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Supply chain risk management and hospital inventory: Effects of system affiliation

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ABSTRACT

In this study we examine the effects of horizontal inter-organizational arrangements on inventory costs for hospitals facing two key environmental conditions, namely the logistics services infrastructure where the hospital is located and the demand uncertainty for clinical requirements that a hospital experiences. Utilizing detailed data from hospitals in the State of California, we investigated the potential mitigating effects of affiliation with multi-hospital systems while controlling for service performance. We argue that these arrangements potentially influence managers' confidence in their supply chains, which in turn impacts inventory accumulation. Results suggest that while affiliation with local, regional, and national systems has mitigating effects under weak logistics services infrastructure, the mitigating effect is greatest for affiliation in local systems. The results also point to potential for improved operating efficiency with system affiliation, a factor that is often not considered in policy discussions regarding hospital system formation. Theoretical and managerial implications are discussed.

1. Introduction

Faced with increasing reimbursement and competitive pressures, many U.S. hospitals are focusing on reducing operating costs through internal process improvements. In this vein, hospitals have been giving growing emphasis to supply chain management. Hospital supply chain costs (i.e., supplies and purchased services) account for as much as 30 percent of a hospital's operating budget and thus represent an important opportunity for cost savings for hospitals individually but also for the US given that hospital budgets collectively account for more than six percent of the country's gross domestic product (Montgomery and Schneller, 2007; Burns and Lee, 2008; McKone-Sweet et al., 2005; CMS, 2011). However, limited systematic research has been conducted to identify practices and strategies for improving hospital supply chain performance.

An area of hospital supply chain management that particularly warrants close study is inventory. Among hospitals and the health care sector in general, inventory accumulation and obsolescence are several times higher than in the retail/industrial sector (Ebel et al., 2013). This is partly because unlike product-based supply chains, cost is typically not the main driver of inventory decisions in the hospital sector. Instead, inventory levels are dictated by the need to meet service performance outcomes. Yet, wide variation exists among hospitals in terms of inventory costs that do not appear to be explained by service performance. For example, Fig. 1 presents inventory costs among top performing California hospitals in 2009 which we define as those in the top 50th percentile on three measures of service performance. As can be seen, hospital inventory costs, as a percentage of their operating budgets, vary markedly within the same peer group for service performance.[1]

The supply chain literature indicates that organizations encounter challenges in managing inventory because of two typical supply chain risks: demand exceeds supply (supply risk) resulting in stockouts or supply exceeds demand (inventory risk) resulting in

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[1] We obtained each hospital's inventory costs from the hospital's balance sheet available from the California Hospital Financial Disclosure Report (CFDR) available from the state Office of Statewide Health Planning and Development (OSHPD) (http://www.oshpd.ca.gov). The hospital service performance measures were obtained from the Medicare Hospital Compare databases (http://www.medicare.gov/hospitalcompare).

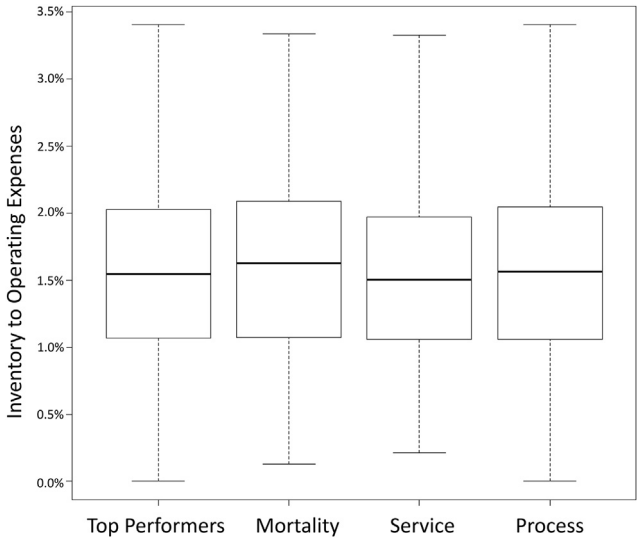

Fig. 1. Distribution of hospital inventory costs for top performing California hospitals in 2009. Top performing hospitals represented by the top 50th percentile in hospital service performance on either of three service performance categories: 30-day pneumonia related mortality rates, timely service patient experience, and surgery patients receiving proper antibiotic to prevent infection.

surplus inventory (Craighead et al., 2007; Kremer & Wassenhove, 2014; Sodhi et al., 2012; Talluri et al., 2013). Much research has focused on relationships between an organization and its suppliers as a key element of an organization's ability to manage supply chain risk (i.e., Wiengarten, et al., 2014; Zsidisin and Ellram, 2003). While this type of vertical inter-organizational arrangement (i.e., relationship between buyer and supplier) is important, far less attention has been devoted to horizontal inter-organizational arrangements among organizations with regard to the management of supply chain risk (Chen et al., 2013).

In this paper, we report results from an investigation of the effects of horizontal inter-organizational arrangements among hospitals on their inventory costs in the context of key drivers of supply chain risk for these organizations. For U.S. hospitals, an increasingly common horizontal inter-organizational arrangement is multi-hospital systems which entail common ownership of two or more hospitals (Burns et al., 2015; Chen et al., 2013). Currently, well over 50 percent of U.S. hospitals are affiliated with such systems (AHA, 2011; Cutler and Morton, 2013). Because these types of horizontal inter-organizational arrangements create opportunities for pooled resources including inventory (Bazzoli et al., 2000; Carey, 2003; Burns et al., 2015), managers of affiliated hospitals may be less likely to be concerned about the need to accumulate excess inventory as a buffer against supply chain risk. In effect, affiliation with a system may mitigate hospital supply chain risks resulting in lower levels of inventory.

To conduct our investigation, we utilized detailed financial data from hospitals in the State of California. We examined the effects of system affiliation on a hospital's inventory accumulation in the presence of supply chain risks arising from its environmental conditions, namely the logistics services infrastructure where the hospital is located and the demand uncertainty for clinical requirements that the hospital experiences. We also examined the potential moderating effects of system affiliation on a hospital's response to these key supply chain risk conditions. Our study makes two primary contributions.

One contribution is to the general supply chain management literature as our study focuses on the largely understudied area of horizontal inter-organizational arrangements and their implications for supply chain management including inventory costs. The extant supply chain literature on integration has tended to focus on vertical integration within the manufacturing sector (i.e., Flynn et al., 2010; Swink et al., 2007; Wiengarten et al., 2014). By comparison, we address integration in the service sector and in the context of horizontal as opposed to vertical arrangements. We build on recent work by Wiengarten et al. (2014) suggesting that, as a form of structural integration, horizontal inter-organizational arrangements are more effective in terms of managing inventory costs under conditions of weak logistics services infrastructure. In particular, we investigate how horizontal linkages among organizations with commonality in assets and resources can be exploited at the operational level where the influence of supply chain risk is more immediate (Narasimhan and Talluri, 2009), and where decisions regarding the deployment of assets and resources are eventually made (Swink et al., 2007). By examining such inter-organizational arrangements in the context of environmental conditions that drive supply chain risks and for organizations where product availability and service are more critical than cost considerations, our study offers new insights regarding the potential operational benefits of horizontal integration. As such, we extend the supply chain integration literature by contributing to the discussion regarding the link between integration and operational performance (i.e., Flynn et al., 2010; Koufteros et al., 2005; Gimenez and Ventura, 2005; Saeed et al., 2005; Germain and Iyer, 2006; Stank et al., 2001; Wiengarten et al., 2014). More specifically, our study provides insights into horizontal inter-organizational arrangements as an efficient alternative to vertical integration with suppliers and customers in service operations where geographic proximity between partners allows for risk pooling benefits.

Another contribution is to US health policy. The growing trend in the number of hospitals that belong to systems has generated much debate among policy makers and industry analysts over whether this form of industry consolidation will enhance hospital operating performance. Numerous studies have been conducted to assess whether system-affiliated hospitals have superior operating performance compared to hospitals that are independent (i.e., Coyne, 1982; Menke, 1997; Carey, 2003; Burns et al., 2015). The results of these studies largely point to little or no advantage for system-affiliated hospitals in terms of operational performance. At the same time, there exists growing concerns that this form of consolidation is driving up hospital prices by enhancing the negotiating leverage of hospitals with health insurance plans (i.e., Gaynor and Town, 2012; Cutler and Morton, 2013; Dafny, 2014). This concern combined with a lack of solid evidence that system affiliation is associated with better hospital operating performance has resulted in calls for more heightened antitrust scrutiny over the formation and expansion of multi-hospital systems (i.e., Daly, 2014). However, the extant literature regarding system affiliation and hospital operating performance is limited in two important ways. First, many of the relevant studies treat system affiliation one dimensionally; that is, whether or not a hospital is system affiliated. This potentially masks substantial variation in the operating performance of system-affiliated hospitals as they vary markedly in terms of the structural characteristics of the systems to which they are affiliated and the environmental conditions to which they are exposed, both of which have implications for their operating performance. Two, the studies largely examine hospital performance based on total operating expenses. While system affiliation potentially enhances hospitals' operating performance in certain areas, it may also impede their operating performance in other areas (Burns et al., 2015). As such, if only aggregate performance measures are used the differences may offset one another. Accordingly, we have conducted our investigation to account for