purchase most of the supplies needed for the renovated Operating Room. This investment was a key success factor of the project. It should, however, be emphasized that while significant, the investment in new supplies was temporary. It was agreed that upon completion of the project and start-up of the renovated Operating Room, the items distributed to the various temporary storage locations and

the newly purchased supplies would be used prior to products being reordered. This expense also covered purchases that would have been required upon start-up in any case.

Double Bin Replenishment System:

The high-density modular storage system offers complementary accessories (bin separators, label holders, etc.), allowing it to be used in conjunction with the Double Bin replenishment method. This method incorporates information management tools such as bar coded labels and digital scanners. Blouin *et al.* (2001) describe the Double Bin method as a system that divides the supply quota for an item equally into two bins. Once the first or primary bin is empty, Nursing or Clerical staff remove the bar coded label, attach it to a label board, and use supplies from the second or secondary bin. Labels that have been placed on the board are scanned according to a predetermined schedule. The information gathered by the optical scanner is then transferred to the information system, which generates the list of items required in the hospital's Central Stores. Once the medical supplies have been delivered, the items remaining in the secondary bin are transferred to the primary bin and the new items placed in the secondary bin, thus assuring stock rotation.

This system simplifies the process of determining supply needs and in doing so significantly reduces the Nursing staff's involvement in supply management duties. Compared to other replenishment systems, the Double Bin method demands no inventory counting on the hospital ward itself. It also facilitates the stock rotation management required to prevent product expiry. Because this practice is based on the replenishment of actual quantities consumed, it greatly improves inventory control.

The RVH has thus become the pilot site in Canada for this technology, which has long been in use in Europe and more recently in the United States. The Double Bin Replenishment method is used for both stocked and non-stock items (direct purchases).

The storage of items was accompanied by a meticulous exercise to validate the products and the quantities to stock. This task, which was carried out by TRIAX Consulting in close collaboration with the Assistant Head Nurse of each specialty within the Operating Room and a representative of the Materials Management Service, was conducted using data based on actual consumption. The goal of determining product quotas was to find a balance between the process costs (orders, shortages, replenishment) and the inventory investment.

Distribution of Tasks:

Not only did the renovation of the Operating Room provide an opportunity to reorganize its physical layout, it also allowed for a review of medical supply replenishment activities. To fully appreciate the changes made, it is important to

understand that these tasks were previously based on the type of supplies, i.e. stocked products versus non-stock (direct purchase) items. Stocked items (products used by all specialties) were replenished by a dedicated Stock Room Clerk, who went from one storage area to another to evaluate needs based on the *par level*³ system using a bar code scanner. This individual would then electronically transmit an order to Stores personnel, who would prepare and deliver it. The Clerk would check the order and place supplies in their respective storage locations.

For non-stocks (direct purchase) items, Assistant Head Nurses of each specialty evaluated their needs (products and quantities) and noted them in a binder. Then, the Purchasing Clerk entered this data in the information system, creating an order that would be transmitted to the Purchasing department, which was in turn responsible for acquiring the products. Supplies delivered to the Stores receiving dock were transported to the Operating Room, where the unit's Nursing staff would place them in their allotted storage locations.

Today, two MMS Stock Room Clerks working two different shifts have been assigned to manage all of the Operating Room's medical supplies, determine needs and place supplies in the storage units. The first Clerk arrives at 6:30 a.m. and finishes work at 2:30 p.m. This Clerk visits the storage areas to scan the bar coded labels that have been affixed to the label board for items requiring replenishment. The data is then downloaded to the information system and forwarded to either Stores (for stock items) or the Purchasing department for non-stock (direct purchase) items. Once this is done, the Clerk updates the database and rearranges the storage units as required to assure system stability for the start-up period. The second Clerk arrives at 11:30 p.m. and leaves at 7:30 a.m. This Clerk begins in Central Stores, gathering stocked items identified that morning when the labels were scanned and transporting the merchandise to the Operating Room. The non-stock items received are then verified, with the Clerk taking care to remove all empty boxes from the Operating Room. The Clerk then enters the Operating Room's sterile area dressed in scrubs to place the various supplies in their proper storage units. The overlapping hour of the two shifts between 6:30 and 7:30 a.m. allows the two Clerks to update one another and identify potential problems.

The reorganization had a positive impact on Nursing staff, who no longer had to involve themselves in the replenishment process of medical supplies, including non-stock (direct purchase) items. It also generated other important benefits, such as the determination of quotas for non-stock (direct purchase) supplies, which are no longer ordered on a random basis as was previously done by the Assistant Head Nurses. In

³ A Stock Handler would conduct an inspection of storage areas and count medical supplies on hand according to a predetermined schedule. The count of all items requiring replenishment would be entered using a bar code scanner. The information was downloaded into an information system that compared the quantity counted with established quotas. The information system then generated a list of requirements, which was used to gather supplies from Central Stores. These supplies would then be delivered and stored in the various wards by a Stock Handler.

addition, by moving the task of placing supplies to the night shift, disruptions to Nursing staff using the storage areas were reduced.

It should be emphasized that this reorganization of tasks assumed that the system of case picking in advance would be deployed in the RVH's Operating Room. Case picking would be assigned to Materials Management personnel rather than Nursing staff. This task would be further facilitated with the new storage units being arranged according to specialties. This presented yet another opportunity to increase productivity, by shifting the time spent managing stock from Nursing staff to Stock Handlers, for whom this activity represented a core competency.

What are the precise benefits of such reorganization? The urgent nature of the project did not allow the full impact of the improvements implemented to be measured. However, a similar project conducted in the Operating Room of the Montreal General Hospital (another MUHC hospital) provided a wealth of data (see Box 2).

Box 2 – The Benefits of an Operating Room Reorganization

An initial report published in the fall of 2000 by the provincial Health and Safety Association (Association de la santé et de la sécurité au travail de la santé et des affaires sociales), as well as a second published the following year by TRIAX Consulting, identified significant shortcomings in the organization and ergonomics of the Operating Room of the Montreal General Hospital (MGH). Many of these shortcomings originated with the Operating Room's supply chain, which included:

- ❑ More than 20 storage areas. A single product could be stored in more than one area, which resulted in an increase in stock levels.
- ❑ Stock outs during surgery, which forced Nursing staff to leave the Operating Rooms to retrieve the missing supplies.
- ❑ Storage areas located at a distance from Operating Rooms, increasing staff movements.
- ❑ The transporting of stock through corridors already congested with carts.
- ❑ Inadequate storage equipment that took up too much space and contributed to the risk of work-related injuries. In fact, according to a survey conducted in the fall of 2000, 75% of Nursing staff reported suffering regularly from back ache caused by handling heavy items.
- ❑ The large quantities of stock coupled with inadequate storage space, resulting in two Operating Room suites being converted to storage areas.

This arrangement brought the time required to manage the Operating Room's supply chain (including Day Surgery) to more than 20,300 hours, resulting in annual costs of close to \$590,000. More than half of this time involved Nursing staff and prompted a number of experienced personnel to leave their jobs.

The measures proposed by the TRIAX Consulting team included centralization of stock in a single zone, deployment of bar codes for all supplies (stocked and non-stock items) combined with a Double Bin Replenishment System, transition to high-density storage equipment, and implementation of case picking by Materials Management staff – in short, measures similar to those introduced at the RVH. On a financial level, all of these measures, once implemented, would lead to:

- ❑ Net productivity improvements in labour costs of more than \$217,000, or 37% of the value of the internal supply chain, including \$386,000 saved in Nursing time.
- ❑ The redeployment of two Operating Room suites that had previously been used as storage areas.
- ❑ A gradual reduction in stock levels, representing non-recurring savings of \$400,000 spread over four years, according to fiscal 2000-2001 data.

Conclusion:

The reorganization of the Operating Room of the Royal Victoria Hospital was a unique experience, given the environment of crisis within which the project was carried out and the need to maintain service to the unit's patients. Despite these difficult circumstances, the Operating Room was decontaminated and reorganized, with new logistics processes implemented that almost completely eliminated the need for Nursing staff to involve themselves in the management of supplies.

For the Associate Director of the Materials Management Service, to a certain extent the crisis became a success factor. The situation created an environment where all of the stakeholders involved shared a common goal and strived to assure the project's success, which in turn fostered a spirit of compromise among the decision makers. Moreover, the administrative resources required were allocated with little hesitation.

While the project's decision makers could have elected to implement traditional solutions, they instead opted for highly innovative storage and replenishment systems and decided to assign additional responsibilities to Materials Management Services. With respect to these innovations, the RVH experience underscores the necessity of involving both healthcare and logistics professionals in such projects. The implementation of a Double Bin Replenishment System demands in-depth knowledge of the products used, and the expertise of Nursing staff is therefore both essential and irreplaceable.

When changes of this magnitude are introduced, the credibility of Material Managers is a key success factor in establishing sound relationships with Nursing staff (McKusick, 1986). The work done by Stock Room Clerks assigned to the Operating Room is therefore intended to stabilize the system prior to proceeding with more extensive improvements. It is essential to achieve a certain number of successes before undertaking new projects.

And finally, bringing together multiple skill sets not only raises the level of discussions, but also assures greater acceptance of the changes by users. This pooling of knowledge can be conducted both internally and with external help. There is no question, however, that consulting external experts allows the organization to expand its knowledge base and add value to its processes.

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