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Abstract

Purpose – This paper aims to assess the impact of the leadership traits of chief executive officers (CEOs) on hospital performance in the USA. The effectiveness and efficiency of the CEO is of critical importance to the performance of any organization, including hospitals. Management systems and manager behaviours (traits) are of crucial importance to any organization because of their connection with organizational performance. To identify key factors associated with the quality of care delivered by hospitals, the authors gathered perceptions of manager traits from chief executive officers (CEOs) and followers in three groups of US hospitals delivering different levels of quality of care performance.

Design/methodology/approach – Three high- and three low-performing hospitals were selected from the top and bottom 20th percentiles, respectively, using a national hospital ranking system based on standard quality of care performance measures. Three lean hospitals delivering intermediate performance were also selected. A survey was used to gather perceptions of manager traits (providing a modern or lean management system inclination) from CEOs and their followers in the three groups, which were compared.

Findings – Four traits were found to be significantly different (alpha $<$ 0.05) between lean (intermediate-) and low-performing hospitals. The different perceptions between these two hospital groups were all held by followers in the low-performing hospitals and not the CEOs, and all had a modern management inclination. No differences were found between lean (intermediate-) and high-performing hospitals, or between high- and low-performing hospitals.

Originality/value – These findings support a need for hospital managers to acquire appropriate traits to achieve lean transformation, support a benefit of measuring manager traits to assess progress towards lean transformation and lend weight to improved quality of care that can be delivered by hospitals adopting a lean system of management.

Keywords Performance, Health leadership competencies, Process management, Management effectiveness, Hospitals, Measurement

Paper type Research paper

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Background

Increasing demands on USA healthcare but lower quality compared with other countries

Over the past decades, the US health-care system has faced serious challenges. There has been an increase in demand for services because more people are getting chronic illnesses, the population is ageing and leading a more unhealthy lifestyle, and more uninsured individuals are seeking health care. This is despite a limited supply of money and qualified personnel such as physicians and nurses (Bohmer and Knoop, 2007).

The financial situation of the US health-care industry receives considerable attention, particularly as support from federal, state and local governments is declining (Levit *et al.*, 2003; McGlynn *et al.*, 2003), and there are cost pressures from stakeholders in the industry (Levin-Scherz, 2010; Porter, 2009; Porter and Teisberg, 2006).

Importantly, according to several studies, the quality of care provided by US hospitals is wanting (Jewell and McGiffert, 2009; Kohn, 2000; Leape and Berwick, 2005; Porter, 2009). Kohn *et al.* (2001) and Bootman (2000) point out that between 44,000 and 98,000 patients die, and almost a million are injured every year in US hospitals as a result of preventable medical errors. Since publication of these alarming figures, the US Federal Government had undertaken initiatives to improve patient safety and make health care more cost-effective (Porter and Teisberg, 2006; Shortell and Singer, 2008; Singer *et al.*, 2003).

Given the quality of care challenges facing US hospitals (Bootman, 2000; Kohn *et al.*, 2001; Jewell and McGiffert, 2009; Leape and Berwick, 2005; Porter, 2009), the Department of Health and Human Services (HHS) and the Centers for Medicare and Medicaid Services (CMS) launched an initiative in 2001 requiring all hospitals to disclose their quality of care measures publicly (CMS, 2012). Unfortunately, these efforts have had little effect, with little progress in improving quality of care since 2000 (Jewell and McGiffert, 2009; Leape and Berwick, 2005).

As Porter stated in 2009:

> The USA healthcare system remains largely the same as it was a decade ago. We have seen no convincing approach to changing the unsustainable trajectory of the system, much less to offsetting the rising costs of an aging population and new medical advances.

These comments are substantiated by the a 10-year anniversary report of a study originally conducted by Kohn *et al.* (2001), entitled: "To err is human – to delay is deadly. Ten years later, a million lives lost, billions of dollars wasted" (Jewell and McGiffert, 2009). The inferior quality of US health-care system outcomes is also obvious by international comparison. Nolte and McKee (2008) reported that preventable deaths declined less in the past five years in the USA than in 18 other industrialized nations.

A need to identify the key determinants of quality of care in hospitals

Given this unsatisfactory situation, much research has been directed towards identifying the key factors influencing quality of care in hospitals (Boyer *et al.*, 2012; Dye, 2000; Gray, 1997; Kovner *et al.*, 2009). The system of management used throughout an organization ("management system") and the behaviours that individual managers exhibit ("manager traits" – also termed "leadership traits"; see below) are recognized determinants of quality of care outcomes (Boyer *et al.*, 2012; Boyer and Pronovost, 2010; Flynn *et al.*, 1994; Marley *et al.*, 2004; Meyer and Collier, 2001).

Determinants of quality of care: management systems

There are already several studies supporting the important influence of management systems on quality of care, including patient safety (Flynn *et al.*, 1994; Boyer and Pronovost, 2010; Marley *et al.*, 2004). Hospital management systems are modelled towards one of two contrasting systems. Chronologically, "modern" management has predominated, though over the past decade, "lean management" has increasingly been introduced by hospitals, and performance may depend on which management system has been adopted (Womack, 2010).

Modern management

Modern management is based on the management principles of Alfred Sloan (Womack, 2010), and has a strong focus on vertical functions and departments, with clear and focused managerial authorities, and a strong top-down decision management style (Ford, 2009; Womack and Jones, 2003). Managers in modern management systems are perceived as generalists who were formally and externally educated and developed (Womack, 2010). They make decisions far from the place where the products and services are created (Emiliani, 2006; Shimokawa *et al.*, 2009; Womack and Jones, 2003) and often jump to solutions without determining the root cause of a problem to move faster (Womack *et al.*, 1990).

Lean management

Lean management, also referred to as process management (Womack, 2010), is effective in transforming organizations across a variety of industries towards improved performance outcomes (Allway and Corbett, 2002; Emiliani, 2006; Womack and Jones, 2003, 2005). Womack *et al.* (1990) showed that car assembly plants applying lean principles required less human effort, halve their manufacturing space, more than halve the inventories and produce fewer defects while producing a greater and growing variety of products and services. These authors concluded that lean is a management philosophy that maximizes customer value and minimizes waste. This claim has been substantiated by numerous other authors (Emiliani, 2005; Lander and Liker, 2007; Liker, 2004; Womack, 2010; Womack *et al.*, 1990).

Benefits of lean management

Positive results from applying lean principles in organizations have been reported across industries, including service organizations (Ahlstrom, 2004; Hanna, 2007; Swank, 2003), the aerospace industry (Murman *et al.*, 2002; Slack, 1999) and the public sector (Bhatia and Drew, 2006; Hines *et al.*, 2008; Radnor and Walley, 2008). Over the past 10 years, lean practice has been successfully applied to hospitals (Institute for Healthcare Improvement, 2012; Jones, 2006), with lean health-care literature appearing from 2001 in the UK and 2002 in the USA (Robinson *et al.*, 2012).

One success story is the Virginia Mason Medical Center in Seattle, WA. This is a 340-bed hospital with 400 physicians and more than 5,000 employees. The centre has aimed for zero defects/medical errors since 2000, while continuously improving their processes using lean principles (Institute for Healthcare Improvement, 2012; Kenney, 2010) and in doing so achieved an increase in patient capacity while saving capital expenses for planned expansions. The number of full-time equivalents (FTEs; a measure of workload according to number of full-time employees) employed to cope with the hospital's workload was decreased despite a no-layoff policy. They improved

and redesigned processes to eliminate waste by conducting more than 175 rapid-process-improvement weeks, which led to less re-work, less inventory, better quality, higher patient satisfaction, improved productivity and cost savings of more than $10 million (Institute for Healthcare Improvement, 2012; Kenney, 2010; Nelson-Peterson and Leppa, 2007).

Therefore, transformation from a modern to lean management system in hospitals may provide considerable opportunity to improve quality of care. However, this is a complex process and involves: "the long-term development of employees and leaders" (Dombrowski and Mielke, 2013).

Manager traits and leadership traits: a definition

The terms "manager" and "leader" are frequently used in the literature. Leadership and management are not synonyms and can be considered as two differing roles (Kotter, 2008a, 2008b; Yukl and Heaton, 2002). Leadership is about motivating a group of people and implies a social influence process, capable of facilitating change. Good leadership is essential to drive business improvement and to implement lean practice throughout an organization. Management is about the organization of a group of people and focuses on providing work structure for individuals through controlling and coordinating activities. However, the same individual may provide leadership whilst undertaking managerial activities (Northouse, 2012). This is the viewpoint used in this paper, and the terms "leadership traits" and "manager traits" are used interchangeably, respecting terminology used by cited researchers.

Implementing a lean management system: it takes time to change behaviours and see results

The process of implementing a lean management system can be lengthy. Case studies illustrate the time from initial commitment to enjoying the full benefits of a lean management system can take up to at least 4.5 years (Ben-Tovim *et al.*, 2008). Leaders should be committed to the "long haul (Kruskal *et al.*, 2012)". Further, leadership commitment (and therefore behaviours and traits) change at different rates and varying degrees of success will be enjoyed in different hospitals (Dickson *et al.*, 2009). As the introduction of lean management in hospitals is a relatively recent phenomenon (Robinson *et al.*, 2012), lean hospitals are far from a homogeneous set of organizations with similar manager traits, and which have achieved "peak" quality of care standards. Indeed, Jones and Filochowski (2006) anticipate improving performance of lean compared with low-performing hospitals over time because lean management is a long-term journey.

Determinants of quality of care: manager traits

In contrast to a number of studies demonstrating association between management system and hospital performance, few have addressed the influence of individual manager (or leadership) behaviours or qualities ("traits") on organizational performance, and particularly the effect on quality of care (Institute for Healthcare Improvement, 2012; Kovner *et al.*, 2009; McGuire and Kennerly, 2006; Spinelli, 2006; Collins, 2001). Those that have, have focused on leadership and employee motivation (Spinelli, 2006; Alexander *et al.*, 1993). Some studies (Marley *et al.*, 2004; Flynn *et al.*, 1994) have shown that "leadership", as a group variable, has an influence on hospital performance outcomes but these studies have not looked at individual manager traits.

However, traits typical of lean managers are frequently opposite to those of modern managers (as indeed lean and modern management systems contrast), which provides an intriguing variable to compare against quality of care performance.

Waldman *et al.* (1998) evaluated transformational leadership activities of individuals in manufacturing and hospital environments as predictors of financial performance. Nurse (2011) looked into executive leadership traits (transformational and transactional), affecting hospitals' financial performance. This study employed a quantitative multivariate correlation approach using an existing multifactor leadership questionnaire (MLQ) Likert-scale questionnaire (Avolio and Bass, 2000) to survey selected chief executive officers (CEOs) at not-for profit hospitals in Canada and the USA. Nurse's findings suggested that leadership traits influence financial performance of hospitals in both countries.

In the case of Spartanburg Regional Healthcare System, Ford (2005) described the creation of a collaborative environment (a learning organization) with a view to implementing change more effectively within the organization. Qualitative and quantitative research demonstrated that management behaviour at an organizational level, as well as the relations between the CEO and the Vice Presidents, changed towards a participative leadership style. More contact with patients and improved patient satisfaction from 50 to 90 per cent was achieved. In a further study, a successful CEO in health care was found to require the following traits (Anon, 1995): responsibility, creativity, ability to deal with stress, insights and good communication skills.

Methods and focus of research to date: a gap in research

Studies that have focused on individual manager traits in hospital settings have employed questionnaires, and qualitative and quantitative research to investigate CEO and follower behaviour (Nurse, 2011; Ford, 2005). Assessing senior manager and follower perceptions of leadership is an established method of research in this area (Hater and Bass, 1988; Wood, 2005).

Most publications concerning management systems describe case studies about individual hospitals (Aherne and Whelton, 2010a, 2010b; Kenney, 2010; Leatherman *et al.*, 2003; Weber, 2006), which therefore fail to consider the entire US hospital industry. On the other hand, a large part of the research done in the area of leadership traits and performance has looked at the broader field of health care, of which hospitals are but a subset.

Therefore, evaluating the perceptions of leadership/manager traits in the context of different management systems specifically within the entire US hospital industry is a considerably under-researched area. To our knowledge, no study exists that has considered the relationship between executive manager traits and the quality of care provided by the hospital industry. We therefore question whether there is a difference between manager traits in hospitals providing different quality of care performance levels.

To investigate this, we gathered perceptions of manager traits from CEOs and followers in three groups of US hospitals: those delivering low or high quality of care performance (HHS, 2012) and a further group of lean hospitals, whose performance was intermediate in ranking between the others. Like the work of Boyer *et al.* (2012), Marley *et al.* (2004) and Meyer and Collier (2001), we rely on a combination of primary and secondary data to evaluate differences in hospital performance.

Methodology

Hospital sample selection

We selected three groups of hospitals for which secondary data on performance level are publicly available (HHS, 2012). The data were derived from patient records from 4,697 US hospitals (CMS, 2012) and related to four core measures for serious health conditions that are associated with preventable medical errors (acute myocardial infarction, heart failure, pneumonia and surgical care improvement project). Hospital performance was calculated as the product of summing numerators of the four core measures, and summing denominators consisting of the number of responses. We ranked the hospitals according to the resulting product (Boyer *et al.*, 2012; Giordano *et al.*, 2010; Marley *et al.*, 2004; McGlynn *et al.*, 2003). High-performing hospitals were in the top 20th percentile and low-performing hospitals were in the bottom 20th percentile. We identified 25 hospitals from both categories based on their participation in an earlier study.

Five hospitals were identified (by an expert; Zak, 2012) that apply lean management principles. Lean hospital performance, according to the criteria used to identify the other groups, fell between the 40th and 70th percentiles. The final total sample comprised three lean, three high and three low performers. This gave a robust data set for multi-comparison statistics (Siegel, 1957).

Online survey design and distribution

The primary data were acquired by a questionnaire aimed at personnel at different levels within each hospital's organization (Drever, 1995; Foddy and Foddy, 1994; van Dijk, 1990). This online survey was hosted by Virginia Tech (Qualtrics Virginia Tech, 2011) and consisted of open-ended questions, categorical scale questions and Likert scale questions (Alreck and Settle, 1995; Fowler, 1995; Likert, 1932; Rea *et al.*, 1997; Weisberg *et al.*, 1996). As well as asking for background information, the survey covered 13 manager traits adapted from a study Womack (2009) (Table I).

A contact list for the survey was compiled from information of the Department of Health & Human Services (CMS, 2010), the American Hospital Association (AHA, 2011) and State Hospital Associations (AHA, 2011) and the Institute for Healthcare Improvement (IHI, 2010). Additional information was found on hospital websites.

In February 2012, before implementing the questionnaire, either the CEO or their assistants selected for this study were contacted by email and/or phone to discuss our study. Discussions included the reason for this study, the selection of employees and the online questionnaire.

The questionnaire was a 360-degree design (Anon, 1993; Dillman, 2007) which allowed researchers to obtain input about the same subject from more than one point of view. We wanted to know how CEOs perceive the management system in their hospital and how their followers perceived them. Followers include frontline associates, senior executives and middle managers. Two versions of the questionnaire were prepared (Qualtrics Virginia Tech, 2011) and sent to the CEO, two senior executives, five middle managers and five frontline associates at each hospital. Subtle changes were made to the phrasing of each question. Questions were presented in a random sequence to avoid bias (Alreck and Settle, 1995; Rea and Parker, 2005).

The questionnaire consisted of two parts. The first contained three questions for CEOs and four questions for followers about the hospital and their employment (the extra question for followers was on their job title). The second consisted of 13

Code	Manager trait	Management system (positive response)
Q1	Managers are responsible for cross-functional activities in addition to their own functional areas	Lean
Q2	Managers are evaluated according to real-time process performance, as well as end-of-the-reporting-period results	Lean
Q3	Decisions are made at the top of the organization and refined through two-way conversation and involvement with employees	Lean
Q4	Successful managers are identified as those who both deliver results and create a learning environment to help their employees in self-discovery	Lean
Q5	When things to do not go according to plan, the manager's job is to develop corrective action in a learning environment	Lean
Q6	Managers focus on how the work is done and assume the results will follow	Lean
Q7	Managers are developed primarily through formal education	Modern
Q8	Managers are developed primarily through in-company learning/ mentoring, on-the-job training and problem solving	Lean
Q9	Managers make decisions by both analysing the existing data and gathering first-hand information	Lean
Q10	Managers identify and solve problems both cross-functionally and within their own Modern functions	Lean
Q11	Managers do not have to re-work/re-visit problems because they have determined and solved the root cause	Lean
Q12	We may develop work standards for activities, but rarely perform the work in accordance with the standards	Modern
Q13	We develop work standards for most activities and usually perform the work in accordance with the standards	Lean

Source: Adapted from Womack (2009)

Table I.
Lean and modern manager traits inquired about in the survey

questions (adapted from a the study by Womack, 2009) covering a range of manager traits. Answered in the affirmative, 11 questions would characterize lean management and 2 questions would characterize modern management, with the converse applying (Table I).

The two factors typical of modern management were used to control for false interpretation and errors from the respondent. *Q7* and *Q8* were paired and both addressed the way in which managers are developed. *Q12* and *Q13* were both related to application of work standards.

Covariates

Staff turnover rate is about 14 per cent in US hospitals (ACHE, 2012) and perceptions of employees vary according how long they have been employed, thus we controlled for the length of employment with the hospital (Alexander *et al.*, 1993; Khaliq *et al.*, 2006; Schmidt and Hunter, 1998). Followers and CEOs were required to be at the hospital for more than one year and five years, respectively.

Analysis

Using statistical analysis system (SAS) 9.2 (SAS Institute Inc., Cary, USA), all data *were* classified into lean, high- and low-performing hospital categories. Follower and CEO responses on manager traits for each of these categories were compared by using non-parametric statistical hypothesis testing (Edwards, 1954; Siegel, 1957; Wilcoxon, 1945), with evaluation by Kruskall-Wallis chi-squared exact test (Breslow, 1970; Kruskal and Wallis, 1952; Theodorsson-Norheim, 1986) and Wilcoxon two-sample test (Litchfield and Wilcoxon, 1949; Wilcoxon, 1945). We tested for differences in manager traits by three paired comparisons:

(1) lean and low-performing hospitals;

(2) high- and low-performing hospitals; and

(3) lean and high-performing hospitals.

As the comparisons included three groups, statistics were adjusted using Bonferroni correction (Cabin and Mitchell, 2000; Edwards, 1954), dividing the nominated alpha of 0.05 by 3, to produce alpha of 0.01667. We checked for internal reliability of dichotomous factors using Cronbach's alpha (Bland and Altman, 2007; Gliem and Gliem, 2003), which showed reliability alpha > 0.7, indicating acceptable internal consistency (Green *et al.*, 1996).

Findings

We received 56 responses in total.

Of ten CEO responses, non-parametric statistical analysis of these showed no significant difference (p-values ranged from 0.236 to 1.000) in manager traits in any of the comparisons (lean versus high, lean versus low, high versus low).

We received 32 follower responses from lean hospitals, 2 from high-performers and 12 from low-performers. We found statistically significant differences between lean and low-performing hospitals (p-values of 0.0004 to 0.0275), but none between high and low-performers (p-values of 0.2424 to 1.0000), or between lean and high-performers (p-values 0.2995 to 1.0000). Table II shows individual responses to the 13 follower questions adapted from a study by Womack (2009).

Four factors were found to be significantly different (alpha < 0.05) between lean and low-performing hospitals. These were *Q4* ($p = 0.0225$), *Q4* ($p = 0.0223$), *Q4* ($p = 0.0275$) and *Q4* ($p = 0.0004$). The different perceptions between these two hospital groups were all held by followers in the low-performing hospitals and not the CEOs. The four questions more frequently answered in the negative by low-performing hospital followers were:

Q4. Successful managers are identified as those who both deliver results and create a learning environment to help their employees in self-discovery.

Q5. When things to do not go according to plan, the manager's job is to develop corrective action in a learning environment.

Q8. Managers are developed primarily through in-company learning/mentoring, on-the-job training and problem-solving.

Q9. Managers make decisions by both analysing the existing data and gathering first-hand information.

Table II.
Follower results regarding process and modern manager traits

Code	Factor	Kruskall-Wallis chi-squared exact test	Wilcoxon two-sample test Bonferroni corrected (0.05/3 = 0.01667) Lean vs low	High vs low	Lean vs high
Q1	Managers are responsible for cross-functional activities in addition to their own functional areas	0.2423	0.1466	0.9487	0.2995
Q2	Managers are evaluated according to real-time process performance, as well as end-of-the-reporting-period results	0.4811	0.2339	0.5000	0.9758
Q3	Decisions are made at the top of the organization and refined through two-way conversation and involvement with employees	0.2301	0.0782	0.7283	0.8125
Q4	Successful managers are identified as those who both deliver results and create a learning environment to help their employees in self-discovery	0.0600	0.0225	1.0000	0.5508
Q5	When things to do not go according to plan, the manager's job is to develop corrective action in a learning environment	0.0664	0.0223	0.4872	0.8930
Q6	Managers focus on how the work is done and assume the results will follow	0.2404	0.1317	0.2424	0.8342
Q7	Managers are developed primarily through formal education	0.8151	0.8719	0.7727	0.5740
Q8	Managers are developed primarily through in-company learning/mentoring, on-the-job training and problem solving	0.0606	0.0275	0.9121	0.5294
Q9	Managers make decisions by both analysing the existing data and gathering first-hand information	0.0009	0.0004	0.3956	0.5490
Q10	Managers identify and solve problems both cross-functionally and within their own Modern functions	0.2489	0.1088	0.7692	0.9358
Q11	Managers do not have to re-work/re-visit problems because they have determined and solved the root cause	0.4539	0.4935	0.4872	0.3939
Q12	We may develop work standards for activities, but rarely perform the work in accordance with the standards	0.4181	0.2691	0.4872	0.7130
Q13	We develop work standards for most activities and usually perform the work in accordance with the standards	0.1162	0.0575	0.7692	1.0000

Source: Adapted from Womack (2009)

Discussion

Differences were found in manager traits between lean (intermediate-performers) and low-performers, but not between high- and low-performers or lean and high-performers. The CEO responses showed that none of the perceptions of manager traits differed significantly (alpha < 0.05) between all tested hospital categories. However, in the case of lean (intermediate-performing) versus low-performing hospitals, this assessment was not shared with followers. Followers of the low-performing hospitals had different perceptions (with a modern management inclination) about their management system compared with their CEOs on traits *Q4*, *Q5*, *Q8* and *Q9*, and low-performers scored lower on these traits than lean (intermediate-) performers.

This discrepancy between CEO awareness and follower perceptions in low-performing hospitals help to explain the performance differences (Schyns *et al.*, 2008). Furthermore, it is possible that the lack of CEO awareness of management systems may render the sense of urgency to improve as less pressing (Kotter, 1995, 1996, 2008a, 2008b; Kotter and Rathgeber, 2006), which might account for the low quality of care performance.

These observations are strengthened by findings from other research showing the positive effects of lean management systems on hospital performance (Aherne and Whelton, 2010a, 2010b; Ben-Tovim *et al.*, 2007; Institute for Healthcare Improvement, 2012; Jones, 2006).

The responses of followers from high and low performers showed no significant differences in all 13 factors (alpha < 0.05). Manager traits do not explain these performance gaps, and our findings are not consistent with other research that indicates management systems are important influences on hospital performance (Aherne and Whelton, 2010a, 2010b; Boyer *et al.*, 2012; Boyer and Pronovost, 2010; Kenney, 2010).

Finally, we compared lean hospitals with high-performing hospitals and again found that none of the system factors were significantly different (alpha < 0.05). This finding is in accordance with other studies that show that management systems do not influence hospital performance (Aherne and Whelton, 2010a, 2010b; Boyer *et al.*, 2012; Boyer and Pronovost, 2010; Flynn *et al.*, 1994; Kenney, 2010; Marley *et al.*, 2004).

Hospitals delivering high, low and lean (intermediate) quality of care do not represent rigid and distinctly separate management systems. High- and low-performing hospitals may also employ lean practices. Further, lean hospitals are at different stages of a long and complex process, evolving from management systems closer to a modern management model. Some lean hospitals will therefore still exhibit modern manager traits. Despite this, it is important to note that there is consistency between the greater score of lean manager traits in this intermediately performing group of (lean) hospitals. It is this group that is anticipated to increase in performance compared with low-performing hospitals over time, because lean management is a long-term journey (Jones and Filochowski, 2006). These findings support a need to foster the development of appropriate manager traits to achieve lean transformation. The study also indicates the value of measuring manager traits as a means of assessing progress towards lean transformation.

Three limitations of the study warrant comment. The quality of care score used here has been used in numerous studies (Boyer *et al.*, 2012; Giordano *et al.*, 2010; Marley *et al.*, 2004; McGlynn *et al.*, 2003). However, it does not reflect the entire patient care experience

and may be narrow in scope. The performance score itself depends on the type of illness and number of patients treated by a hospital.

A second limitation was the exclusion of all hospitals reported quality of care measures from 25 patients or less (HHS, 2012), and the small total number of hospitals analysed, which means that generalization from this study can only be made with caution. The follower responses were not evenly distributed from all categories of hospitals (e.g. we received 32 responses from lean but only 2 from high-performers). However, our non-parametric statistical analysis accounted for this shortcoming. This study also depended on obtaining responses from individual people working within a given organization, which makes personal bias unavoidable.

Finally, followers who were knowledgeable about the management system used at their hospital were more likely to respond accurately to questions than those who were not. The study attempted to account for this situation, by allowing respondents to skip questions or to respond "Not applicable" (Alreck and Settle, 1995; Rea and Parker, 2005). These answers were excluded from the analysis but only affected one of the follower questionnaires and none of the CEO questionnaires. Therefore, this source of bias was only small.

By demonstrating lean manager traits that are more prevalent in better performing hospitals compared with low-performing hospitals, this study supports the claim of Jones (2011) that hospitals in particular (and the health-care industry in general) can derive benefits from lean management. We encourage further research that would validate our findings by using a larger sample of US hospitals. Fundamental research should be conducted into the current state of lean (process) management and modern management used in the US health-care industry.

Conclusions

This study has shown a difference in manager traits between hospitals delivering low quality of care performance and lean hospitals delivering intermediate performance. These findings support a need for managers to acquire appropriate traits to achieve lean transformation. Further, the study suggests a benefit of measuring manager traits as a means of assessing progress towards lean transformation. By demonstrating lean manager traits that are more prevalent in better performing hospitals compared with low-performing hospitals, this study supports the claim of Jones (2011) that hospitals in particular (and the health-care industry in general) can derive benefits from lean management.

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