PART I

STRATEGY
LEARNING OBJECTIVES

➤ Understand why the management of operations and supply chains is important to the health care profession.

➤ Understand the role that purchasing, logistics, and vendor-managed inventory play in health care.

➤ Understand the meaning of efficient and effective operations and supply chain management.

(Continued)
See how the management of operations and supply chains relates to health care.

Understand the competitive dimensions of operations and supply chain strategy within health care.

Know what measures are used to evaluate the operations and supply chain management function.

Understand what the bullwhip effect is and how it applies to health care.

HEALTH CARE OPERATIONS AND SUPPLY CHAIN MANAGEMENT

The operations and supply function in hospitals has historically been viewed as having a limited scope, many times falling under the term materials management. However, over the past decade progressive hospitals have adopted and adapted the concepts of the broader topic of supply chain management (SCM). The combination of operations with supply chain management presents a more expansive and robust view than the subarea of materials.

Definitions of Supply Chain Management

Experts in the field often define supply chain management as the sum total of parties involved, directly or indirectly, in fulfilling a customer request.

Two of the most prominent professional supply chain management organizations in the world define supply chain management as follows:

The Institute for Supply Management defines supply management as “the identification, acquisition, access, positioning, management of resources and related capabilities the organization needs or potentially needs in the attainment of its strategic objectives.”
The Council for Supply Chain Management Professionals defines supply chain management as the function that “encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers and customers.”

These definitions are very broad and contain customer-centric concepts, as they also consider new product identification and development, marketing, operations, distribution (channels), finance, and customer service as part of supply chain management.

These definitions can be applied to health care operations and/or systems to include the flow of products and associated services to meet the needs of the health care provider and system and the patients served.

**Operations and Supply Chain Management Applied to Health Care**

In turn, the nature of this book is quite different from the traditional operations text that may focus more on products and manufacturing from a perspective such as the automaker Ford, or a high-technology firm such as Hewlett-Packard, or a continuous processing company such as Alcoa.

This text addresses the broader picture of operations and supply chain management tasks: not only the sourcing of materials, but also forecasting demand, developing and employing simulation models, discussing quality management tools and techniques, and the management of projects within health care. All of these topics will be applied to the health sector. Knowledge of these tasks will assist the health care professional and act as a building block for operations and supply management excellence.

Given the unique nature of the health care profession, the hospital operations and supply chain manager most often has relationships with a wide variety of organizations that connect suppliers to the health care organization. These relationships extend to group *purchasing* organizations, distributors, third-party service providers, information managers, and transportation support staff.

**Health Care Operations and Supply Chain Management in Action**

It is said that when times are good, expansion plans, future investments, and revenue growth are the focus points in most industries. However, during down
times, all organizations scrutinize spending. Economic crises hit all industries, including the health care sector. Adjustments are made, such as private practices being closed, hospital operating margins being squeezed, and many nonclinical jobs getting cut.

So what do hard times mean for health care industry supply chain managers? It appears that in an attempt to usher in supply chain efficiencies and shape a healthier bottom line, clinicians, executives, and others are now more ready than ever before to listen to their supply chain managers.

It has been shown that supply chain managers’ importance has been heightened as a result of recent estimates showing that average hospital profit margins are down. It is very possible that health care supply chain executives at large health care organizations are responsible for hundreds of millions of dollars in spending per year. The best supply chain managers seek input for all levels in the health care organization, from physicians to nurses to pharmacists. Many times those employees demand products and services without any notion of potential costs or impacts to the operating atmosphere.

Of late, it appears that health care supply chain managers are beginning to look at other industries for assistance. Many health care organizations are looking to inject talent from those who have not been in the health care industry and can be tapped for new ideas.

The bottom line is sometimes summarized as follows:

- Executive leadership [is] beginning to include the supply chain as a key contributor to a healthy bottom line.
- Executives are looking for supply chain managers outside of the industry to run their health care supply chains.
- A shift from tactical to strategic models is occurring.
- As the supply chain becomes more efficient, supply chain managers are being asked to bring efficiencies to other spending areas of a health care network.

—From “Troubled Times Magnify Health Care Supply Chain Manager’s Role,” Knowledge@W.P. Carey
PURCHASING, LOGISTICS, AND VENDOR-MANAGED INVENTORIES

Supply costs are on average around 30 to 40 percent of total operating costs in most hospitals (Kehoe, December 2011 issue of Healthcare Facilities Management). In the recent past, many health care organizations were not focused on managing the supply chain, but relied on external entities called group purchasing organizations (GPOs) to negotiate all of their contracts (e.g., Novation and Premier).

Internal as well as external operations of a health care organization are encompassed by the logistics function. Externally, the distribution of health care products is a great challenge for the global logistics system. Firms such as Baxter, Cardinal, or even UPS act as third-party logistics providers (3PLs) since many health care organizations do not support their own logistics network. However, internally, health care logistics has organization-specific needs of purchasing, warehousing, transport logistics, and collaboration. Many health care organizations choose health care logistics software to help in these areas.

It can be said that the health care industry has been reluctant to follow the lead of manufacturing by adopting just-in-time (JIT) inventory and logistical systems. However, the health care industry has begun to understand the benefits of JIT. By using bar code technology of medical products for faster delivery, reduced medical errors, and prevention of fraud and abuse, health care professionals see tangible benefits. Using a health care logistics software system can cut operation costs and result in lower patient care costs. Streamlining operations with suppliers through effective use of e-commerce can result from applying health care logistics tools. Efficient health care logistics systems can also reduce internal labor costs.

The health care field is positioning itself for increased use of JIT inventory and logistical systems. In addition, review of the contractual agreements with GPOs and third-party logistics providers is paramount for the improvement in spend management. This can be witnessed anecdotally as those contracts become increasingly complex and tight budgets demand better control of costs. More health care organizations are being asked to isolate, track, and manage third-party spending (e.g., electronic invoicing and auditing thereafter). Also, more collaboration is occurring as those vendors bring solutions such as JIT inventory
management to the table. One manner in which JIT inventory management is being manifested in health care organizations is through the use of vendor-managed inventory systems.

The Vendor-Managed Supply Chain

Vendor-managed inventory (VMI) is one technique that has become popular for addressing the areas isolating and tracking inventory. VMI and VMI systems have been in use in the retail industry for a decade. VMI has the capability to forecast a hospital’s demand for supplies and can help eliminate the problem of overstocking costs. In turn, demand ultimately drives the product ordering and replenishment cycles. Hospitals should focus on supply demand management in particular.

VMI allows the supplier (typically a distributor) to respond to the hospital’s immediate supply needs as determined by the hospital’s own consumption data. Orders are generated on the basis of an economic order quantity (EOQ; covered in Chapter 15). EOQ takes into account factors such as safety stock, lead time, seasonality, and demand created by exceptional circumstances. As a result, the hospital is able to reduce its in-house inventory and lower its order management costs.

The VMI software usually resides with the health care distributor (e.g., Cardinal) because of the benefits that a distributor can gain from the economies of scale (i.e., running the VMI application across multiple health care facilities). The arrangement is also attractive to a distributor as a means to better understand its own demand for supplies and in turn more efficiently manage its own inventory and order processes.

EFFICIENCY, EFFECTIVENESS, AND VALUE

Technology investment, acquisitions, and major expansion are all ways health care professionals could enhance their current operation. However, innovations in operations and the supply chain tend to be reliable and are generally low-cost. Currently, those studying within the health care profession are well positioned to develop innovative operations and supply chain–related ideas.

This book provides the reader with the concepts and tools now being employed at the best health care organizations in the world. These concepts and
tools allow those organizations to develop efficient and effective operations and supply chain areas. Efficiency is defined as performing a task at the lowest possible cost or with the least amount of resources. One goal of an efficient health care facility is to provide a quality service by using the smallest input of resources possible.

Effectiveness, in turn, means doing the correct things to assist the customer/patient and bring the most value to the organization. Value could be profit if the health care organization is a for-profit entity, or value could be helping the most people possible if the organization is a nonprofit or not-for-profit entity.

As a health care provider tries to maximize efficiency and effectiveness at the same time, a conflict may be created between the two goals. This is a typical trade-off in the health care world, as providers wish to do the best for the most but are still constrained by limited resources. At a health care facility, being effective means helping as many patients as possible to get the proper health care. However, being efficient in that same arena means minimizing the amount spent with each patient and using the least amount of resources to help the patient.

Value comes from both of these goals being optimized. It may sound odd in a health care setting that we are talking about value, but think on this: What would happen if a patient went to a health care facility for an earache and got the best care ever but it took three days to actually be seen? The experience was highly effective but not efficient, to say the least. However, if a patient received attention very quickly but no one even looked in the patient’s ear regarding the pain, the experience would have been highly efficient but not very effective. The value for the patient would be low in each of these cases.

Health care professionals must provide value, and that value comes from the combination of effectiveness and efficiency within the health care organization. Smart management of resources, operations, and the health care supply chain can lead to high levels of value.

A Brief History of Health Care Supply Chain Management and the Association for Healthcare Resource and Materials Management

The Association for Healthcare Resources and Materials Management (AHRMM) began in the early 1950s as part of the American Hospital Association. Over the past 60 years, the Association has continually grown and reinvented itself to become the leading professional organization for the health care resource and
materials management field. A brief history is presented here to illustrate how the organization developed into a vital part of the health care supply chain industry.

- Early 1900s—The first health care group purchasing organization (GPO) is formed.
- 1929—Baylor University Hospital in Dallas, Texas, introduces the first monthly hospital insurance plan.
- 1940s—Employer-based health insurance grows as World War II begins.
- 1950—The Naval School of Healthcare Administration is established to provide training in health care administration and financial and materials management.
- 1962—AHRMM's first annual conference is held.
- 1975—AHRMM's name is changed to the American Society for Hospital Purchasing and Materials Management (ASHPMM) to more accurately reflect the emergence of materials management systems in the hospital industry.
- Early 1980s—The prospective payment system is instituted by Medicare.
- 1983—ASHPMM becomes the American Society for Hospital Materials Management (ASHMM) to reflect changes in the health care field.
- 1983—The term diagnosis-related group (DRG) is implemented.
- Late 1980s—Reduced reimbursements to health care providers lead to hospital consolidation, increased use of GPOs, and the development of vendor-managed inventory control programs.
- The mid-1990s bring the Efficient Healthcare Consumer Response (EHCR), the Health Insurance Portability and Accountability Act (1996), and the Ambulatory Payment Classification Act (1999).
- 1998—ASHMM officially changes its name to the Association for Healthcare Resource & Materials Management (ARHMM).
- 2000—The Certified Materials & Resource Professional (CMRP) program is introduced.
• Early 2000s—More health care organizations begin developing relationships with third-party logistics providers (3PLs) and implementing collaborative planning, forecasting, and replenishment (CPFR) agreements with suppliers.

• 2009—AHRMM continues its mission to partner with other health care professionals, and in conjunction with GS1 Healthcare US creates and releases the “Standardization Stat!” video promoting awareness of the issues of standardization in the health care supply chain.

—From the Association for Healthcare Resource & Materials Management website (www.ahrmm.org)

Why Study Health Care Operations and Supply Chain Management?

Besides the notion of creating value by optimizing both effectiveness and efficiency, there are five other reasons to study health care operations and supply chain management.

1. Approximately 45 percent of a health care organization’s total operation expenses are made up of supplies, pharmaceuticals, consumables, and physical plant (e.g., equipment, transportation networks, etc.). With that said, it is critical to understand the operational and supply chain aspects of the organization to ensure effective and efficient management of those expenses.

2. A health care education is incomplete without an understanding of modern approaches to managing health care operations and the supply chain. There is much talk of health care reform, and at the operations and supply chain management level these initiatives draw heavily on total quality control principles, process design and reengineering, statistical data analysis, and inventory control, to name four.

3. The underlying concepts of operations and supply chain management provide a systematic method of observing, documenting, and analyzing health care organizational processes.

4. Operations and supply chain management tools interface with many other functions within the health care industry. All health care professionals, whether doctors, nurses, or administrators, must plan work, control quality,
and ensure productivity of the individuals under their supervision. All health care employees, from surgeons to janitorial staff, must know how to effectively and efficiently perform their jobs.

5. Career opportunities in the health care profession are ever expanding, and now more than ever before, health care employees are being asked to perform their jobs more efficiently and effectively. The management of operations and the supply chain becomes even more important with this new emphasis.

**COMPETITIVE DIMENSIONS OF HEALTH CARE**

Although not quite as broad as, say, retail, health care customers do have choices regarding the services and products they purchase. Obviously health care customers include patients, but customers can also include vendors and third-party providers. In the case of patients, some primarily listen to their family doctor or health care provider whereas others may purchase services from third-party providers (e.g., walk-in or doc-in-the-box services). Some patients are interested in cost only, and certain health care organizations may cater to these customers. In contrast, vendors or third-party providers may not have as broad a choice in where their services are needed. They may have to compete directly on price or speed of delivery, both of which may be dictated by another party (e.g., a hospital, an in-home patient, the state, or U.S. government). In fact, there are a number of competitive dimensions that health care providers must address.

Health care providers do establish *competitive dimensions*, which may include these four areas:

1. Cost or price—lower-priced or free services such as a free clinic.
2. Quality of service—delivery of outstanding services such as the Mayo Clinic.
3. Speed of delivery—delivery of the service quickly such as a minor medical facility.
4. Support after the service—excellent support after the service has been rendered, such as technical sales help regarding medical equipment (e.g., insulin pumps).
Competitive Dimensions of Health Care and Trade-Offs

It becomes apparent after perusing the competitive dimensions that it may be impossible for one health care organization to excel simultaneously on all the dimensions at once. This notion is central to the concept of operations and supply chain strategy. Trade-offs exist between any and all of these competitive dimensions. In turn, the organization must decide on which performance parameters are critical to success and concentrate resources on those areas.

A good example of this type of trade-off is when a health care organization wishes to focus on speed of delivery (i.e., see patients as quickly as possible) but also wants to be flexible (i.e., be able to see any and all types of patient problems). A trade-off usually must be made. Minor medical facilities may do a better job at providing speedy service but they cannot handle major medical issues such as brain surgery.

Likewise, high quality is generally traded off with lower cost. A strategic position is not sustainable unless an organization makes compromises with other positions. The notion of a trade-off is just this: when more of one item necessitates less of another.

Some health care organizations have attempted to provide choices to their patients by straddling different dimensions. For example, a large trauma one health care facility (i.e., full service, high quality) may build an off-site emergency department to handle less severe or acute patient problems and in turn deliver on speed or lower cost. However, organizations must be aware that straddling is a risky strategy and many ill-fated attempts have been abandoned (e.g., discount LASIK eye centers delivered on speed and price, but were flawed regarding post-op support).

Measures to Evaluate the Operations and Supply Chain Management Function

Although health care has not been put under the microscope as minutely as have publicly held business entities, that time has almost come to an end. Monitoring, assessing, and improving a health care organization’s performance, specifically in regard to operations and supply chain management, are becoming commonplace in today’s competitive world.

Key performance indicators (KPIs) are data-driven measures that can range from improving patient safety practices to reducing variability of supply utilization...
to reducing overall health care costs. KPIs are an important part of taking a proactive approach to running a health care organization. KPIs are generally used to benchmark a health care provider’s performance compared to other similar providers in the marketplace.

It can be said that when the organization understands exactly what care is being provided by whom, what resources are consumed, the total cost of that care, and the resulting outcomes, then an organization can establish benchmarks, capture feedback, and implement changes to achieve continuous improvement in patient outcomes as well as cost control. The following list gives a number of KPIs for a typical health care organization. KPIs are discussed in more detail in Chapter 11 on lean concepts in health care.

Standard KPIs may include:

- In-house infection rates
- Prime-time utilization
- Estimated case time duration and accuracy
- Emergency room throughput
- Mean emergency room wait time
- Average inventory and inventory turns

**THE BULLWHIP EFFECT IN HEALTH CARE**

The *bullwhip effect* can be defined as the instance where orders to a supplier tend to have larger variance than sales to the buyer (i.e., demand distortion), and the distortion becomes amplified (i.e., variance amplification) as it propagates upstream in the supply chain.

The inability of the health care industry to predict demand leads to a wide range of these types of upstream inefficiencies. In general, inventory piles up, inventory turns go down, inventory becomes obsolete, and in turn costs increase. The health care industry has not fully investigated the cost of these inefficiencies.

For example, in a manufacturing setting the bullwhip effect results in higher levels of inventory and shortages. However, in the health care industry it leads to lower levels of throughput, higher operating costs, and longer patient waits. In
turn, the causes of these problems must be addressed by employing initiatives and strategies for minimizing the bullwhip effect.

**Strategies for Minimizing the Bullwhip Effect**

Strategies for minimizing the bullwhip effect can be categorized in five areas: reduction of uncertainty, reduction of variability, development of strategic partnerships, realignment of incentives, and improved coordination within the supply chain. Each of these areas is detailed next.

1. **Reduction of uncertainty.** Reducing uncertainty throughout the supply chain is a main driver of minimizing or even eliminating the bullwhip effect. Timely and consistent data delivery assists in eliminating the duplication of effort.

2. **Reduction of variability.** The use of good forecasting methods alleviates variability. Minimizing variability helps reduce the overall bullwhip effect.

3. **Development of strategic partnerships.** Strategic partnerships have the ability to change the manner in which information is shared. In turn, better information can help minimize the bullwhip effect. In the case of hospitals, the hospital administration could forge strategic alliances with medical specialists. Although this might not eliminate the bullwhip effect, it will in part reduce the effect.

4. **Realignment of incentives.** Incentives are pervasive throughout the supply chain. In addition, each supply chain entity appears to be evaluated and rewarded based on different criteria. This disparity leads to a lack of coordination and meaningful information sharing and in turn exacerbates the bullwhip effect. These evaluation and reward systems should be modified to stress cooperation across stages.

5. **Improved coordination within the supply chain.** In points 1 to 4 the themes of reducing uncertainty and variability and improving information exchange play into the final area of improved coordination within the supply chain. Improved coordination across the supply chain has the ability to bring about improvements in the other four areas and in turn improvements in the bullwhip effect.
Table 1.1 summarizes the major causes of the bullwhip effect, notes some contributing factors to the bullwhip effect, and recommends some remedies for minimizing the effect.

**SUMMARY**

This chapter has discussed the overall importance of operations and supply chain management to the health care profession. It proposed definitions of supply chain management, including several by the most prominent professional supply chain groups in the world. It described operations and supply chain
management applications to the health care industry. Nachtmann and Pohl 2009 provide additional information on the state of logistics in health care; Schneller et al. 2006 provide a strategic overview of managing health care supply chains.

Furthermore, the roles of purchasing, logistics, and vendor-managed inventory (VMI) were detailed. The chapter discussed vendor-managed supply chains along with the software that accompanies VMI.

The notions of efficiency, effectiveness, and value were reviewed, as well as reasons to study health care operations and supply chain management, such as the large impact on operating expenses, understanding how operations and supply chain management interface into the bigger picture, documenting and analyzing health care organizational processes, and finally career opportunities.

Competitive dimensions of health care were given. Cost, quality, speed, and support may all be advantages that health care organizations compete on. The chapter discussed trade-offs between and within each dimension.

Key performance indicators (KPIs) such as average inventory or mean emergency room wait time are examples of measures to evaluate operations and supply chain management within an organization.

Finally, the bullwhip effect was defined and related to the health care industry. The chapter concluded with strategies for minimizing the bullwhip effect, as well as causes and contributing factors.

**KEY TERMS**

- bullwhip effect
- purchasing
- competitive dimensions
- supply chain management
- key performance indicators
- vendor-managed inventory
- logistics

**DISCUSSION QUESTIONS**

1. Discuss what health care supply chain management is and how it compares to operations.

2. Discuss why operations and supply chain management must be studied at the same time.
3. What role does purchasing play in a health care organization?

4. What role does vendor-managed inventory play in a health care organization?

5. Discuss efficiency, effectiveness, and value regarding health care organizations.

6. What are the competitive dimensions of operations and supply chain management in a health care organization?

7. What measures should be used to evaluate the operations and supply chain management functions within a health care organization?

8. What is the bullwhip effect, and how does it apply to health care?

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**MINICASE: THE BULLWHIP EFFECT IN HEALTH CARE ORGANIZATIONS**

Blue County Memorial Hospital (BCMH) is one of the largest health care organizations in eastern North Carolina. It serves the eastern one-third of North Carolina and maintains a 500-bed facility offering 24/7 acute medical and surgical care. The health care facility has over 30,000 patient admissions a year, and its average length of stay (LOS) is about four days.

The health care facility is organized by specialty and staffed with qualified MDs, physician assistants (PAs), nurses, and technicians. BCMH contains 12 operating rooms, all with state-of-the-art equipment, numerous wards for postoperative care, and related ancillary services (rehabilitation, testing labs, etc.). The operating room department has a large challenge in that it must manage and allocate equipment and staff so that surgeries can be performed effectively but also in the most efficient manner possible. In all, the assignment of equipment and staff is a difficult job.

State regulations require threshold levels for nurse-patient ratios, and not meeting these thresholds may lead to underutilization of available capacity. In turn, the size and mix of staff are critical decisions for the workforce planners. Overstaffing, understaffing, or unbalanced staffing leads to issues with quality of care and increased patient cost. BCMH meets its staffing requirements with a mix of permanent staff and an on-call group of part-time staff available on short notice. There is also temporary staffing that occurs for nurses with six-month to one-year contracts. Overall, the hospital’s staffing needs have been met by
60 percent permanent staff, 35 percent temporary staff, and 5 percent on-call staff.

BCMH provides services to patients, and in turn those patients, either through insurance or by direct payments, reimburse BCMH for services provided. Although many services are provided, surgery is one area where BCMH adds value and garners profits. However, surgery demands numerous resources, including equipment and staff (surgeons, nurses, technicians, etc.). BCMH is also responsible for preoperative care and postoperative care. Insufficient capacity in any area (surgery, postoperative wards, etc.) can lead to surgical procedures being turned away or to higher costs if accepted when over capacity.

Slotting is used for planning and scheduling purposes. Each area within BCMH is broken up in half-day slots, meaning there are 14 slots per week. Slot planning and scheduling is conducted about once a quarter (once every three months). A plan is developed in consultation with surgeons; demand for surgical procedures varies little from year to year, but the demand does have a seasonal component, making some quarters busier than others. In addition, some specialties have peak demands whereas other specialties have very stable demand.

The slotting and planning process also encompasses the staffing of nurses. The labor cost of nurses for surgery is one of the largest and most controllable operating costs. Nursing staffing plans are prepared each month for a month’s time frame and two weeks in advance. The nursing schedule is frozen one day in advance and then resource requirements are matched based on the upcoming surgeries. This type of planning is efficient for day-to-day operations but gives limited flexibility in terms of the permanent staff, temporary staff, and on-call staff. The nurse scheduler must many times rely on temporary staff or on-call staff when demand changes occur in the short term. Subsequently, BCMH must meet its nursing needs from outside, and in monetary terms the outside staff costs more, as higher rates are paid to the outside staff. In addition, the staffing in preoperative and postoperative wards is done in a similar fashion.

Is it possible that BCMH could experience the bullwhip effect? What items can be identified that would exacerbate the bullwhip effect at BCMH? How does variability from all areas impact BCMH? Can the use of temporary workers benefit BCMH but also be detrimental at the same time?
REFERENCES