ABSTRACT
Strategies for integration, efficiency, and customer satisfaction have been established in manufacturing, but these concepts may not port easily to decentralized healthcare systems. Governance can be challenging when key service suppliers, such as attending physicians, lack financial relationships with the hospital. Without financial governance, relational methods may synchronize activities. We conceptualize governance in healthcare delivery as a supply chain problem and investigate relationships among strategy, structure/processes and performance. Findings from 302 acute care USA hospitals reveal links among lean strategy, integration, efficiency and patient satisfaction. The moderation effects of trust and physician employment are revealed as governance mechanisms.

KEYWORDS: Hospitals, Lean, Integration, Governance mechanisms

INTRODUCTION
The notion that strategy influences organizational processes and ultimately performance is common thinking in Supply Chain Management (SCM) (Chen et al., 2009a; Ralston et al., 2015). For example, operations and SCM researchers posit relationships among core concepts such as lean strategy, integration, and performance (Hopp and Spearman, 2004; Das et al., 2006; Devaraj et al., 2007; Shah and Ward, 2007; Schoenherr and Swink, 2012). However, most of these studies have been conducted in manufacturing-focused, centralized supply chains where actors’ behaviors are motivated by contractual and financial governance mechanisms (see Chung et al., 2010; Dyer and Singh, 1998). It is important to examine governance as a means of coordinating decentralized supply chains, particularly in healthcare delivery (Kim et al., 2006; Sanders and Wagner, 2011; Shah et al., 2008; Fredendall et al., 2009; Nembhard et al., 2009).

While many believe supply chain concepts have applicability, porting these concepts from a manufacturing to a healthcare context can be thorny (Smeltzer and Ramanathan, 2002; McKone-Sweet et al., 2005). This challenge is driven in large part by the decentralized nature of
the healthcare delivery supply chain (Shah et al., 2008) – more specifically the significant role of attending physicians in influencing supply chain performance (Schneller and Smeltzer, 2006). Chilingerian and Sherman (1990) provide support for this notion by observing that physicians drive as much as 80% of hospital costs and quality of care while having, in most cases, no financial or contractual interests in the performance of the supply chain (Ilie et al., 2009). “Probably no other organization in the United States has such important members who are not employees but perform their work within the organization,” (Smeltzer and Ramanathan, 2002: p. 2562). In addition to the absence of financial coordination, the healthcare supply chain is also fragmented in terms of clinical decision making and processes, information technology use and information asymmetry, and communication (Nembhard et al., 2009; Ford and Scanlon, 2007; Dobrzykowski and Tarafdar, 2015). It is vital to have physicians and other clinical functions working together in an integrated fashion.

Decentralized supply chains, such as those found in healthcare delivery, face pressures for efficiency and customer/patient satisfaction, which can be illusive because it is difficult to align members in pursuit of these outcomes. This leads to higher system costs, sub-optimization, and substantial reallocation of operational costs and activity among members (Avgar et al., 2011; Robinson et al. 2005). “A key issue in SCM is then to develop mechanisms that can align the objectives of independent supply chain members and coordinate their decisions and activities so as to optimize system performance,” (Li and Wang, 2007: p. 1). This is owing to the notion that effective governance among counterparts can improve performance (Dyer and Singh, 1998; Fugate et al., 2006).

Therefore, an opportunity exists to increase the understanding of governance, and improve hospital performance by using a SCM lens (Ford and Scanlon, 2007). This is consistent with calls from the medical community to better understand how value is created in healthcare delivery (Porter, 2010). Specifically, we investigate critical questions facing managers of decentralized supply chains and make two overarching research contributions: (1) Can a lean supply chain strategy drive integration in a decentralized supply chain – such as that found in healthcare delivery – and can a lean supply chain strategy and integration drive efficiency and customer satisfaction? and (2) How can traditional financial as well as relational mechanisms influence this phenomenon?

This study develops and tests research model using data from 302 acute care hospitals in the USA. It examines the relationships among lean supply chain strategy, integration, efficiency, and patient satisfaction. More importantly, this study tests the mediated moderation effect of trust on the links among these variables. Further, this study examines the moderation effects of trust in two different agency contexts; one comprised of employed physicians (high agency) and the other comprised of independent physicians (low agency).

THEORETICAL DEVELOPMENT/MODEL

With varying degrees of success, many hospitals are turning to lean as a strategic response to the pressures to increase efficiency and patient satisfaction (Plsek, 2014). Mixed results from implementing lean may, in part, result from an overemphasis on goals (i.e., waste elimination) and insufficient attention on the structures or processes required to translate a lean supply chain strategy into improved performance (Graban, 2009). As such, the research model is grounded in the strategy-structure-performance (SSP) theoretical framework which was developed in the
A fundamental tenet of SSP is that an organization’s strategy drives the development of structures or processes which are necessary for the success of the strategy (Grinyer et al., 1980; Habib and Victor, 1991). Stated another way, strategy drives conduct and ultimately the performance of the supply chain (Ralston et al., 2015). In the supply chain context, Chen et al., (2009a) conceptualized the strategic priorities of the firm as cost and customer orientations and suggested that this ‘strategy’ drives the development of streamlined and coordinated processes (Chen et al., 2009b) which result in improved efficiency and effectiveness. Herein, SSP is used to frame the research model linking lean supply chain strategy to integration and ultimately performance, measured by efficiency and patient satisfaction (Stank et al., 2012). See Figure 1 for the research model and Table 1 for variable definitions.

The relationships in Figure 1 are influenced by governance mechanisms which synchronize the actions of supply chain members, thereby improving efficiency and profit (Li and Wang 2007). These governance mechanisms align the objectives of decentralized supply chain members with system-wide outcomes (Chen et al., 2001). Lee (2004) suggests using relationship as a way to align companies’ interests with their partners. Working with trusted partners is an important way to integrate action and improve system performance (Chen et al., 2001; Gittell 2001). Trust may be particularly important when implementing a lean strategy in healthcare given that “physician autonomy, another chief characteristic of the clinical culture, has been found to be a barrier to implementing quality improvement programs because physicians perceive quality improvement efforts as an interference in their practice,” (Khatri et al., 2006: p. 125). In a growing number of cases, hospitals are employing physicians with the objective of integrating care delivery and aligning the goals of the physician and the hospital (Fink and Hartzell, 2010). These financial governance mechanisms are designed to replicate mechanisms that exist in centralized manufacturing supply chains (Dyer and Singh, 1998).
Table 1: Construct definitions

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<th>Construct</th>
<th>Definition</th>
<th>Measurement items</th>
<th>Literature</th>
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<tr>
<td>Lean Supply Chain Strategy (LSCS)</td>
<td>the extent to which a hospital encourages actors involved in providing patient care to continuously improve processes to eliminate waste and non-value added activities, while understanding the needs of patients, being adaptable to change, and able to provide responsive, personalized care.</td>
<td><em>In care delivery, our hospital leadership encourages:</em>&lt;br&gt;LCSC 1: process improvement.&lt;br&gt;LCSC 2: elimination of waste.&lt;br&gt;LCSC 3: understanding of patient needs.&lt;br&gt;LCSC 4: adapting to change.&lt;br&gt;LCSC 5: providing personalized care.</td>
<td>Vonderembse et al., 2006; Goldsby et al., 2006; Qi et al., 2009.</td>
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<td>Integration (INT)</td>
<td>the extent to which the activities of the people involved in healthcare delivery are streamlined and coordinated.</td>
<td><em>In our hospital:</em>&lt;br&gt;INT 1: cross-functional teams which include admitting/attending physicians are integrated for process design and improvement.&lt;br&gt;INT 2: there is a high level of coordination among all functions.&lt;br&gt;INT 3: there is a high level of communication among all functions.&lt;br&gt;INT 4: information systems are integrated. (deleted)</td>
<td>Lambert and Cooper, 2000; Frohlich and Westbrook, 2001; Chen et al., 2009b.</td>
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<td>Efficiency (EFF)</td>
<td>the extent to which the actions of those involved in healthcare delivery contribute to holding down costs, attaining high labor productivity, and maintaining high capacity utilization.</td>
<td>Compared to our competitors, we do a better job of:&lt;br&gt;EFF 1: attaining high equipment utilization.&lt;br&gt;EFF 2: eliminating waste of supplies.&lt;br&gt;EFF 3: eliminating waste of energy.&lt;br&gt;EFF 4: holding down inpatient costs.&lt;br&gt;EFF 5: attaining higher labor productivity.</td>
<td>Li and Benton, 2006; IOM, 2001; IOM 2009.</td>
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<td>Patient Satisfaction (PS)</td>
<td>the extent to which patients feel that the hospital understood and responded to their personal needs</td>
<td>Compared to our competing hospitals, our patients feel that we are more:&lt;br&gt;PS 1: responsive to their requests.&lt;br&gt;PS 2: responsive to their medical needs.&lt;br&gt;PS 3: respectful of their personal values.&lt;br&gt;PS 4: respectful of their preferences.&lt;br&gt;PS 5: responsive to their complaints.</td>
<td>Graban, 2009; IOM, 2009; Ancarani et al., 2011; Pejsa and Eng, 2011</td>
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<td>Trust (TRT)</td>
<td>the willingness to rely on an admitting/attending physician in whom one has confidence and a belief of integrity.</td>
<td>Our admitting/attending physicians have:&lt;br&gt;TRT 1: been honest in dealing with our staff.&lt;br&gt;TRT 2: been open in dealing with our staff.&lt;br&gt;TRT 3: respect for the confidentiality of patient information.&lt;br&gt;TRT 4: earned our confidence through their clinical practices.</td>
<td>McAllister, 1995; Spekman et al., 1998; Ramayah et al., 2008; Bobbio et al. 2012; Chen et al., 2013; Whipple et al., 2013.</td>
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<td>Employed physician / Non-employed physician</td>
<td>a doctor who receives/does not receive financial compensation from a hospital in exchange for treating patients.</td>
<td>Two sets of items were measured for each measurement item; one for employed physicians and a second for non-employed physicians.²</td>
<td>Schneller, 2001; Schneller and Epstein, 2006; Dobrzykowski and Tarafdar, 2015.</td>
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1) Likert scales used for to measure the items: 1-strongly disagree, 2-disagree, 3-neutral, 4-agree, 5-strongly agree. N/A was also offered.
2) Respondents were asked to opine for each item with regard to their hospital’s dealings with employed physicians and non-employed physicians.
Hypotheses

A firm’s supply chain strategy influences managerial decisions regarding where and how to allocate resources for effective work flows (Borgstrom and Hertz, 2011). The lean supply chain strategy focuses on knowing and delivering on patients’ needs as well as a desire, and in the current resource constrained environment, the absolute necessity for efficiency (Graban, 2009). With an eye toward efficiency Harrison and van Hoek (2005) argue that “a high degree of supply chain integration is a prerequisite” (Borgstrom and Hertz, 2011: p. 363). Collaborative activities, such as process integration, have also been suggested to be high when supply chain strategies center on responsiveness (Autry et al., 2008; Omar et al., 2012). The knowledge of and desire to respond to patients’ needs is a key for lean and it drives integration (Endsley et al., 2006). Not surprisingly, considering the SSP framework, according to Chen et al. (2009a), cost orientation and customer orientation, both important aspects of a lean supply chain strategy, are influential antecedents of integration. Process simplification and connectivity (integration) are useful in executing a lean supply chain strategy (Chen et al., 2009b). Thus, this study postulates:

H1. Lean supply chain strategy is positively associated with integration.

Increasingly, supply chain researchers suggest that efficiency (or cost) and customer satisfaction ought to co-exist (Borgstrom and Hertz, 2011; Leuschner et al., 2012; Shah and Ward, 2007). Lean supply chains aim to eliminate non-value added activities thereby improving efficiency. Employee empowerment is another central tenant of lean which improves supply chain efficiency and customer satisfaction (Vonderembse et al., 2006). Lean supply chains are able to operate cost-effectively while maintaining responsiveness to patients (Christensen et al., 2005; Germain et al., 2011). In the context of healthcare delivery, this translates into competencies which include eliminating waste, while understanding patient needs, adapting to change, and providing personalized care. These competencies are critical because supply chain actors armed with such competencies use resources more efficiently, better serve the patient, and learn to work well together – leveraging supply chain relationships (Golicic and Sebastiao, 2011). As such, it is expected that lean strategy will directly influence performance in terms of efficiency and patient satisfaction. Thus, this study postulates:

H2a. Lean supply chain strategy is positively associated with efficiency.

H2b. Lean supply chain strategy is positively associated with patient satisfaction.

In the supply chain literature, integrative cross-functional processes and communication have been shown to improve firm performance (Sanders and Premus, 2005). More specifically, Schoenherr and Swink (2012) discuss the advantages of integration which include improved efficiency and flexibility (or responsiveness to customers). Integration enables actors in the supply chain to attain and exploit distinctive knowledge in ways that solve problems and improve efficiencies (Chen et al., 2009b; Das et al., 2006). As such, integration can create combinations of knowledge, unique skills, and joint capabilities as well as an understanding of
process interdependencies among supply chain actors (Fugate et al., 2008; Schoenherr and Swink, 2012).

While the benefits may be contextually specific, the supply chain literature has suggested a multitude of advantages stemming from integrating the work of network partners (Mackelprang et al., 2014). Integration is particularly important in the healthcare delivery supply chain context given the interdependencies of clinical professionals operating in narrow and deep specializations when delivering services to patients (Dobrzykowski and Tarafdar, 2015). Operational activities, such as integration practices, have been shown to influence financial outcomes for hospitals (Tucker, 2004; Stock et al., 2007). Likewise, in lean hospitals, all employees work in a streamlined, integrated fashion, so more time can be spent satisfying patients (Graban, 2009). In this way, integrated processes translate the lean supply chain strategy of a hospital into improved efficiency and effectiveness (patient satisfaction) (Chen et al., 2009a). Thus, this study postulates:

**H3a.** Integration is positively associated with efficiency.

**H3b.** Integration is positively associated with patient satisfaction.

Next, we examine how trust and physician employment can moderate the relationships emanating from lean supply chain strategy. Relational mechanisms, such as trust, support supply chain actors to develop relational rents through knowledge-sharing routines (e.g., integration) which lead to competitive advantages such as efficiency and patient satisfaction (Dyer and Singh, 1998). This relational RBV has led a number of scholars to suggest the importance of a firm’s relation-specific inter-firm routines (Holweg and Pil, 2008) such as process improvement and tacit knowledge communication (Rosenzweig et al., 2003), both of which are structures and/or processes representative of integration (Chen et al., 2009b; Schoenherr and Swink, 2012). Others have described integration in the context of effective relational governance (Wang and Wei, 2007). This implies that not only is trust key to a firm’s supply chain orientation (Fugate et al., 2006), but it strengthens a firm’s integration efforts (Chen, Daugherty and Roath, 2009).

Relational governance is most useful when uncertainty is high, such as in a health system (Fredendall et al., 2009). Likewise, relationships increase in importance when supply chain partners perceive that they are interdependent in that neither completely controls the outcome, as is the case when physicians and hospitals collaborate in treating patients (Porter, 2010; Nembhard et al., 2009; Zacharia et al., 2011a). This human behavior orientation may significantly influence how operating systems such as lean work, perform, and respond to management interventions (Gino and Pisano, 2008). When strong relationships exist, the actors coordinate work more effectively and work together to optimize performance (Gittell, 2002b). Trust is particularly important given the decentralized nature of the healthcare delivery supply chain (Porter, 2010).

In the decentralized environment, hospitals’ monitoring of physicians’ behavior – the agency problem – is relevant because of information asymmetry and ineffective monitoring systems (Eisenhardt, 1989; Ford and Scanlon, 2007). The principal often lacks the information needed to manage its agents, especially when the nature of an agent’s work practices and
outcomes are difficult to measure and monitor (Ahrens and Dobrzykowski, 2011). While information exchange is improving in healthcare with federal programs tracking process of care and other care delivery outcomes, given the uncertainty, differentiated knowledge, and interdependence facing healthcare delivery professionals (Nembhard et al., 2009; Dobrzykowski and Tarafdar, 2015) and the slow adoption of IT in healthcare, the agent’s actions are not directly monitored by the principal and are largely unobservable during the input-output transformation process (Ford and Scanlon, 2007). With respect to efficiency, hospitals can monitor physicians’ behavior collectively in the form of macro outcome measures (Chang, 2011), but systems to monitor individual physician performance are only emerging. These operational conditions along with their substantial autonomy (Boyer and Pronovost, 2010) enable the practices and decisions of physicians even if employed, to potentially be inconsistent with the goals of the hospital (Eisenhardt, 1989; Chang, 2011). Indeed, “hospitals can’t simply hire physicians or contract with them and expect for care to magically be coordinated and value-driven,” (Andrabi, 2012).

Summarizing, neither trust nor employment alone are individually sufficient to enhance the relationship between a hospital’s lean supply chain strategy and outcomes. While employment may move the goals of the physician and the hospital toward alignment (Fink and Hartzell, 2010), other factors such as physicians’ air of authority, product preferences, and supplier relationships (Schneller and Smeltzer, 2006; Boyer and Pronovost, 2010) mitigate the intended coordination effect. Rather, as goal alignment and relational characteristics such as trust in agents (physicians) on behalf of the principal (hospital) improve, these actors will work together in a more integrative way toward collective goals such as efficiency and patient satisfaction (Conrad and Christianson, 2004; Schneller and Smeltzer, 2006; Mishra and Shah, 2009). While leadership encouragement of process improvement, waste elimination, understanding patient needs, adapting to change, and providing personalized care will increase cross-functional communication, coordination and physician involvement in process redesign, this link will be enhanced when the physicians involved share the goals of the hospital and are perceived to be open, honest, committed, and competent. Thus, this study postulates:

**H4.** When physicians are employed by the hospital (high agency), trust positively moderates the relationship between lean supply chain strategy and process integration.

However, relational (trust) or financial mechanisms (employment) alone may not always directly influence performance (Stewart et al., 2012). This is relevant in the context of the current study given that these governance mechanisms alone may be insufficient to achieve relational rents such as efficiency or patient satisfaction, but these outcomes can be realized through the exchange of knowledge that occurs in integration (Dyer and Singh, 1998; Chen et al., 2009a). As such, it is expected that when physicians are employed by the hospital, the effect of trust improves the relationship between strategy and integration, and that this moderation in turn affects performance through integration. This is consistent with the agency view suggesting that financial goal alignment ought to motivate the agent to engage in work practices desirable to principle (Eisenhardt, 1989). Thus, this study postulates:
H5a. When physicians are employed by the hospital (high agency), trust positively moderates the relationship between lean supply chain strategy and efficiency indirectly, mediated by integration.

H5b. When physicians are employed by the hospital (high agency), trust positively moderates the relationship between lean supply chain strategy and patient satisfaction indirectly, mediated by integration.

METHODS & DISCUSSION
Research methods, results, and implications will be discussed at the conference.

REFERENCES
References are available upon request from the first author.