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Method

SUCCESSFUL IMPLEMENTATION OF LEAN AS A MANAGERIAL PRINCIPLE IN HEALTH CARE: A CONCEPTUAL ANALYSIS FROM SYSTEMATIC LITERATURE REVIEW

Riikka Maijala
Turku University Hospital, Department of Public Health, University of Turku
riimai@utu.fi

Sini Eloranta
Turku University of Applied Sciences, Health and Well-being
Department of Nursing Science, University of Turku

Tero Reunanen
Turku University of Applied Sciences
Tampere University of Technology

Tuija S. Ikonen
Turku University Hospital, Department of Public Health, University of Turku

Purpose: The aim of this study was to identify and analyze the characteristics of leadership and management associated with a successful Lean thinking adaptation in healthcare.
Design: A systematic literature review was undertaken using electronic databases: PubMed, PubMed Systematic Review, ABI/INFORM, Business Source Complete, Emerald, JBI, and Cinahl. Inclusion criteria were: (i) a description of Lean management or leadership in health care, (ii) a reference to Lean thinking, (iii) a peer-reviewed original research article or a literature review, and (iv) a full text article available in English. Among the 1,754 peer-reviewed articles identified, nine original articles and three systematic reviews met the inclusion criteria. Data on informants, methods, and settings were extracted and collated. Content analysis was used to conduct a review of the nine original studies describing and analyzing the success factors of Lean adaptation. The characteristics of leadership and management were analyzed by using the concept of a managerial windshield that divides leadership and management into four ontological dimensions: activities, style, focus, and purpose, each with typical developmental stages of skills and capabilities. The current study has some limitations: some papers from the journals not indexed in the searched databases may have been overlooked and the literature searches were carried out only for a 5-year period.
Findings: Considering the results using the windshield concept emphasizes the philosophy, principles, and tools of Lean thinking. Lean leadership and management factors in health care were mainly conceptualized as skills and capabilities such as problem solving, making changes occur, empowering, communicating, coaching, supporting, facilitating, being democratic, organizational learning, and organizational success, all of which represented middle-stage or advanced managerial skills and capabilities.
Practical Implications: A conceptual analysis of systematically reviewed studies of Lean leadership and management point to certain traits as being typical when adapting Lean thinking to health care. The concept of a managerial windshield is useful when categorizing and analyzing essential managerial skills and capabilities for Lean implementation. Findings are beneficial when learning and educating the skills required for Lean transformation in healthcare organizations.

Keywords Lean leadership, Lean management, Health care, Concept of managerial windshield

Health care is a complex multi-professional setting with a tradition of strong professional leadership and considerably conservative structures and managerial models (1;2). During past 2 decades, there has been a requirement for transformation of the leadership and management of healthcare organizations to improve efficacy and safety (1;3). Typically, the new managerial principles are adopted from the industry without a thorough consideration how these managerial models fit or should be implemented into health care. For healthcare professionals, who are used to evidence-based decision making, there are few if any systematic tools to analyze the benefits and usefulness of various leadership ideologies in advance. However, the principles of health technology assessment should be applicable to the systems and managerial processes, as well, and might provide better understanding about the skills and capabilities that are required to good leadership and management in healthcare organizations while aiming at continuous transformation as a response to the ongoing change of technologies and societies. Lean thinking is one of the recent leadership and transformation ideologies adapted from business and industry that should be assessed critically in the context of healthcare organizations.

Lean is a set of operating philosophies, leadership and management practices, and tools that can help create maximum value for patients, for example, by reducing the sources of waste in a process (4–7). Lean health care can be described as a management philosophy to develop a hospital culture through continuous improvements, in which all employees actively participate in identifying and reducing non–value-adding activities

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(waste) (8). Health expenditure and the cost of treatments are expected to increase due to advances in medical technologies, population ageing, and rising public expectations (9). Lean is thought to be one solution in response to the efficiency and productivity demands to improve the quality of health services (10–17). In the same time, it seems that the concept of Lean has been misunderstood in the health care. Staff associate Lean with automotive applications and cost reduction. It would be fruitful for managers to develop a strategy for continual improvement and use vocabulary that is familiar with healthcare staff (18). In addition, the healthcare sector is going through technology-enabled changes. It has been suggested that it's possible to increase IT productivity in health care by 20 to 40 percent through the application of Lean (19).

However, it is not clear that healthcare organizations generally carry out implementations systematically. Usually, Lean thinking is attempted by means of piecemeal applications and small-enclosed projects using Lean methods and tools, rather than creating a holistic cultural change that promotes the involvement of employees in daily improvements and behavioral changes (20;21).

Recent studies have stated that leadership and management practices are critical to successful implementation of Lean thinking in health care (20–22). Approximately 80 percent of the effort in Lean implementation is expended on changing the practices of leaders (23). Lean leaders are coaches who create the strategy, build the team, and help employees develop their skills (20). Successful Lean interventions share some common features, such as management and leadership engagement (21).

Leaders need to act in two differing roles (24;25). Lean management is rooted in two key principles: continuous improvement and respect for people. Both strive to eliminate waste and add value for customers or stakeholders (26). Management is concerned with the organization of groups of people with a focus on providing work structures for individuals through controlling and coordinating activities. Leadership is concerned with motivating groups of people and suggests a social influence process, capable of facilitating change (24;25). However, little is known about which facilitators are most important (21).

Lean management tools and techniques have many process management applications as regards health care and organizations that can improve quality, patient safety and cost-effectiveness (27;28). These tools and techniques need to be related to the overall strategy and the principles of Lean health care to be successful (8). It has been stated that implementing Lean thinking and Lean tools into health care requires different skills from leaders than those required by traditional healthcare management (20;28). However, at the same time, there is a lack of complete understanding of the leadership/management practices that are necessary to achieve the successful widespread mobilization and sustainability of Lean thinking (29;30).

The aim of this study was to review and analyze recent literature regarding Lean leadership and management, and to identify the characteristics of leadership and management that are associated with successful Lean thinking adaptation in health care. In addition, we tested the concept of the windshield (31–34) to analyze the skills and capabilities of Lean leadership and management that were described in the original studies, as to present a comprehensive overview of the managerial traits that are important for achieving successful Lean thinking in health care. Vanharanta describes that the management windshield metaphor is built from three different viewpoints: time, leadership and management. These viewpoints have been placed into a driver's windshield. The focus of the concept of the managerial windshield is to help decision makers in those situations where managers, leaders, and executives are at a conscious management and leadership "stage."

Another purpose is to clarify some important management and leadership concepts. In the managerial windshield, the concept of being a manager is divided into two categories, leadership and management. Both managerial categories are further divided into four ontology dimensions: activities, style, focus, and purpose (31). In this review, we did not use time-perspective. The model was chosen because it affected a systematic way of identifying and parsing leadership features.

DESIGN

Search Methods

Data were collected systematically. In February 2016, literature searches were carried out with the aid of an information specialist at Turku University Library for references published between January 2011 and February 2016. Search terms are presented in Figure 1. We conducted a computer search of published literature on the following electronic databases: PubMed, PubMed Systematic Review, ABI/INFORM, Business Source Complete, Emerald, JBI, and Cinahl. In all the searches, appropriate truncations and possible misspellings were included and the search terms were adapted for different databases. Other sources of information were examined by a hand search, such as reference lists of key articles identified through the search strategy. A full description of the review protocol and process for selecting studies can be obtained from the authors (Figure 1).

Inclusion and Exclusion Criteria

Articles had to satisfy the following inclusion criteria to be considered: (i) a description of Lean management or leadership in health care, (ii) a reference to Lean thinking, (iii) a peer-reviewed original research article or a literature review, and (iv) a full text article available in English. Exclusion criteria were: (i) an editorial article or (ii) a description or an evaluation of an educational framework or model (Figure 1).

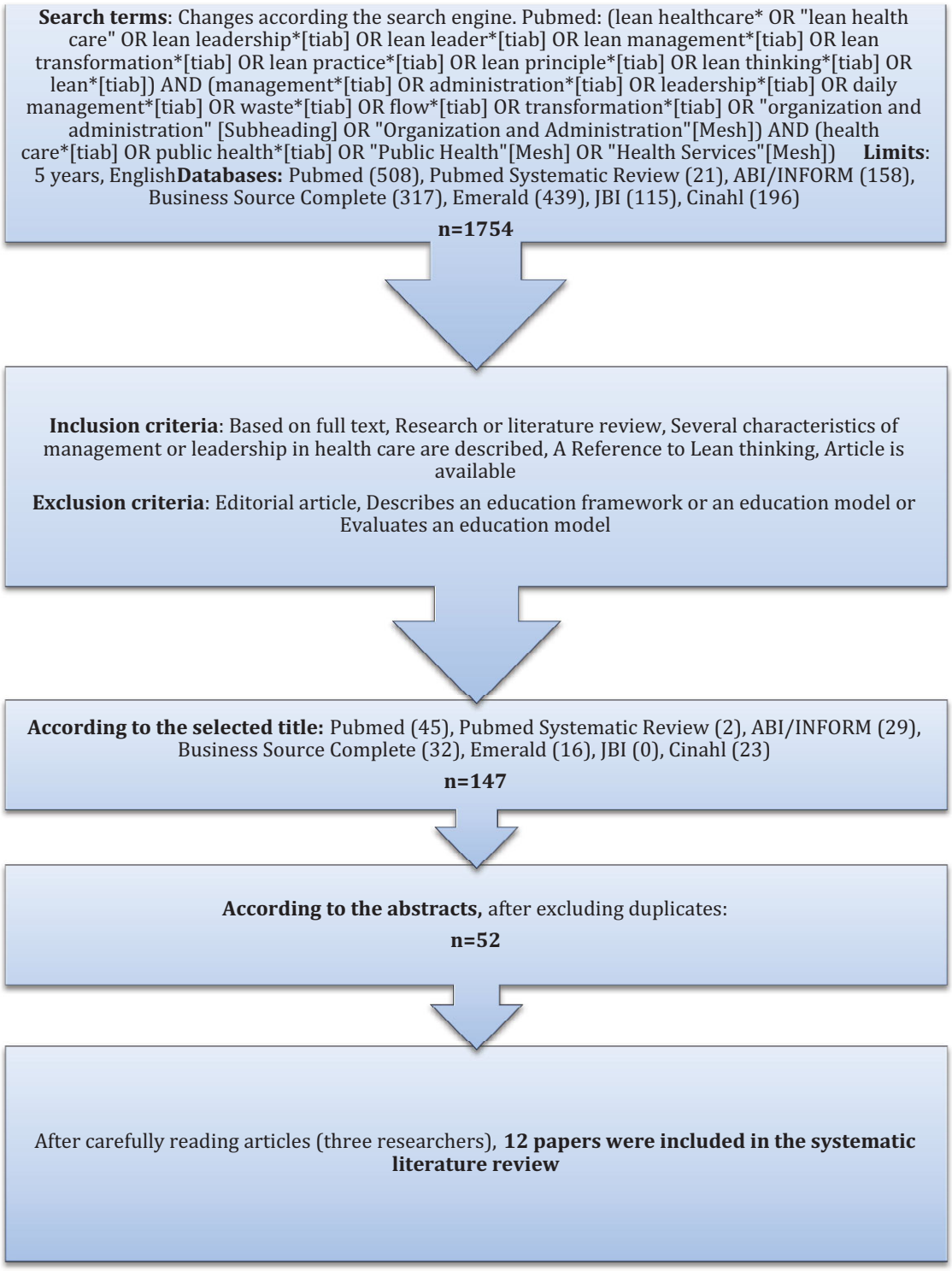

Figure 1. Process of data collection.

Retrieval of the Studies for Review and Their Critical Appraisal

The selection of the studies was performed in three steps. First, one of the authors (R.M.) examined the titles and, second, three authors (R.M., S.E., T.I.) examined the abstracts. Third, all the authors reviewed the full text articles with regard to the inclusion criteria. Any disagreement between the authors was resolved by an additional review. We retrieved a total of 1,754 peer-reviewed articles of which 1,742 were rejected and twelve papers were included in the review. The critical appraisals were discussed between the authors and by consensus all twelve articles were accepted into the review. Nine studies were original articles. Three systematic reviews were included to widen the

perspective and ensure that no essential qualitative information from earlier studies was missed (Figure 1).

Analysis of the Data

Deductive content analysis was used to analyze the data. One author performed a content analysis on each chosen study using open coding, category creation, and abstraction (35;36). After this, the constructions were discussed together by all the authors and a consensus was reached as to how the data were to be interpreted.

The analysis of nine original studies of adapting Lean thinking to health care was conducted by identifying the characteristics and traits related to the skills and capabilities mentioned as being associated with successful Lean adaptation. The traits were defined as four leadership and management dimensions: activities, style, focus, and the purpose of the concept of the windshield. Information was collected from the abstracts, results, including tables or figures, and conclusion sections of the original articles in a table format.

FINDINGS

Description of the Studies Reviewed

Of the twelve studies included in the review, nine were original studies and three reviews. The original studies were conducted in the United States ($n = 5$), the Netherlands ($n = 3$), and Canada ($n = 1$). A variety of data collection methods were used in the original studies: surveys/questionnaires ($n = 2$), interviews ($n = 6$), observations ($n = 1$), ethnographic case study ($n = 1$), and a combination of these ($n = 2$). One of the original studies did not describe the data collection methods in detail. Typically, the study settings consisted of patient treatment. Lean thinking was established within eight of the organizations and one was in the process of implementing Lean. In seven studies, the informants were positioned as managers in the organization. In eleven studies, both concepts of leadership and management were used, only one original study just used the concept of management (Table 1).

Three of the review articles accepted in this review presented different perspectives of leadership and a successful implementation of Lean in health care. One of the review articles presented a comprehensive overview of the main issues highlighted by research on the implementation of Lean in a complex context such as health care (37). Another review aimed at identifying and investigating the strength of the connection between two models, Lean health care and productive ward, and to explore the implications for leadership and implementation (38). The purpose of the third review was to determine the readiness factors that are critical to the application and success of Lean operating principles in healthcare organizations (39).

D'Andreamatteo et al. (2015) examined 243 articles. The results of the review were that the theoretical works have mainly focused on barriers, challenges, and success factors. They suggested that health professionals, managers, and policy makers should learn from the research as to how to play a pivotal role for a more effective implementation of Lean in different health contexts (37). White et al. (2013) outlined the similar employee effects that exist between Lean-type improvement initiatives and the productive ward: empowerment, leadership, and engagement and exploration of the opportunities for leadership. They provided a list of reported employee impacts and the effects of value to healthcare leaders attempting to establish an environment and culture of improvement (38).

Al-Balushi et al. (2014) investigated 170 articles which included additional references identified through citation analysis, including books, workshop materials, and conference papers. Their findings were that leadership, the organizational culture, communication, training, measurement, and reward systems are recognized as readiness factors throughout Lean literature. Directly related to the successful implementation of Lean in health care is that a setting is able to authorize a decentralized management style and undertake an end-to-end process view. However, these can be difficult initiatives in healthcare settings (39) (Table 2).

Analysis of Managerial Dimensions

Activities.

Leadership. Traits and skills related to handling conflicts, problem solving, and making change happen were mentioned in most articles. The authors emphasized an understanding of the complexity of the changes (24;30) and Lean (30), as well as an understanding of the system rules and changing power structures (30). It was also suggested that it is important that attention be paid to resistance to change (29). In addition, it was mentioned that it is necessary to have an understanding of the company history of collaboration or conflict, and an understanding of how communication, leadership, and workload will affect the implementation (22).

Furthermore, the activities of leading, visioning, and especially empowering were considered essential for successful Lean leadership. Many of the studies (four of nine) referred to the fact that Lean leaders should have the abilities to empower, trust, and engage other team-members (25;29;30;40). In addition, many studies suggested a visible leadership of Lean was a recognizable feature of Lean leadership (29;30;40;41). Visible leadership contains increasing transparency (29) (Table 3).

Management. The majority of the studies (seven of nine) referred to problem-finding, classifying, and solving activities (22;24;25;29;30;41;42). As an example, management activities consist of implementing techniques such as root cause analysis, and metric tools for measuring and monitoring the improvements (42). Gemba is an activity in which leaders go to the "shop floor" to examine processes and speak to workers, to see

Table 1. Original Studies of Successful Lean Implementation, Their Healthcare Settings, Data Collection Methods, Informants, Study Objectives, and the Main Findings of the Study

Author year country	Healthcare setting	Data collection method	Informants (*n*)	Study objectives	Main findings of the study
Aij et al. 2013 Netherlands	Surgery wards, OT, outpatient psychiatry clinic	Semi-structured, in-depth interviews	31 medical, surgical, and nursing professional leaders, that formulated at least one improvement after Lean implementation	Barriers and facilitators encountered after LTP	Leadership management support, a continuous learning environment and cross-departmental co-operation play a significant role in successful Lean implementation.
Aij et al. 2015 a USA	Selected hospitals, performance ranked by national hospital ranking system for the quality of care	Online survey by a questionnaire, semi-structured, two parts (CEOs and followers), covering 13 manager traits	10 CEOs and 46 followers (frontline associates, senior executives and middle managers)	To compare CEOs' and followers' perceptions of manager traits between hospital groups	Four significantly different traits between Lean and low-performing hospitals among followers: result delivery, learning environment, in-company learning/mentoring, data-analyzing, and first-hand information. Comment: the study was underpowered to compare high-performing hospitals.
Aij et al. 2015 b Netherlands	University medical center, various specialty departments and OT	Ethnographic case study: experiences, observation, interviews, and document analysis	Autoethnography, three team leaders, Lean program manager, OT manager, medical head	Characteristics of successful Lean leadership	Characteristics of importance for Lean transformation: Going to the gemba, see the situation for one's own self, empower healthcare employees, modesty, and openness.
Goodridge et al. 2015 Canada	Saskatchewan province health system	Qualitative: consultation, workshop, documentary review, videotaped interview, discussions	9 key informants, 49 stakeholders (decision makers and knowledge users), 27 interviewees from Lean activity participants (patients, workers, leaders)	Changes in leadership practices associated with Lean implementation and subsequent outcomes	Lean leadership: aligns the aims and objectives, attention, and resources to QI and change management, a set of tools, changes attitudes or beliefs about styles and behaviors, demands expertise, accountability and commitment, uses data, supports learning organization culture.
Hung et al. 2015 USA	Ambulatory not-for-profit, fee-for-service care delivery system, a pilot multi-specialty clinic, and 3 clinical departments	In-depth interviews and focus groups	34 primary care physicians, staff, and site leaders	Key facilitators and barriers to implement Lean among frontline primary care providers	Staff engagement and performance management, sensitivity to the professional values and culture of medicine, adequate resources. Drivers: empowerment of staff, visual display of performance metrics, culture of innovation, and collaboration.
Hwang et al. 2014 USA	Major hospital, specific departments	Interview and observation	Observational, not specified	define Lean implementation key factors	Sharing goals and processes among healthcare managers and professionals.

Table 1. Continued.

Author year country	Healthcare setting	Data collection method	Informants (*n*)	Study objectives	Main findings of the study
Johnson et al. 2012 USA	A magnet hospital and principal teaching hospital, OR and ED	Two case studies of nurse directed Lean initiatives	Not specified	An overview of lessons learned for adapting Lean to the patient care environment	Leadership and communication are critical for success, interdependence of all project teams, nurses who lead multi-disciplinary teams, trained in assessment, and system thinkers are ideal Lean leaders.
Lorden et al. 2014 USA	Health care system, Small group practice and health system quality improvement	Semi-structured interview	Two healthcare managers	Interplay among sociotechnical factors that lead to successful Lean implementation	Themes relevant to quality improvement success: Leadership support, communication of shared vision, overcoming resistance, importance of regulatory influence.
Steed 2012 USA	8 acute care hospital organization, board and hospital administration and management	Survey, questionnaire, interview	25 senior leaders of acute hospitals	Leadership attributes and methods essential in Lean adaptation	A strong combination of personal characteristics, learned behaviors, strategies, tools, and tactics.

CEO, chief executive officer; ED, emergency department; LTP, Lean Training Programme; OT/OR, operation theatre, operation room; QI, quality improvement.

the situation for themselves, empower health-care employees, reinforce Lean practices and by doing so engages leaders in experiential learning about implementation (25;29;30). One of the key factors to finding problems is to understand functional and professional silos (25) and the background that has caused the organization to initiate a Lean quality improvement project (22).

A3 problem solving is part of the problem solving techniques (30). Daily performance management using visual displays has also been mentioned, as well as communication huddles (40). Data walls collect and display locally relevant data (42). Visually displaying daily progress-technique is known more formally in Lean terminology as the use of a "daily management" or "daily engagement" system (25;29;40). Communication was one of the key factors referred to in most articles. As a part of management activities Hwang et al. (2014) emphasized that especially for a heavyweight manager it is important to communicate well both with top managers and project team members. In addition, Lorden et al. (2014) pointed out the necessity of two-way communication across the organizational hierarchy. The means of delivering information were also raised, such as monthly newsletters (41), a senior leadership newsletter, and house wide reports (30) (Table 3).

Style.

Leadership. Facilitating, supporting, and functioning as coaches and mentors seemed to be the prevailing style for successful Lean leadership and was pointed out in all the original articles. These leadership styles mean that Lean leaders can increase their teams' expertise both directly in their work and in quality improvement (25;29;30;40;42). Traits related to delegating decision making or power were also mentioned in some studies (25;41;42).

Management. Features related to a democratic style of management were strongly indicated in the reviewed studies. Almost half of the studies (four of nine) referred to team-work concepts such as "team-oriented" and "understanding team dynamics" (30;40–42) Many studies emphasized the importance of having time for multidisciplinary collaboration (22;25;29;40;42). In addition, there were various other leadership and management styles that were mentioned in one or two studies, which are presented in Table 3.

Focus.

Leadership. Most of the studies (five of nine) suggested that elementary to achieving transformation in Lean leadership is the leaders' involvement and commitment to Lean and improvement (25;29;30;41;42). In addition, there were many demands concerning the leaders' personal traits. For example, they should have the characteristic of being a high performer (30), and have several features that characterize being a servant, such as modesty and openness, ability to express

Table 2. Selected Review Articles, Their inclusion and Exclusion Criteria, Number of Reviewed Studies, Studies on Whole System, Lean Implementation/Managerial Traits, Healthcare Settings and Countries, Study Objectives, and Main Findings

Author, year, type of review	Inclusion and exclusion criteria	No. of Lean implementation or managerial studies	Setting and country	Study objectives	Main findings of the review
Al-Balushi et al., 2014, Comprehensive literature review	Peer-reviewed publications up to January 2012 pertaining to Lean health, Lean readiness, healthcare change management, and process redesign in health care for the subject of "readiness factors for lean applicable to healthcare"	170 including additional references identified through citation analysis, including books, workshop materials, and conference papers	Most studies on lean in healthcare utilize a case study approach	To determine the readiness factors critical to the application and success of lean operating principles in healthcare	Leadership, organizational culture, communication, training, measurement, and reward systems are commonly attributed readiness factors. Directly related to successful Lean implementation is that a setting is able to authorize a decentralized management style and undertake an end-to-end process view.
D'Andreamatteo et al., 2015, Comprehensive literature review, thematic analysis	Empirical and theoretical articles published up to September 2013	15 articles on systemic Lean implementation	Hospital settings, Majority from USA. Others from UK, Australia and Netherlands	Comprehensive overview of the main issues on implementation of Lean in a complex context (healthcare)	With a plan of actions to improve the whole organization performance, the organizations become more process-oriented; reduce costs; increase quality, safety, and access to care; employees become change agents and work team-based.
White et al., 2013, Literature review, qualitative content analysis	the Lean Healthcare and Productive Ward: RTC literature January 1980 until January 2013	RTC theme, 44 articles Lean and Health Care, 66 articles	All papers were examined for items relating to, containing or reporting on the employee experience.	To identify and investigate the strength of the connection between the two models; to explore the implications for leadership and implementation	Similar employee effects and impacts; 3 top themes of Empowerment, Leadership, and Engagement; 1 key difference between the 2 initiatives, the socio-cultural effect and impact which is strongly reported with Lean-type improvement initiatives.

ED, Emergency department; OT/OR, Operation theatre, Operation room; QI, Quality improvement; RTC, releasing time to care.

Table 3. Results

	Leadership				Management				
Activities	Handling conflicts: *Attention to resistance to change[1], Understanding company history of collaboration or conflict[8], Understanding how communication, leadership, and workload are affecting the implementation[8], Overcoming resistance[8]*	Problem solving: *Identify and solve problems both cross-functionally and within their own Modern functions[2], Fosters mutual understanding of the problem[3], To see the situation for one's own self[3], Adopt no-blame approaches[4], Problem solver[9]*	Making change happen: *Responsible for cross-functional activities in addition to own functional areas[2], An understanding of the complexity of the change[3], Understanding what system rules, both formal and informal, are successful for creating the change desired[8], Changing power structures[8], Importance of regulatory influence[8], Skilled communication[9], Understands change process, Change leader and manager[9], Can lead change and sustain change[9], Understands lean[9]*		Finding problems: *Understanding functional and professional silos[1], Going to the gemba[3], Understanding what history brought the organization to initiate a lean quality improvement project[8], Walks-the walk and talks the talk[9]*	Classifying problems: *Measures and uses data effectively to identify actual and relevant local problems and the root causes of those problems[4]* *System thinking, seeing wholes and interrelationships[7]*	Problem solving: *Managers do not have to re-work/re-visit problems because they have determined and solved the root cause[2], Managers develop corrective action in a learning environment[2], A3 Problem solving[9]*	Decision making: *Make decisions by both analyzing the existing data and gathering first-hand information[2]*	
A2 -Activities	Guiding: *Standardizing care[5], Experienced and credible[9]*	Leading: *Role model for the desired behavior[1], Spend time on the floor and lead by example[4], Leads by example and acting as a role model[9], Actively visible through participation[9], Spend time in the workplace to supervise the process[1]*	Visioning: *Frequent communication about change[7], Remind the staff to keep the vision of the future state in mind[7]*	Empowering/ inspiring: *Building on a nurturing environment to learn, improve and effectively implement goals[1], Empower health-care employees[3], Empowerment and trust[3], Inspires staff to join on a journey towards a challenging destination[3], Engaging and empowering[5], Empowers and engages[9], Inspired and inspiring[9]*	Organizing: *Develop work standards for most activities and perform in accordance with standards[2], Standardizing work processes[5], Pace-setter[9]*	Motivating: *Able to motivate others[9] Motivated and motivating[9]*	Controlling: *Daily performance management using visual displays[5]*	Developing: *Staff's education and training[1], Staff's Quality training[8], Managers are developed primarily through in-company learning/ mentoring, on-the-job training and problem solving[2]*	Communicating: *A heavyweight manager, who communicates well both with top managers and project team members[6], Monthly newsletter[7], Two-way communication across the organizational hierarchy[8], Senior leadership newsletter, Communication huddles, House wide reports[9]*
Style	Directing: *Structured and consistent manner[3]*	Coaching: *Coach to enhance problem-solving abilities[3], To operate foremost as coaches and mentors[4], Follow-up coaching to reinforce changes[5] Coach and mentor[9]*	Supporting: *Senior management support[1], Visible support and endorsement[5], Top management support[6], Leadership support to the workforce in solutions[8], Confident and approachable[9]*	Facilitating: *Availability of an effective facilitator on the work floor[1], To facilitate and support[3], Leaders accessible[7], Good listener[9], Skilled facilitator[9]*	Delegating: *Lean leaders trust their staff[3], Top leaders believe in the teams' abilities[7], Leads from behind through other people[9], Encourage shared decisions making[9]*	Autocratic:	Democratic: *Collaboration[5], Multidisciplinary collaboration[1], Decisions are made at the top of the organization and refined through two-way conversation and involvement with employees[2], Partnered dynamic between physicians and medical assisstants[5], More even distribution of work responsibilities and egalitarian relationships[5], Interdependence of all project teams[7], Team-oriented[9]*	Freedom: *Allow maximal flexibility[3], Develop inclusive approaches that seek input from all members of the team[4], Holds self and others accountable[9]*	

Table 3. Continued

	Leadership				Management					
Focus	Transactions: *Demands expertise, accountability and commitment[4], High performer[9]*	Actions: *Understands process improvement[9]*	Transformation: *Senior management commitment[1], Lean leaders are developing all the time[3], Senior management: Commitment and a prevailing culture of a continuous improvement[3], Committed to continuous development[9], Leaders engaged[7]*	Servant: *Modesty and openness[3], Ability to express uncertainty[3], Humble, Learns from others[9]*	Emotional intelligence: *Build personal connections[1], Consistent and flexible[3], Respect for others[3], Consistent, flexible, proactive and adaptive, agile, resilient[9]*	Resources: *Sufficient resources: time, staff, training[1], Attention and resources to quality improvement and change management[4], Adequacy of organizational resources[5]*	Results: *Focus on how the work is done and assume the results will follow[2], Data savvy and technical expert[9]*	Assessing progress: *Evaluated according to real-time process performance, as well as end-of-the-reporting-period results[2], Proof that the change will produce the desired effect[3], Strong performance track record[9]*	Organizational learning: *Continuous learning environment[1], Deliver results and create a learning environment to help employees in self-discovery[2], Creates or supports a 'learning organization' culture[4], Mistakes are opportunities for learning[4], Committed to lifelong learning[9], Learns by seeing and doing[9], Kaizen Events[9]*
Purpose	Individual success: *Quick learner[9], Driven[9], Ambitious[9]*	Followers: *Objectives, purposes and goals must be evident for everyone[1]*	Vision: *Top leaders: the long-term vision for the work[7], Communication of a shared vision[8]*	Crafting the future: *Shared understanding about complex goals (e.g. reducing waste)[6]*	Organizational success: *Celebrate success[1], Fostering a culture of innovation[5], Creativity[5], Passionate for excellence, Inclusive and collaborative[9]*	Objectives: *Aligns the aims and objectives of health regions[4], Clear project targets based on sound front-end planning[6], Abreast of evidence based best practices[9]*	Goals: *A clear, well-planned strategy[1], Give goals to work towards[3], Goal and action oriented[9], Team members work towards a common goal, communicate clearly and understand one another's roles[1]*	Values: *Ethical values[3], Sensitivity to the professional values and culture of medicine[5], Strong work ethic, honest[9]*	Mission: *Creating value for the patients[3], Enhancing customer value[6]*

Note. The features or activities recognized to indicate various success factors of Lean implementation or adaptation in nine original articles that describe and analyze healthcare systems or units with Lean activities, categorized according to the concepts of leadership and management in the windshield model. Aij et al. 2013 (1), Aij et al. 2015 (a) (2), Aij et al. 2015 (b) (3), Goodridge et al. 2015 (4), Hung et al. 2015 (5), Hwang et al. 2014 (6), Johnson et al. 2012 (7), Lorden et al. 2014 (8), Steed 2012 (9)

uncertainty, being humble, and learning from others (25). Signs of emotional intelligence were confirmed by features such as consistent and flexible, and having respect for others, being proactive and adaptive, agile, and resilient (25;30) (Table 3).

Management. Many of the studies (four of nine) suggested that the utmost focus of Lean management is continuous learning, which was characterized by several expressions and examples such as learning from mistakes, learning by seeing and doing, and being committed to lifelong learning (25;29;30;42). Financial and manpower resource commitments were recognized as being required while implementing Lean (29;40;42). Other focuses concerning results and assessing processes included evaluation according to real-time process performance, as well as end-of-the-reporting-period results (24) (Table 3).

Purpose.

Leadership. The majority of the studies (five of nine) emphasized the communication of a clear vision and targets for improvement (22;29;41–43). As an expression of purpose, top managers have been found to be aware of a long-term vision for the work (41). There were also several studies that mentioned the kind of features that emphasize organizational success, such as celebrating success (29), fostering a culture of innovation, collaboration and creativity (40), a passion for excellence, and inclusive and collaborative team work (30) (Table 3).

Management. Some elements related to purpose were associated with management. Creating value for the patients (24) and enhancing customer value (43) were considered to be related to mission. Lean leaders should have an understanding as to who the customers are and what value means for them (25;40;42). Two of the studies paid attention to sensitivity to professional values and the culture of health care (29;40). Goal-related features were characterized by a clear, well-planned strategy (29), as well as being goal and action oriented (30). Other objective related terms in the studies included adherence to evidence based practices (30) and "aligns the aims and objectives of health regions" (Table 3).

Other traits presented in the reviewed literature that could not be classified with windshield categories were related to learning and training of personnel: managers are developed primarily through in-company learning/mentoring, on-the-job training, and problem solving (25).

CONCLUSIONS AND PRACTICAL IMPLICATIONS

The purpose of our study was to identify the characteristics of leadership and management that are associated with successful Lean thinking adaptation in health care by using a systematic literature review. This was done to identify from recently published original study sources a conceptual analysis of managerial traits.

Our main findings were that both leadership and management are required for successful Lean adaptation. In addition, we were able to classify the contents of the reviewed articles by using the four dimensions of leadership and management: activities, style, focus, and purpose. Various problem-solving techniques and skills, measuring performance, and various ways of communicating, including visible techniques, are the key activities of transformation for the healthcare organization to reach its goals (22;24;25;29;30;40;41). The role of leaders as mentors, coaches, or facilitators as well as their emotional intelligence were highlighted (25;29;30;40;42).

The signs of organizational democracy, such as team work and a multiprofessional collective perspective, were also emphasized as being significant styles of Lean leadership and management (22;25;29;40;42). Continuous learning has a significant role as a part of focus of Lean management (25;29;30;40;41). It is useful to notice that, in health care, it is significant to pay attention to sensitivity to professional values, and the culture of health care (29;40). As an expression of Lean leadership's purpose is to communicate a clear vision and targets for improvement (22;29;40–43). Part of this is to understand who the customers are and what value means for them (24;38;39) (Figure 2).

Results were quite similar than previous study. Andersen et al have shown that a supportive culture, training, accurate data, physicians and team involvement were most frequent factors when enabling a successful Lean intervention (21). Leadership, organizational culture, communication, training, measurement and reward systems (39), actions to improve the whole organization process-oriented, team-based performance (37), and empowerment and engagement (38) are also the key traits in previous studies.

The researchers in this study made decisions on how the material was classified in accordance with the managerial windshield. The decisions were based on the contexts in which the results were presented in the material. The categorization for leadership and management was not always straightforward, and some features could fit into various categories. Nevertheless, looking at the results with windshield concepts clearly emphasizes the philosophy, principles, and tools of Lean thinking and the need for multiple skills and behavioral traits in the individuals responsible for change in their organizations before successful transformation of the system is achieved. Interestingly, strategic perspectives, mission and goal setting, as well as resource management were not stressed/highlighted as strongly as the skills and techniques of problem solving, activities related to empowerment, transformation, and continuous learning. The model of managerial windshield was well suited for structuring the features of Lean leadership and management.

Typically, the reviewed articles used both leadership and management to describe the managerial function, but the definitions of and differences between these two were seldom explained. It needs to be pointed out that the scope of our study

Lean leadership and management characteristics	
Activities Problem solving techniques and skills Measuring performance Communication including visible techniques	Style Role of leaders as mentors, coaches or facilitators Emotional intelligence Multiprofessional collective perspective and team work
Focus Continuous learning Attention to sensitivity of professional values and culture of health care	Purpose Clear communication of a vision and targets for improvement Understanding who the customers are and what values mean for them

Figure 2. Key findings of successful implementation of Lean as a managerial principle in health care.

was not to look into the professional job descriptions of managers as leaders. There is a variety of professional hierarchies in different healthcare systems as regards managers, leaders, or directors. Our intention was rather to look into the skills, activities, and behaviors of the two recognizable managerial concepts, that is, leadership and management.

Furthermore, one of our findings was that the description of Lean thinking was unclear in the majority of the studies, and there were few if any definitions of features that would differentiate Lean leadership and management from any other managerial or improvement settings. This is in accordance with a previous review which concluded that by reviewing the literature, everything it seems may be termed Lean (34). Nevertheless, by analyzing the characteristics of managerial dimensions, we were still unable to obtain evidence as to whether Lean thinking had been adapted successfully in the studied organizations and whether the targets and goals had been reached or not; it was also not possible to determine the impact of the managerial function in the process of adaptation to Lean thinking.

Strong leadership and management are being considered critical to successful implementation of Lean thinking (7;20;21;22;23;37–39). Leadership has been considered as a key to understand why, or why not, Lean interventions make contributions to health care (21). According to transformational leadership theory, leaders influence followers and, thus, are thought to be agents of change (44). Thus far, there has not been a complete picture of Lean management, Lean leadership attributes and Lean methods in health care (29;30).

In addition, the analysis of the benefits and the criticality of Lean leadership/management in health care seems to have been undervalued (21). The concept of the windshield focus is to help managers and leaders in decision making and to clarify some important management and leadership concepts (31). The results of our study can, on the one hand, be used in analyzing decision making related to Lean management in health care and, on the other hand, help to identify essential managerial concepts of Lean management and leadership in health care. The external validity of the findings could be strengthened by testing in an empirical study. In addition, there is insufficient knowledge about how Lean leadership and management is practically applied, which characteristics are emphasized at different levels of organization hierarchy, and whether the predominant characteristics of Lean leadership and management vary over a longer term in organizations. Appropriately tested instruments for modelling Lean adaptation are required.

The current study has some limitations. Although a careful search approach was used, some papers from the journals not indexed in the searched databases may have been overlooked. Another limitation was that the literature searches were carried out only for a 5-year period. Not to miss any important qualitative information, three systematic reviews were included to widen the perspective and ensure that no essential information was missed. Another shortcoming is that our review only included English-language studies; this precludes relevant insights stemming from papers published in languages other than English, and the fact that there might be cultural aspects that are overlooked by analyzing only English publications.

The trustworthiness of this study is demonstrated by describing the data selection process and by the involvement of three researchers in the selection and appraisal process. The PRISMA Checklist (45) list was applied in study. The reliability and validity of the original articles were checked with

the Consolidated Criteria for Reporting Qualitative Research (COREQ) study design and analysis/reporting checklist. This checklist consists of items specific to the reporting of qualitative studies and precludes generic criteria that are applicable to all types of research reports (46). The criteria were variably met by the reviewed articles.

Scientific proof for Lean as an efficient and effective quality-improvement method is needed (21). Future research should be conducted to define experiences of Lean management and leadership models and the usefulness of these models when using the Lean system. Moreover, new leadership requires a new kind of role and competence from healthcare staff, and from this point of view, research data are also needed. The readiness factors identified from such data will enable healthcare leaders to be better prepared through learning and education as they begin or continue their journey toward Lean implementation.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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