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# Challenges and Opportunities of Health Care Supply Chain Management in the United States

Dean Elmuti, Grace Khoury, Omar Omran, & Ahmed S. AbouZaid

This article explores current supply chain management challenges and initiatives and identifies problems that affect supply chain management success in the U.S. health-care industry. In addition, it investigates the impact of health care supply chain management (SCM) initiatives on the overall organizational effectiveness. The attitudinal results, as well as the performance results presented in this study support the claim of health care proponents that the SCM allows organizations to reduce cost, improve quality, and reduce cycle time, and leads to high performance.

**KEYWORDS** health care supply chain, challenges, performances, effectiveness

The supply chain can be defined as the lifecycle processes or route that items travel through from manufacturer to the point of use and payment.

A supply chain consists of physical, informational, financial, and knowledgeable flows whose purpose it is to satisfy end-user requirements with products and service from multiple, linked supplies (University of Maryland Medical System, 2008). Managing the chain of activities and events in this process is called supply chain management (SCM). Effective management must take into account coordinating all of the different pieces of this chain as quickly as possible without losing any of the quality or customer satisfaction, while keeping costs down (Elmuti, 2002). SCM (SCM) is seen as a total system approach, which increases the efficiency of the entire business process, beginning with the raw material and ending with the finished product delivered to the customer (Stevenson, 2007).

In health care supply chains, the principal participants include manufacturers (drugs, medical equipment, and hospital medical supplies), distributors, medical service provisions, medical groups, insurance companies, government agencies, employers, government regulators, and users of health care services (Burns & Lee, 2008). The ultimate goal of the supply chain is to deliver materials and information in order for patients to receive quality care. An effective supply chain brings in the right materials and information at the right time, with the right quantities, to the right place. This can have a direct, positive impact on patient care by reducing risk and errors, eliminating operating room waits and cancellations, and reducing the length-of-stay (Shumaker, 2006; Singh, 2006; Mantone, 2007).

SCM in health care is a very important necessity that must be implemented in order for U.S. citizens to receive optimal service at a reasonable cost. However, there are barriers to SCM in health care, such as a lack of executive support, misaligned or conflicting incentive, need for data collection and performance measurement, limited education on supply chain, and inconsistent relationships with group

purchasing organizations and other supply chain partners. (Mckons-Sweet, Hamilton, & Wills, 2005).

It is against this background this research is set. More explicitly, this study explores current health care SCM issues and practices and identifies problems that affect the success of supply chain initiatives in the health care industry. In addition, it investigates the impact of these supply chain initiatives on the overall organizational effectiveness. This article is organized in the following manner: the next section reviews the SCM literature and develops the research questions. The third section presents the methodology used in this study. The fourth section highlights the overall results of the study. The fifth section presents detailed results to answer specific questions. And, the final section summarizes organizational improvement in performance, productively, and quality, followed by practical implications and conclusions.

## LITERATURE REVIEW

A significant amount of literature described the use and effectiveness of SCM in manufacturing industry sectors in our economy (Stevenson, 2007; Youngdahl, 2000; Gryna, 2001). However, the implementation of SCM in the health care sector lacks description and clear frameworks for analysis. Compared to manufacturing, the health care industry is way behind in the effective utilization of the benefits that could be derived from effective SCM (Rai, Patnayakuni, & Seth, 2006; Sing, 2006; Long, 2005).

Health care expenditures in the United States are currently about 18% of the GDP, and this share is projected to rise sharply (Buntin & Cutler, 2009; History of the Healthcare Information and Management Systems Society, 2009). Many believe that it is time to redesign our health system to reduce inefficiency and waste and to improve health care quality. One of the approaches for this problem is effective and efficient SCM. Past research progressed along several paths. First, some researchers focused on health care industry characteristics as an explanation for SCM activities and outcomes (Burns & Lee, 2008; Mantone, 2007; Buntin & Cutler, 2009). According to this perspective, SCM projects were undertaken to reduce health care costs and to respond to market place and customer demands. Burns and Lee (2008), for instance, suggested that the HSCM is undertaken for purposes that have a large impact on an organization's characteristics and bottom-line, although more distant purposes such as strategy, profitability, and competitive advantage may have been the rationales for the more direct reasons.

Other researchers have focused on barriers and challenges to health care supply chain efforts (Mckons-Sweet et al., 2009; Nachtmann & Pohl, 2009; Kanof, 2003). For example, Nachtmann and Pohl (2009) identified several challenges to initiatives such as a lack of resources to implement data standards, lack of quality information, conflicting goals across supply chain activities, data inaccuracy, and others. Burns and Lee (2008) recommended the use of group purchasing organizations (GPO) as a

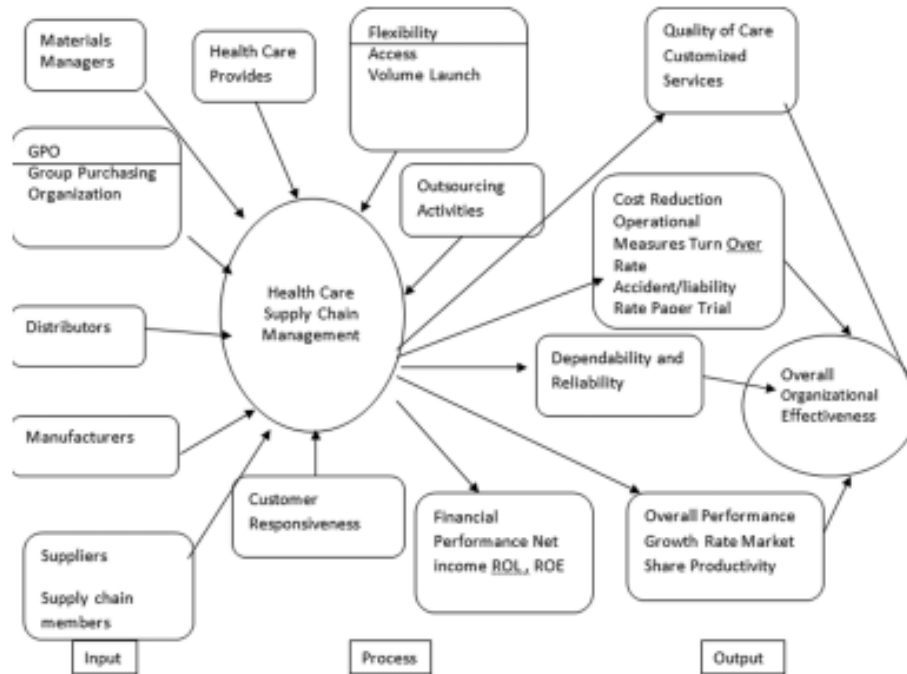
tool to negotiate vendor contracts and reduce costs. Their findings concluded that GPOs succeeded in reducing health care costs by lowering product prices, particularly for commodity and pharmaceutical items. Alliances also reduce transaction costs through commonly negotiated contracts and the establishment of price ceilings in these contracts beneath which hospitals negotiate on their own (Kanof, 2003).

Other researchers have focused on supply chain performance measurement (Narasimhan & Jayaram, 1998; Hewitt, 1999, Beaman, 1999). For example, Beaman (1999) identified three types of performance measures as necessary components in any supply chain performance measurement system: Resource measures, output measures, and flexibility measures. Hewitt (1999) recommended customer satisfaction, return on trading assets, and flexibility of SCM activities as the measurements for supply chain performance. From a difficult perspective, Christopher (2000) suggested that one of the keys to success is the creation of an agile supply chain on a worldwide scale. Agility implies rapid strategic and operational adaptation to large-scale, unpredictable changes in the business environment focusing upon eliminating the barriers to quick response. Kowalski (2009) suggested that another approach to success is to adopt a strategic approach to health care SCM. A common mistake of the health care industry is the distinction between products and services, which may contribute to mismanagement of the health care supply chain. Despite its importance, theoretical development, and popularity in the business and academic press, there is little empirical research that clearly links health care supply chain initiatives to overall organizational effectiveness and investigates their impact as a whole among health care industry participants. Consequently, more investigations are needed to describe the state of health care SCM and identify existing challenges and opportunities for quality improvements in health care settings.

## RESEARCH FRAMEWORK

The preceding discussion provides a basis for the research framework. It identifies several measurement variables including cost, dependability, flexibility, quality, outsourcing, and supplier's capacity. The casual linkage among these variables is assumed to influence organizational performance and customer responsiveness. The research model views these variables as important elements of an effective HSCM system and is linked to organizational effectiveness as shown in Figure 1.

The claims by proponents of health care SCM suggested several research questions that guided this investigation to the relationships between health care SCM initiatives and organizational effectiveness.



**FIGURE 1** Conceptual model for effective and efficient implementation of the health care supply chain.

Nine research questions were formed and used to guide this investigation of such impact:

RQ1: To what extent does the degree of familiarity and utilization of health care supply chain initiative vary across the health care industry?

RQ2: Why do organizations undertake health care supply chain programs or initiatives?

RQ3: What are the major health care SCM initiatives?

RQ4: What are the challenges to implementation of successful health care supply chain initiatives?

RQ5: To what extent is the degree of collaboration among health care supply chain participants (manufacturers, suppliers, GPOs, distributors, providers)?

RQ6: Do health care SCM initiatives achieve their stated objectives of improving organizational effectiveness?

RQ7: What factors are associated with the success or failure of health care SCM initiatives?

RQ8: Will health care professionals report positive assessments of HSCM initiatives to the overall organizational effectiveness?

RQ9: Do outsourcing activities and decisions within the health care SCM system affect the organizational objectives of lowering cost, higher quality, flexibility, and dependability?

## METHODOLOGY

In order to answer the research questions, a survey of health care SCM was developed and distributed to 700 organizations involved in health care supply chain activities throughout the United States. In addition, this research involved a qualitative study employing in-depth interviews of 30 health care supply professionals who are working for 20 medical centers from all major sectors. Respondents were asked to provide their perceptions of characteristics of a successful health care supply chain, barriers to implementation of a supply chain, and to assess the impact of implementing a health care supply chain on the overall organizational performance and effectiveness in their organizations. The names of the firms were generated randomly from a computer database known as “compact disclosure,” Directory of the Association for Health Care Resource and Materials Management, and Medical Group Management Association (MOMA).

Study participants were randomly selected to represent a range of organizational sizes and a variety of positions within the organizations. Survey respondents included hospital executives, materials managers, GPO executives, or group purchasing organizations, or hospital purchasing alliances, distributors, manufacturers, industry experts, and health care providers. Surveys lasted for 30 minutes using telephone calls, traditional mail, online or through the web systems to collect data from respondents. Several reminders and postcards and notes were sent to respondents to encourage respondents to complete the surveys within 2 months. This study was conducted from August 2009 to March 2010. A total of 240 questionnaires were returned for a response rate of about 34%. Thirty questionnaires were not acceptably completed, thus reducing the response rate to 30%. The remaining 210 were usable questionnaires, and these responses were analyzed in this study.

## MEASURES

To measure organizational effectiveness, the author used a Likert’s profile of organization characteristics because, unlike other potential measures, it allowed additions to be made to the questionnaire in order to assess overall effectiveness with specific new programs or initiatives such as health care SCM initiatives (Likert, 1973). Several variables were identified as being significant for the purpose of this study. First, there were the elements used to measure the independent variables—health care SCM initiatives with measures (derived from Burns & Lee, 2008; Nachtmann & Pohl, 2009; Geyskens, Steenkamp, & Kumar, 1999) that included health care SCM dimensions such as drivers, enablers, and related activities measures. Health care SCM involves tasks, activities, events, processes, and interactions undertaken by all suppliers and all end users in the consumption of a specific good or service (Gryna, 2001). The second variable focused on the elements used to measure the dependent variable—organizational effectiveness that included productivity (cost savings, efficiency, cycle time), quality (customer service and percentage of defects), market performance (market share, return on investment, return on sales), and dependability. Some of these measures of effectiveness are

used by several authors (Youngdahl, 2000; Hewitt, 1999; Kowalski, 2009; Likert, 1973). See Appendix.

The Likert instrument has been shown to have acceptable levels of reliability and validity across a variety of settings. This study used a 5-point, Likert-type scale (5 = most effective level; 1 = least effective level). All reliability tests were conducted for indices of organizational performance to enhance their creditability. The coefficient alpha for this study was above 0.78. Most researchers consider an alpha at 0.70 to be an acceptable criterion for adequate scale reliability (Nunnally, 1978; Stockburger, 2007). In addition to the scales described previously, basic demographic questions including gender, age, job status, industry type, sizes of the firms by number of employees, and annual sales were included in the survey. Furthermore, several characteristics of responding firms were compared between earlier and later respondents to provide an indication of nonresponse bias. This analysis showed no significant differences in the two samples. This result offered some assurance about the representative of the responding firms and reliability of the sample of this study.

## ANALYSIS AND RESULTS

### SCM Familiarity, Usage, and Maturity Level

RQ1 in this study asked participants about their familiarity and utilization of health care SCM initiatives. The results indicated that about 38% of the organizations surveyed reported that they were familiar with the health care SCM concept. About 62% of the respondents (130 organizations) reported that they did not have an existing health care SCM program. The remaining 80 organizations reported the duration of their SCM programs to be “less than 1 year” (12 firms), “less than 2 years” (16 firms), and “3 or more years” (22 firms). These organizations have adopted a health care SCM concept in part to include the area of inventory control, manufacturing and GPOs cooperation, managing transportation, logistics, facilities, information systems, and outsourcing. Many of these companies are working to improve on only one piece or area of the total supply chain. Fewer than 37% (30 firms) of survey respondents indicated that their organization has mature or well defined and “integrated” supply chain systems with the majority of these being GPOs or health care providers. At the same time, 63% (50 firms) of respondents indicated their organization has an immature supply chain system (loosely defined, unstructured, limited cooperation between departments within their organizations, and limited cooperation with external vendors).

### Why SCM Projects Are Undertaken

RQ2 asks: Why do organizations take the initiative of health care SCM? The major general reasons for undertaking supply chain projects identified by the survey results were to achieve cost savings, improve product traceability, enhance

customer responsiveness and services, increase productivity, profitability, maintain sufficient flexibility, improve invoice accuracy, reduce cycle time, and provide better evolution of supplies and vendors performance. These findings complement the previous studies (Shumaker, 2006; Mantone, 2007; Smith, Lacy, & Justice, 2008; Burns & Lee, 2008; Buntin & Cutler, 2009) and suggest that health care SCM is undertaken for purposes that have a large impact on the organization's bottom-line, although more distant purpose such as strategy, profitability, and competitive advantage may have been the rationales for the more direct reasons.

## HEALTH CARE SCM ACTIVITIES AND INITIATIVES TO IMPROVE PERFORMANCE

Health care supply management projects target specific types of activities or initiatives (see Table 1). The main initiatives identified by the survey respondents were standardize internal procurement procedures, centralize supply chain data and inventory control, better product-equipment traceability, limit duplication of core activities, utilize various outsourcing activities, share information, engage in strategic alliances, and more efficient delivery systems. These findings support recent studies on health care supply chain activities and answer RQ3 in this study (Giroso, Meili, & Scoville, 2005; Nachtmann & Pohl, 2009; Kuehn, 2005).

## BARRIERS AND CHALLENGES TO HEALTH CARE SUPPLY CHAIN EFFORT

RQ4 of this study asked participants to identify barriers to health care supply chain initiatives. Several barriers and challenges identified by the health care professionals participating in the survey were a lack of resources to implement data standards (data standards increase compatibility and reduce redundancy), conflicting goals across supply chain activities, data inaccuracy, duplication of core activities, lack of information technology, lack of training for supply chain professionals, lack of trust and partnerships, and high variation in customer and client preferences and demand (see Table 2). These findings complement and support recent studies on health care supply chain barriers (McKons-Sweet et al., 2009; Nachtmann & Pohl, 2009; Burns & Lee, 2008; Buntin & Cutler, 2009).

## Collaboration Among Health Care Supply Chain Partners

RQ5 in this study asked participants about the level and degree of collaboration that existed between GPOs, suppliers, and distributors. And, the lowest collaboration was between health care providers and other health care providers. The providers in this study indicted institutions to improve their own supply chain performance/effectiveness. For organizations with limited information system capabilities, GPOs and distributors can add value by providing accurate and timely data to enhance decision making and planning. Of course, GPOs' incentives often do not encourage them to share information with other supply chain players. For example, common product identification would allow customers to easily compare prices across competitors (McKons-Sweet et al., 2005).



**TABLE 1** Health Care Supply Chain Activities or Initiatives to Improve Performance

Activities or initiatives	% of providers/ hospital executives	% of materials managers	% of GPO executives	% of distributors	% of manufacturers	% of industry experts
Standardize internal procedures to reduce data integrity errors and fill rate, picking accuracy	62	60	40	53	43	45
Centralize supply chain data (data base management)	60	55	42	46	40	42
Better management of product utilization (inventory control)	54	62	46	56	42	40
Better product-equipment traceability (ordering and delivery management)	58	68	45	54	44	38
Techniques to improve invoice and billing accuracy (according and auditing)	60	50	40	42	46	36
Limit duplication of core activities	58	50	34	46	40	35
Sharing information with all levels of the supply to chain partners	40	68	58	48	30	38
Establish better suppliers, vendors performance measurement (bench marketing against other suppliers)	45	52	38	40	32	30
Engage in strategic alliances with health care providers	60	58	58	46	40	30
Better management of shipping/receiving activities	58	60	52	56	38	30
Management of transportation and transfer activities and delivery means	56	62	43	58	43	35
	58	61	44	47	40	60

## Causal Linkages in Health Care Supply Chains and Performance-Effectiveness Dimensions

RQ6 asked whether the health care supply chain initiatives in this study achieved the stated objectives of improving efficiency and flexibility to accommodate volume and schedule fluctuation, responsiveness to customer, client needs, dependability, quality of products and services, and reduce cost and improve overall performance and effectiveness. The relationships between health care SCM and organizational performance/effectiveness were accomplished by using a regression analysis to evaluate the dependence of measures of organizational performance/effectiveness on health care SCM dimensions. The regression values indicated that 42% of the variance in productivity, 48% of the variance in efficiency, 36% of the variance in quality, 52% of the variance in flexibility, and 47% of the variance of the financial performance are explained by linear regression on the SCM dimensions. These findings complement previous studies (Narasimhan & Jayaram, 1998; Rai et al., 2006; Russel, 2007; Wicks, Visich, & Li, 2006) that found a positive relationship between SCM activities and performance/effectiveness. In addition, they point to a positive relationship between measures of integrated health care supply chain initiatives and organizational functions (such as manufacturing, GPOs, distribution, health care providers, information systems, human resources, and finance).

### Relationship Between Outsourcing Decisions and Performance

The relationship between outsourcing decisions and supplier power and organizational performance within these integrated health care supply chains was examined through the use of multiple regression analysis. These results point to a positive relationship between measures of outsourcing decisions and supplier power and the organizational performance, as reflected in the multiple regression ratios. The results show the variations (62% in efficiency cost/unit price, 35% in quality, 52% in flexibility, 46% in dependability, and 62% in overall performance) as explained by linear regression for the outsourcing decisions and supplier power dimensions. The F ratios indicate that these linear associations are statically significant at  $p > .05$ . The causal link between outsourcing decisions and organizational performance was statistically significant confirming prior expectations and complementing previous studies (Stevenson, 2007; Chase, Jacobs, & Aquilina, 2001). The study points to the positive impact of outsourcing decisions and supplier power on the organizational performance in terms of low cost, high quality, flexibility and expendability, thus improving competitiveness, profitability, and overall effectiveness. These findings provided positive responses to RQ9.

## SUMMARY AND DISCUSSION

Several significant findings emerged as a result of this study. First, the altitudinal results presented in this study provide support for the claims of health care SCM proponents that health care SCM allows companies to reduce costs, improve quality, increase productivity, reduce cycle time, and improve

**TABLE 2** Barriers and Challenges of Health Care Supply Chains

Barriers and challenges to supply chain performance	% of providers/ hospital executives	% of materials managers	% of GPO executives	% of distributors	% of manufacturers	% of industry experts
Lack of data standards due to lack of resources	78	70	68	64	60	78
Quality of information	72	70	71	70	70	70
Conflicting goals across supply chain activities	64	62	65	65	68	68
Data inaccuracy	60	58	60	62	60	65
Duplication of major core activities	66	62	52	50	50	68
Lack of integrated IT systems	70	70	65	65	60	68
Lack of performance measures to match cost to specific output	68	65	64	62	58	70
Lack of knowledge and training for supply chain professionals	70	68	62	60		
Separation between procurement, payers, and clinicians	76	66	58	56	56	70
Privacy and regulatory compliance	74	65	52	50	50	74
Lack of trust and partnerships	68	66	66	68	68	68
Lack of long-term commitment	62	60	54	52	52	58
Lack of flexibility to respond to change	69	64	66	60	60	68
High variation in customer and client preferences and demand	60	62	78	77	70	78

organizational performance. Health care SCM, in this sense, is beneficial to organizational effectiveness.

The performance measures clearly indicate a positive impact on organizational performance. Participants in most of the health care SCM programs/initiatives improved the system efficiency rate, and enhanced overall productivity and return on investment.

Second, the link between these favorable changes in performance/ effectiveness and the health care SCM initiatives was supported by limited follow-up, in-depth interviews with key health care supply chain professionals in order to validate the research findings. All respondents indicated that the health care supply chain initiatives made a contribution to organizational productivity, quality, flexibility, and overall performance/effectiveness. The bottom line for these professionals was that the health care SCM initiatives were effective and worth having.

Third, the lack of data standardization, conflicting goals among supply chain partners, lack of performance measures, lack of integrated and linked information systems, and high variation in customer/client preferences and demands were among the most common challenges to achieving health care supply chain excellence faced by the study respondents regardless of their organization.

Fourth, a number of factors were also identified as key contributors of health care SCM success. These involved strategies to increase the integration of activities including functional areas information sharing, cooperation and collaboration throughout the supply chain channel, and establishing partnerships with key suppliers, GPOs, distributors, and health care providers.

## LIMITATIONS

There are obvious limitations to the self-reported data collected in this study and to the interview responses from the key health care supply chain professionals. Interview responses can contain inherent biases among individuals toward programs that they may have personally requested or supported. This study is limited by its small sample across a wide range of health care sectors and organization sizes. In addition, a survey methodology was also used which is susceptible to both misinterpretation and common method variance.

Despite these limitations, this exploratory empirical investigation provides a tentative avenue for increasing the probability of success of health care SCM initiatives and identifies areas that need further research. This study identified key dimensions of an integrated health care SCM and organizational performance/effectiveness dimensions in limited numbers of health care settings. Nevertheless, further work is needed in the health care industry in terms of size, nature, and location settings and to confirm outsourcing/ SCM/performance

linkages, and should incorporate suppliers, customers, and other shareholders into the measurement and analysis process, not just health care professionals.

## CONCLUSION

A by-product conclusion drawn from the study is that the introduction of a health care SCM initiative requires the introduction of multifaceted change in organizational operations. These changes include closely integrating the internal functions within an organization and effectively linking them with the external operation of suppliers, distributors, GPOs, manufacturers, and channel members. Both the attitudinal perceived results, as well as the performance results presented in this study, support the claim of HSCM proponents that the system allows organizations to reduce costs, improve quality, and reduce cycle time, and leads to productivity improvements due to reduced inventory and external failure costs. Lower costs, flexibility, and improved customer satisfaction, resulting in better service and organizational performance. These confirm prior expectations and complement previous studies (Narasimhan & Jayaram, 1998; Kuehn, 2005; Long, 2005; Wisner & Choon, 2000).

## IMPLICATIONS

Although this is limited in scope and focus study, the strong support for the proposed linkages in the research model have several major implications for practicing managers. Organizations must realize that health care supply chain initiative requires each stage of the supply chain to take into account the impact its actions would have on other stages. They should also realize that it takes commitment and skill to implement any health care SCM program to reap its rewards. The payoff can be substantial creating strong and well-integrated relationships with partners, GPOs, distributors, and suppliers not only in terms of needs, but also in terms of similar business domains, with the resulting choice maximizing business efficiency. This is particularly important in the area of supplier base, distribution channels, and the geographical area served. Common activities provide an increase in the opportunities of strategic compatibility and in sharing technical and managerial skills, which can lead to economies of scale and exploration of core competencies. Carefully managed strategies like a health care SCM system have the potential to aid health care professionals as they attempt to compete and increase their share organizational effectiveness, while contributing to the improvement of health care logistics.

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