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# Comparison of Leadership Traits among Chief Executive Officers (CEOs) in High-performing, Low-performing and Lean-Management Hospitals in the USA

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***Authors' contributions***

*This paper was carried out in collaboration between all authors. Author KA designed the study, wrote the protocol. Author RA anchored the field study, gathered the initial data and performed preliminary data analysis. Authors KA and GJ managed the literature searches and produced the initial draft. All authors read and approved the final manuscript.*

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## ABSTRACT

**Background:** The effectiveness and efficiency of the Chief Executive Officer (CEO) is of critical importance to the performance of any organization, including hospitals. This aim of this study was to assess the impact of the leadership traits of CEOs on hospital performance in the USA.
**Methods:** We conducted a survey in 2010 on the leadership traits of CEOs at nine hospitals selected by quality-of-care performance ranking. The sample comprised three high-performing (HP) (top 20th percentile) hospitals, three low-performing (LP) (bottom 20th percentile) hospitals and three lean-management (LM) hospitals (40th–70th percentiles). For each of these hospitals, the survey information to allowed comparisons of CEO self-assessments and CEO follower

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assessments about various managerial parameters, and these were analysed against the quality-of-care performance indicators.
**Results:** Analysis of the CEO self-assessment survey failed to show any differences between traits of CEOs, but results from the follower survey revealed significant differences. These differences applied to comparisons between LM and LP hospitals, as well as HP and LP hospitals. No significant differences were found between LM and HP hospitals.
**Conclusion:** These results generally support the growing evidence that the leadership traits of CEOs have an influence on the level of performance among hospitals in the USA.

*Keywords: Chief executive officer (CEO); leadership traits; quality-of-care measures, patient safety; hospital performance; lean management.*

## ABBREVIATIONS

*HP: High Performing; LM: Lean Management; LP: Low Performing.*

## 1. BACKGROUND

Over the last decades, the US healthcare system has been challenged by an increasing demand for services. As well as aging population, the public are leading unhealthy lifestyles and the incidence of chronic diseases is on the rise. There is also a limited supply of resources, including money and healthcare personnel [1]. Financial support from federal and state governments is decreasing [2,3] while more and more uninsured patients require treatment [1,4] and there are persistent cost pressures from stakeholders in the hospital industry [5,6,7].

The quality of care provided by US hospitals is poor [6,8]; for example, preventable hospital errors lead to the death of 44 000–98 000 patients every year in the USA, as well as over a million of injuries [9,10]. These safety figures were part of the rationale for a government initiative to create a more cost-effective healthcare system [7,11,12,]. The initiative, beginning in 2010, involves delivering high-quality healthcare, holding hospitals accountable and disclosing quality-of-care measures (Department of Health and Human Services (HHS) [13], and the Centers for Medicare & Medicaid Services (CMS) [14]).

Poor-quality healthcare is an international problem [15], however over a five-year period, another eighteen industrialized countries managed to reduce numbers of preventable deaths to a greater extent than the US [15]. One observer [6] noted that the US healthcare system "remains largely the same as it was a decade ago" and goes on to say there has been "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 observations were supported by a 10-year update on the situation by Jewell and McGiffert [16], which examined the study by Kohn [8] on quality of care in the US healthcare system.

Research has been directed towards the drivers that determine quality-of-care performance outcomes [17-20]. Leadership style is acknowledged as one such driver [21,22], and is used within the Malcolm Baldrige National Quality Award Healthcare Criteria (MBNQA) [22]. There is strong support for the influence of leadership factors on patient safety [10,11,22], but few researchers have examined specific leadership traits with respect to performance of an organization [23-25].

Leadership traits are discussed in trait theory, whereby leadership is rooted in characteristics that certain people possess [26-31]. The early research had a psychological focus, primarily on inherited traits, and the emphasis was on identifying these traits by studying successful leaders. The first well-known theory is the Great Man (trait) theory, in which great leaders are born, their capacity to lead is inherent [32]; they are male, heroic and mythic and will rise when needed. These traits relate to a person's individual behavior, and the way that they behave is influenced by the strength of each trait they possess.

Stogdill and Melvin [31] suggested numerous traits and skills that are crucial for a successful leader, such as adaptability, assertiveness, cooperativeness, ambition, achievement-orientation, alertness to social environment, decisiveness, dependability and dominance.

They must be energetic, persistent, self-confident, tolerant of stress and willing to assume responsibility. Intelligence (cleverness), conceptual skills, diplomacy, tact, creativity and fluency in speaking are other attributes, as well as being organized, persuasive, socially skilled and knowledgeable about group tasks.

McCall and Lombardo [33] identified just four primary traits: intellectual breadth (an understanding of a wide range of topics, rather than being narrow-minded or short-sighted); emotional stability and composure (being confident, predictable and calm, particularly in stressful situations); good interpersonal skills (to communicate and persuade without using negative or coercive strategies); and the ability to admit faults (to own mistakes publicly rather than try to hide them).

Most research on leadership traits in healthcare do not consider their impact on hospital performance [34,35,36]. Usually it is limited to description of traits required for healthcare administration [36], such as dealing with the complex and chaotic healthcare environment [34], or they investigate gender-based differences in leadership traits [35]. Morales and Molero [37] investigated leadership traits and hospital performance, and several empirical, holistic studies have explored the relationship between traits and performance based on census sampling [17].

The aim of this study was to investigate the association between the leadership traits of hospital CEOs and indicators of hospital performance related to the quality of care provided by the hospital [38]. We targeted HP hospitals, LP hospitals [38] and LM hospitals, using both primary and secondary data to evaluate the differences in the traits of CEOs in each kind.

## 2. METHODS

Primary data were obtained using a questionnaire sent to several personnel at each hospital [39,40,41]. This 360-degree survey [42], was hosted by Virginia Tech [43], and measured 44 leadership traits compiled from multiple sources. We had chosen a Survey research desig**n** because it depicts a standard way of conducting research based on the characteristics of a population or a random sample of a population to make inferences about certain characteristics of this population. Considerations in survey research have to be given to the goals of the survey, the questionnaire design, the survey sample, the presentation and dissemination of results, and time and cost. However, Rea and Parker (2005) stated that the design of the questionnaire and the development of the questions is the most critical part in conducting survey research. Three types of questions were used: Likert scale questions, open-ended questions, and categorical-scale questions [44-47]. An additional file shows the Survey Questionnaire for CEOs in more detail [see additional file 1]. Relevant questions were arranged in three parts:

- Part One–3 questions for CEOs and 4 for followers on background information (hospital name, job position, and number of years worked within the hospital);
- Part Two–44 questions on CEO leadership traits and one open-ended question about the three main characteristics of CEOs. These factors were adapted from multiple sources [48,49,23,24, 50,51,52,53];
- Part Three–56 questions: 10 on the big picture of the hospital, 14 about people in the hospital, 19 about process and culture, and 13 about leadership.

The order of the questions was randomized to avoid response bias [44,53].

For each of the final 9 selected hospitals, questionnaires were sent to one CEO, two senior executives, five mid-level managers, and five frontline associates. This was intended to elicit points of view both from the CEOs and their followers. Two versions of the questionnaire were required [43]: the followers' version contained an additional question about their rank in the hospital hierarchy, but otherwise they contained the same questions, albeit phrased differently. For example, CEOs were asked how they perceive their own leadership traits, and followers were asked how they perceived their CEOs' leadership traits. An additional file shows the Survey Questionnaire for Followers in more detail [see additional file 2].

Virginia Tech specialists reviewed the questionnaires and feedback was also obtained from Lean Global Network (LGN) affiliates in the Netherlands, South Africa, France, and the UK. A pre-test was conducted by eleven hospital associates from two independent hospitals in Virginia to verify and statistically validate the questionnaire by checking if factors loaded

sufficiently and check for clarity, acceptability, timeliness, and comprehensiveness [44,47]. Minor adjustments were made based on this feedback. The order of the questions was randomized to avoid response bias [44,53].

The survey ran from February and April 2012. Weekly phone calls were made to CEOs and weekly reminders were emailed to maximize response rates [42,53]. The database of email contacts was compiled from the American Hospital Association [54], US Department of Health & Human Services [14], State Hospital Associations [54], and Institute for Healthcare Improvement [55].

The survey yielded 56 responses – 10 from CEOs and 46 from followers (11 senior executives, 19 mid-level managers and 16 frontline associates).

### 2.1 Identifying Hp. LP and LM Hospitals

These were derived from the CMS database, which contains quality-of-care data [14] on 4679 hospitals. The performance indicators are four core measures related to serious health conditions are commonly associated with preventable medical errors [14], namely acute myocardial infarction, heart failure, pneumonia and the surgical care improvement project (SCIP).

The data for all 4679 hospitals was ranked on these performance indicators, producing an average weighted percentage of patients receiving quality care [3,17,22,56]. Hospitals lying in the top $20^{th}$ and bottom $20^{th}$ percentiles were searched for among the 597 hospitals that responded to the survey. We found 20 matches among the HP and 25 among the LP hospitals from which we selected three HP and three LP hospitals.

Hospitals run on lean-management principles were identified by expert selection [57] (Fig. 1). These hospitals were ranked within the $40^{th}$–$70^{th}$ performance percentiles.

The final sample comprised of three LM hospitals, three HP hospitals, and three LP hospitals. These nine hospitals comprised a robust dataset for statistical analysis and afforded the multiple comparisons [58]. We tested for differences in CEO traits in three combinations:

- Between HP and LP hospitals
- Between LM and LP hospitals
- Between LM and HP hospitals.

### 2.2 Covariates

We controlled for two factors. First, the number of years the respondent had worked in the hospital; this is important because perceptions about CEO traits vary depending on the length of time an employee has been with an organization [59-61]. Second, we controlled for turnover rate: CEOs had to have tenure of more than 5 years, and followers of at least one year.

### 2.3 Data Analysis and Statistics

Data were stored, coded and organized in Qualtrics [43] and exported to MS Excel 2010. Responses from all hospitals were clustered and uploaded to SAS 9.2 statistical software (SAS Institute Inc., Cary, US).

CEO leadership traits associated with the three categories were compared by non-parametric statistical hypothesis testing [58,62,63] and evaluated using Kruskall–Wallis chi-squared exact tests [64-66] and Wilcoxon Chief two-sample tests [63,67].

Statistics were adjusted using the Bonferroni correction [62] as there were multiple comparisons. The nominated alpha of 0.05 was divided by 3 resulting in an alpha of 0.01667. We checked for internal reliability of dichotomous factors using Cronbach's alpha ([68,69], which had reliability greater than 0.7, indicating acceptable internal consistency [70]. The research protocol was approved by the Chair, Dr. David M. Moore, of the Institutional Review Board of the University of Virginia Tech. Blacksburg, Virginia. The approval provides permission to the human subject activities outlined in the IRB-approved protocol (http://www.policies.vt.edu/HumanSubjectsPolicy.pdf)

## 3. RESULTS

### 3.1 CEO Responses

The non-parametric statistical analysis of the CEO responses revealed no significant differences in traits between the three hospital categories ($p = 0.100–1.000$). A statistically significant difference was found between LM and LP hospitals for one item (*CEO asks "What can*

*we learn?"*) without Bonferroni correction (p = 0.0286) based on the Wilcoxon two-sample test.

### 3.2 CEO Follower Responses

Statistical analysis of follower responses (n = 46) revealed significant differences in perception of CEO traits between LM and LP hospitals, and HP and LP hospitals. No statistically significant difference (p = 0.0642–1.000) was found between LM and HP hospitals. Table 1 shows the follower responses regarding level-five leadership traits of CEOs. The traits of CEOs in LM and LP hospitals' show significant differences in all eight traits. Kruskall–Wallis chi-squared exact tests revealed no significant differences for two leadership traits (T36 and T37), but the Wilcoxon two-sample test (not Bonferroni-corrected) for LM and LP hospitals did.

High and LP hospitals showed a significant difference (p = 0.0440) in T9 *Our CEO acts with quiet, calm determination* (not accounting for Bonferroni correction). No significant differences were detected between LM and HP hospitals (p = 0.3743–1.000).

Seven out of the 8 traits in Table 2 showed significant differences (not accounting for Bonferroni correction). These differences were greatest between LM and LP hospitals. Among LM and LP hospitals, all 8 traits were found to be significantly different (alpha < 0.05). When Bonferroni-corrected [62], 7 traits showed significant differences. For HP and LP hospitals, statistically significant differences were found for one trait only, T8 Our CEO actively listens to different points of view. Comparison between LM and HP revealed no significant differences (p = 0.4367–1.000).

Few differences in CEO traits for LM, HP and LP hospitals were found when testing the traits relating to modern versus process management [52]. Table 3 shows that only 7 of 14 factors showed significant differences between at least two categories of hospital (Kruskall–Wallis chi-squared exact test; alpha = 0.05). Eight traits T1, T4, T6, T7, T32, T34, T40 and T44 were found to be significantly different between LM and LP hospitals (Table 3). No significant difference was found for T2–T5, T33, T41 and T42, or between HP and LP hospitals or LM and HP hospitals (Table 3).

We also researched differences in CEO traits with questions adapted from Bass and Avolio [49], Alban-Metcalfe and Alimo-Metcalfe [48] Flynn and Saladin [50] and McGuire and Kennerly [24]. Table 4 shows our analysis with Kruskall–Wallis (alpha = 0.05), whereby 10 out of 14 traits had at least one difference between hospital categories (in T13–T18, 20, 22, 31, and 43). Differences were most common between LM and LP hospitals. T13 (Our CEO coaches and advises us) was not significantly different in LM and LP hospitals, but was significantly different between high and LP hospitals (p = 0.0440). Similarly, T19 (Our CEO observes and searches for deviations from rules and standards and takes corrective actions) was significantly different between high and LP hospitals. Four factors on Table 4 showed significant differences (alpha = 0.05) in high and LP hospitals (not accounting for Bonferroni). These were: Our CEO coaches and advises us (p = 0.0440); Our CEO gives personal attention (p = 0.0220); Our CEO recognizes and celebrates accomplishments (p = 0.0110); and Our CEO observes and searches for deviations from rules and standards and takes corrective actions (p = 0.0330).

The survey results showed no statistically significant differences (alpha = 0.05) between CEO traits in LM and HP hospitals (p = 0.0642–1.000; Table 4). The Kruskall–Wallis chi-squared exact test showed 30 out of 44 traits to be significantly different (alpha = 0.05). Testing the categories pairwise using Bonferroni-corrected Wilcoxon two-sample tests, 25 traits were found to be statistically different (alpha = 0.05; 0.01667 after Bonferroni correction) in LM versus LP hospitals, one trait (after Bonferroni correction) in HP versus LP hospitals, and none for LM versus HP hospitals (Tables 1–4).

Based on these results, we found 25 factors to be significantly different (alpha = 0.01667) between LM and LP hospitals. We found one trait to be significantly different (alpha = 0.01667) between HP and LP hospitals. No factors were significantly different (alpha = 0.01667) between LM and HP hospitals.

**Table 1. Follower responses to items adapted from Collins [24] on level-five leadership traits of CEOs (Table used with permission from Lean Management Institute, the Netherlands)**

| CEO trait | | Chi-squared exact test[1] | LM vs LP[2] | HP vs LP[2] | LM vs LP[2] |
|---|---|---|---|---|---|
| T8 | Our CEO generates superb results | 0.0098 | 0.0090 | 0.2198 | 0.5490 |
| T9 | Our CEO acts with quiet, calm determination | < 0.0001 | < 0.0001 | 0.0440 | 1.0000 |
| T10 | Our CEO shows professional will and personal humility | < 0.0001 | < 0.0001 | 0.2088 | 1.0000 |
| T35 | Our CEO demonstrates a compelling modesty, shuns public adulation, and is humble | 0.0074 | 0.0033 | 0.4945 | 1.0000 |
| T36 | Our CEO gives credit for the organization's success to other people, external factors, and good luck; takes full responsibility for poor results, never blaming other people, external factors or bad luck | 0.0746 | 0.0317 | 0.9615 | 0.6613 |
| T37 | Our CEO channels ambition into the hospital, not the self; sets us successors for even greater success in the next generation | 0.0969 | 0.0315 | 0.7473 | 0.6023 |
| T38 | Our CEO demonstrates an unwavering resolve to do whatever must be done to produce the best long-term results, no matter how difficult | 0.0022 | 0.0029 | 0.0989 | 0.5294 |
| T39 | Our CEO sets the standard of building an enduring great hospital; will settle for nothing less | 0.0020 | 0.0009 | 0.6703 | 0.3743 |

**Table 2. Baldrige leadership behaviors (adapted from Flynn and Saladin [51,52]. Table used with permission from Lean Management Institute, the Netherlands**

| CEO trait | | Chi-squared exact test[1] | LM vs LP[2] | HP vs LP[2] | LM vs LP[2] |
|---|---|---|---|---|---|
| T23 | Our CEO follows through on words and promises made | 0.0169 | 0.0320 | 0.0989 | 0.4920 |
| T24 | Our CEO shows and sets a personal example of what is expected | 0.0004 | 0.0004 | 0.1684 | 1.0000 |
| T25 | Our CEO sets achievable plans, milestones and goals | 0.0043 | 0.0078 | 0.0989 | 0.4866 |
| T26 | Our CEO is committed to experiments and takes risks | 0.1078 | 0.0407 | 0.7308 | 1.0000 |
| T27 | Our CEO asks "What can we learn?" | 0.0004 | 0.0004 | 0.1429 | 1.0000 |
| T28 | Our CEO actively listens to different points of view | < 0.0001 | < 0.0001 | 0.0440 | 0.7433 |
| T29 | Our CEO treats everyone with respect and dignity | < 0.0001 | < 0.0001 | 0.1868 | 1.0000 |
| T30 | Our CEO makes sure that people grow in their jobs | 0.0268 | 0.0399 | 0.0989 | 0.4367 |

*[1]Kruskall–Wallistest; [2]Wilcoxon two-sample test (Bonferroni-corrected 0.05/3 = 0.01667)*

## 4. DISCUSSION

Our study tests for differences in CEO traits among lean, high- and low-performing US hospitals based on a national ranking of hospitals using publicly available quality-of-care measures. This entailed assessment of leadership qualities by hospital CEOs and their followers from different levels from each participating hospital. We also used quality of care data from the CMS 2010 database [38].

CEO traits differed considerably between LM and LP hospitals and, to a lesser degree, between high and LP hospitals, but we found no differences in CEO traits between LM and HP hospitals.

The CEO self-assessment showed only one leadership trait to be significantly different between LM and LP hospitals, namely *The CEO asks what we can learn* ($p = 0.0286$). One can speculate that CEOs of LM hospitals are more reflective and involved in continuous learning than CEOs of LP hospitals [71-73], however, we would also have expected to find more pronounced differences in CEO traits as reported by the CEOs among LM, HP and LP hospitals. Thus, the question remains whether CEOs in all three hospital categories actually have similar traits or have only small, undetectable differences, or whether the CEOs' self-awareness does not reflect reality.

The outcomes of the CEO self-assessments and the follower assessment are interesting as they differed remarkably. For example, when comparing LM versus LP hospitals, CEO responses showed only one trait to be significantly different, whereas their followers perceived 33 significantly different traits (Tables 1–4; not considering Bonferroni). This might indicate that the perceptions about CEOs by followers of LP hospitals are significantly different from the CEOs' own assessments. This does not apply when comparing CEO traits between LM and HP hospitals, as revealed by a mean comparison of responses between CEOs and followers. Thus we speculate that the discrepancy between CEO self-awareness and follower perception is part of the problem in hospital with lower performance ratings [29,74].

The results comparing LM hospitals with LP hospitals, show that 33 out of 44 CEO traits were perceived to be significantly different by followers. The traits that distinguish CEOs in LM and LP hospitals included all 8 factors derived from Collins [23] describing "great" leaders (Table 1); CEOs of LM hospitals score higher on T8–T10 and T35–T38.

Our results also show that level-five leadership traits [23] are more evident in LM hospitals than they are in LP hospitals.

Differences in traits between CEOs of LM hospitals compared to CEOs of LP hospitals also included all 8 factors adapted from the Baldrige criteria in Table 2 [50,51], namely T23–T30. Our findings are in-line those of Meyer and Collier [75], whereby the components inquired about for the Baldrige criteria are significantly linked with results for organizational performance.

We found that 8 of 14 LM leadership traits adapted from Jones [52] were significantly different between LM and LP hospitals (Table 3; T1–7 and T32–T34, T40–T41 and T44. We speculate that the less pronounced differences between LM and LP hospitals are due to difficulties in determining to what extent an organization has adapted or believes to have adapted LM principles.

Among the CEO traits adapted from multiple sources [24 5048 49), 9 out of 14 differed among LM and LP hospitals (Table 4; T14–T18, T20, T22 and T43.

We compared HP and LP hospitals, and found that 6 out of 44 traits were significantly different between HP and LP hospitals (Tables 1–4). The traits that distinguish between CEOs in HP and LP hospitals includes one factor of the level-five traits [23], that is T9 (Table 1). However, other than this, our findings do not reflect Collins' claim that high-performing organizations (or, as he calls them, great companies) have a CEO that embodies level-five traits [23]. According to results from the Baldrige leadership behaviors we tested (Table 2), the one trait that is significantly different between HP and LP hospitals is T28. Among LM leadership traits [52] comparing HP and LP hospitals (Table 3), no significant differences arose, but we found 4 out of 14 traits to be significantly different (Table 4). These were T13, T14, T15 and T19.

**Table 3. Lean leadership traits (adapted from Jones [53]). Table used with permission from Lean Management Institute, the Netherlands**

| CEO trait | | Chi-squared exact test[1] | LM vs LP[2] | HP vs LP[2] | LM vs LP[2] |
|---|---|---|---|---|---|
| T1 | Our CEO sets clear directions | 0.0441 | 0.0363 | 0.2308 | 0.5145 |
| T2 | Our CEO enables staff to do their work | 0.1111 | 0.0933 | 0.3956 | 0.5900 |
| T3 | Our CEO develops and mentors staff by asking questions rather than telling them what to do | 0.1318 | 0.1141 | 0.3626 | 0.5134 |
| T4 | Our CEO deploys the right improvements to close performance gaps | 0.0036 | 0.0056 | 0.0989 | 03476 |
| T5 | Our CEO is present/visible on a regular basis | 0.1255 | 0.1451 | 0.2308 | 0.5009 |
| T6 | Our CEO thinks from a patient/customer point of view | 0.0014 | 0.0012 | 0.2418 | 1.0000 |
| T7 | Our CEO establishes a learning organization (thinking and doing) | 0,0005 | 0.0004 | 0.1667 | 1.0000 |
| T32 | Our CEO follows and applies the scientific method – Plan Do Study Adjust (PDSA) | 0.0008 | 0.0011 | 1.0000 | 0.0713 |
| T33 | Our CEO creates process stability and practices frontline management (where value is created) | 0.0512 | 0.0909 | 0.0769 | 0.3428 |
| T34 | Our CEO manages by facts | 0.0141 | 0.0077 | 0.2527 | 1.0000 |
| T40 | Our CEO trains us in responding and solving problems | 0.0417 | 0.0180 | 0.4359 | 1.0000 |
| T41 | Our CEO holds regular stand-up meetings, uses visuals and keeps everyone on track | 0.3080 | 0.7594 | 0.1978 | 0.2228 |
| T42 | Our CEO manages by going to the place where the work is performed and to observe what will happen and asks why | 0.1118 | 0.5771 | 0.06667 | 0.1175 |
| T44 | Our CEO focuses on the vital few things and deselects other tasks | 0.1264 | 0.0354 | 0.6667 | 0.9375 |

**Table 4. Additional CEO traits (adapted from Alban-Metcalfe and Alimo-Metcalfe [49] Bass and Avolio [50]; Flynn and Saladin [51] 25). Table used with permission from Lean Management Institute, the Netherlands**

| CEO trait | | Chi-squared exact test[1] | LM vs LP[2] | HP vs LP[2] | LM vs LP[2] |
|---|---|---|---|---|---|
| T11 | Our CEO abdicates responsibility and avoids making decisions | 0.3001 | 1.000 | 0.2821 | 0.1622 |
| T12 | Our CEO promises rewards for good performance | 0.1791 | 0.0940 | 0.2747 | 0.8681 |
| T13 | Our CEO coaches and advises us | 0.0182 | 0.0655 | 0.0440 | 0.1705 |
| T14 | Our CEO gives personal attention | 0.0037 | 0.0089 | 0.0220 | 0.3087 |
| T15 | Our CEO recognizes and celebrates accomplishments | < 0.0001 | < 0.0001 | 0.0110 | 0.5076 |
| T16 | Our CEO provides us with a vision and a sense of mission | 0.0003 | 0.0003 | 0.1667 | 1.0000 |
| T17 | Our CEO has our respect and trust | < 0.0001 | < 0.0001 | 0.0989 | 1.0000 |
| T18 | Our CEO communicates high expectations | 0.0277 | 0.0149 | 0.3956 | 1.0000 |
| T19 | Our CEO observes and searches for deviations from rules and standards and takes corrective actions | 0.1430 | 0.5563 | 0.0330 | 0.1552 |
| T20 | Our CEO expresses important purposes in simple ways | < 0.0001 | < 0.0001 | 0.0989 | 1.0000 |
| T21 | Our CEO intervenes only if standards are not met | 0.1896 | 0.9483 | 0.1648 | 0.0642 |
| T22 | Our CEO promotes intelligence, rationality and careful problem solving | 0.0001 | 0.0001 | 0.0769 | 0.5490 |
| T31 | Our CEO instils pride | 0.0001 | 0.0001 | 0.1758 | 1.0000 |
| T43 | Our CEO follows up on promised rewards | 0.0145 | 0.0127 | 0.0641 | 0.6702 |

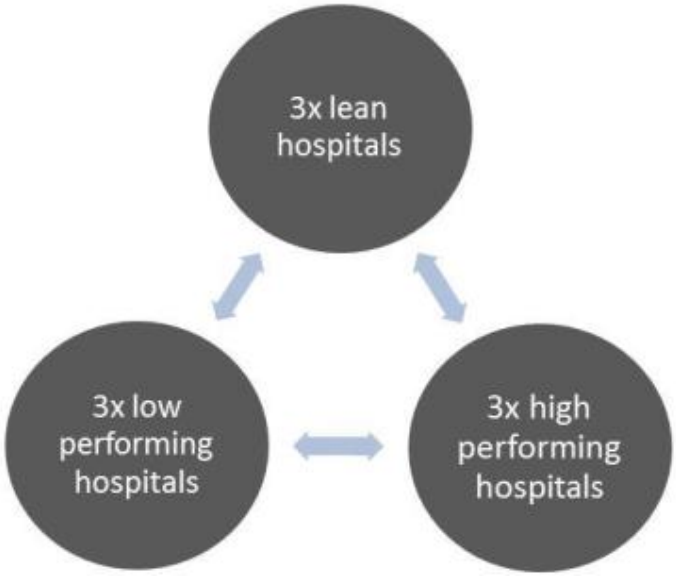


**Fig. 1. Research construct. Figure used with permission from Lean Management Instituut, the Netherlands**

Interestingly, we only found statistically significant differences (alpha = 0.05) in 13.6% (6/44) of all traits between HP and LP hospitals. While we were able to conclude that there is a difference in CEO traits between HP and LP hospitals in the USA, the results were not as pronounced as hoped in order to advise on which factors make the difference between HP and LP hospitals. Note that our observations were based on only two follower responses from HP hospitals, which are sufficient for drawing statistical conclusions, but do not provide much power to statistical analysis. Thus, additional research efforts are needed in this area.

We found that none of the 44 traits were significantly different between LM and HP hospitals (Tables 1–4). Thus, with the limitation of the low response rate for HP hospitals in mind, it can be concluded that traits between CEOs in LM and HP hospitals do not differ. Thus their traits do not explain partially or fully the performance gaps between LM and HP hospitals. Multiple studies show that leadership is not the only important factor in improving hospital performance [21,22].

When testing the additional traits (adapted from Alban-Metcalfe and Alimo-Metcalfe [48]; Bass and Avolio [49]; Flynn and Saladin [50]; McGuire and Kennerly [24], we found it interesting that two factors (T13 and T19; Table 4) were significantly different between HP and LP hospitals but not between LM and LP nor LM and HP hospitals.

There is no simple explanation for these findings, but we speculate that these observations can explain some of the performance differences between the three categories of hospital tested.

## 5. CONCLUSION

This study adds to our understanding of the relationship between the traits of CEOs and hospital performance outcomes. We suggest that further research should be conducted using a larger sample of hospitals. Basic research is also needed to describe the current state of lean management, to allow quantification of differences in practices between high-performing, low-performing and lean-management hospitals.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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