

Examining of the effect of HRM in mitigating negative effects of LM&SS on employee well-being in health care

Effect of HRM
in mitigating
negative
effects

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Abstract

Purpose – This study aims to examine the effect of human resource management (HRM) in mitigating negative effects of Lean management and Six Sigma (LM&SS) on employee well-being in health care. The authors subdivide well-being into three components: happiness, trust and health.

Design/methodology/approach – This is a cross-sectional, multisite survey study in internal service units of hospitals. Data analyzed using multivariate regression come from a sample of 1,886 survey respondents (42 units, $N = 218$ supervisors, $N = 1,668$ employees) in eight Dutch academic hospitals that have implemented LM&SS.

Findings – The present study findings show no or weak effects of LM&SS on the happiness and health component of employee well-being. In addition, the authors found a significant but weak direct positive effect ($\beta = 0.07$) of the LM&SS bundle on the trusting relationships component of well-being. Therefore, moderating effects of HRM practices on the relationship between LM&SS and employee well-being seem less relevant because an existing relationship between LM&SS and employee well-being is a prerequisite for moderation (Hayes, 2009). There were unexpected side effects. Inspired by research that discusses direct effects of HRM on employee well-being, the authors tested this relationship and found that HRM has a direct positive effect on trust and happiness of employees in health care. For the health component of well-being, the present results show a weak negative effect of HRM.

Practical implications – This study results in a cautiously optimistic view about LM&SS in health care, provided that it is applied in a targeted manner (to improve the performance of their processes) and that HRM is strategically aligned with the goals of LM&SS to improve employees' happiness and trusting relationships.



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Originality/value – Unique features of the study are the focus on the consequences for employees' well-being related to LM&SS in health care, the role of HRM in regard to this relationship and the participation of all eight Dutch academic hospitals in this research.

Keywords Employee well-being, Lean management, Six Sigma, Human resource management, Health care
Paper type Research paper

1. Introduction

Health-care professionals try to provide the best care for their patients every day. To achieve this ambition, they need to balance between rapidly developing medical knowledge and technological capabilities, an increasing number of chronic diseases, co-morbidity, economic budgets and expectations and preferences of the patient (Main *et al.*, 2002; Smith *et al.*, 2013). To do so, health-care organizations embrace methodologies and philosophies derived from manufacturing, such as Lean management and Six Sigma (LM&SS). Lean has been started in the Toyota Production System with the main emphasis on eliminating wastes by focusing on the value chain, doing things better and achieving an improved performance (Mi Dahlgaard-Park *et al.*, 2006; Vaishnavi and Suresh, 2021). Six Sigma (SS) has originated from Motorola with a focus on diminishing variation in process to improve efficiency and quality (Antony *et al.*, 2016b). LM&SS, as a combination of Lean management (LM) and SS, is seen as the most effective process improvement that it is widely implemented in the top performing organizations (Sreedharan and Sunder, 2018), and also in health care (Chassin, 2013; Dahlgaard *et al.*, 2011; Poksinska *et al.*, 2017; Ahmed *et al.*, 2018).

Some researchers and practitioners object to the notion of industrialized health-care delivery (De Koning *et al.*, 2006). Tensions may arise between the need to demonstrate efficiency and achieve performance targets (derived from governmental financial pressure) and the need to invest time and resources in continuous improvement (Burgess and Radnor, 2012). Moreover, some state that with these increasing administrative burdens and productivity targets, the intrinsic motivation of health-care employees is suffering (Waring and Bishop, 2010; Radnor *et al.*, 2012; McMahon, 2018). This line of reasoning is confirmed by a growing number of recent studies concluding that LM&SS interventions are negatively associated with employee well-being in health care (Holden, 2011; Saskatchewan Union of Nurses, 2014; Moraros *et al.*, 2016; Goodridge *et al.*, 2018). Potential negative effects of LM&SS on employee well-being are relevant in the light of the workforce shortage in health care combined with the current high levels of burnout among health-care professionals (Reith, 2018). The debate about relationship between LM&SS and employee well-being is still open and require further analyses (Gaiardelli *et al.*, 2019). LM&SS is not a neutral and value-free activity (Pedersen and Huniche, 2011) and there is a need to carefully evaluate how LM&SS may impact upon the well-being of employees in health care (Poksinska, 2010; Holden, 2011; Van Lent *et al.*, 2012; Goodridge *et al.*, 2018), especially, because there is no agreement on the effect – positive or negative – of LM&SS on employee well-being (Jackson and Mullarkey, 2000; Godard, 2001; Conti *et al.*, 2006).

This study contributes to this need in several ways. First, based on a review of the literature, we translated LM&SS from a manufacturing perspective into a health-care perspective (Radnor *et al.*, 2012). The integration of LM and SS is still relatively rare in health care (Wilson *et al.*, 2018) and there is a need for more empirical research on the application of LM&SS in health care (Watkins *et al.*, 2014; Bertolaccini *et al.*, 2015; Ko *et al.*, 2016; da Silva *et al.*, 2018). Research shows that “soft” LM&SS practices, concerning people and relations (Mamata *et al.*, 2015), are crucial for achieving superior performance and the internalization of LM&SS (Taylor *et al.*, 2013). However, especially in health care, LM&SS is often perceived as a set of “hard” practices, concerning tools and techniques for improving processes (Poksinska, 2010; Stamatis, 2011). For

example, [Henrique and Filho \(2020\)](#) state, based on their systematic review, that most used techniques found in health care are the value stream mapping (VSM), standardization of work and visual management. In our research, LM&SS consists of both “hard” practices which are focused on practices for improving processes (quality information, process management, structured improvement procedure, focus on metrics) and “soft” practices aimed at employees and relationships (top management support, customer relationship and supplier relationship) ([Bortolotti et al., 2015](#)).

Second, when we look at research on the effect of LM&SS on employees in health care, the conceptualization of employee well-being has been very limited ([Hasle, 2014](#)), with workers satisfaction as the far most commonly mentioned component ([Mazzocato et al., 2010](#); [Moraros et al., 2016](#); [D’Andreamatteo et al., 2015](#)). Contrary to earlier research, we included three core components of employee well-being: happiness, trust and health ([Grant et al., 2007](#)). In addition, only few studies on LM&SS focus on both positive and negative results of the method on employees ([Longoni et al., 2013](#); [Farris et al., 2009](#); [Saurin and Ferreira, 2009](#); [Parker, 2003](#); [Jun et al., 2006](#)). Therefore, we argue that is important to examine potential “positive” and “negative” consequences of the same set of LM&SS practices on each component of employee well-being ([Cullinane et al., 2014](#); [Karthi et al., 2014](#)).

Third, we focused on the conceptualization as well as the role of HRM in the relationship between LM&SS and employee well-being. This is relevant because growing research underlines the importance of human resource management (HRM) regarding employee well-being ([Alfes et al., 2013](#); [Kroon et al., 2009](#); [Veld and Alfes, 2017](#)). Although there is increasing evidence that organizations that combine LM&SS with HRM outperform organizations that do not apply this combination ([MacDuffie, 1995](#); [Zu and Fredendall, 2009](#); [De Menezes et al., 2010](#); [Yang et al., 2012](#)), studies that focus on LM&SS, HRM and employee well-being are scarce. Contrary to the above-mentioned studies which considered HRM as part of LM&SS, we included a separate HRM systems approach for those “soft” LM&SS practices that are specifically HR-related, such as training and development, performance appraisal and rewards, team working and autonomy and participation and job design. The rationale behind including HRM as a separate influencing factor is twofold. First, the growing number of critical views on the (negative) effect of LM&SS on employees argued for the HR side to be viewed separately ([Moraros et al., 2016](#); [Goodridge et al., 2018](#)). Second, there is no extensive research on the role of HRM regarding the relationship between LM&SS and employee well-being ([Hasle et al., 2012](#); [Cullinane et al., 2014](#)) and no agreement about which HR practices should be incorporated ([Boselie et al., 2005](#); [Paauwe, 2009](#); [Paauwe et al., 2013](#)). Therefore, including a separate HRM systems approach in our research supports thorough understanding of how and in what form HRM affects the relationship between LM&SS and employee well-being. It is against this background that this paper aims to contribute, by answering the following research question:

RQ1. “How is LM&SS related to employee well-being in hospitals and how does HRM moderate this relationship?”

The structure of this paper is as follows. First, we discuss relevant theory in Section 2 as well as a more in-depth operationalization of the concepts that are part of our study. Also, hypotheses are drawn. Section 3 highlights the research methods applied and provides insight into the sample and survey, and the development of constructs. Analysis of the data are discussed in Section 4. In Section 5, the results and the theoretical and managerial implications are discussed, and Section 6 provides the conclusion, limitations and future research directions.

2. Theoretical background

LM&SS follows a long history of system management and quality improvement (Waring and Bishop, 2010), starting at the beginning of the 20th century through mass production affected by, among others, Henry Ford (Womack *et al.*, 1990), followed by the Toyota Production System (TPS) in the Japanese automotive industry (Spears and Bowen, 1999) and adopted as LM in the Western world since 1980 (Womack and Jones, 2003; Stamatis, 2011). Around the same time that LM was embraced, many large companies, including Motorola and General Electric, implemented SS with a focus on reducing errors and minimizing variability (Joint Commission on the Accreditation of Healthcare Organizations, 2008). While the definitions of LM and SS differ, both serve the aim of reducing waste and resources while improving customer satisfaction and financial results (Andersson *et al.*, 2006) and organizations increasingly combine these methods into one single approach: LM&SS (Glasgow *et al.*, 2010).

2.1 Lean management and Six Sigma in health care

In addition to manufacturing, LM&SS is nowadays also widespread in health care (Goodridge *et al.*, 2015; D'Andreanmatteo *et al.*, 2015). In health care, LM&SS is applied with the aim to improve process efficiency, reduce waste, enhance the care process, reduce waiting time and cost and improve quality and patients satisfaction (Vaishnavi and Suresh, 2021; Molla *et al.*, 2018; Hynes *et al.*, 2019; Ahmed *et al.*, 2018; Tagge *et al.*, 2017; Agarwal *et al.*, 2016; Fuwad *et al.*, 2015). An example of LM&SS in health care can be seen in Mayo Clinic Rochester in the USA, which increased their process efficiency and financial performance in 2011 by applying LM&SS (Cima *et al.*, 2011; Kuo *et al.*, 2011; Al Khamisi *et al.*, 2019). Also, there are examples of LM&SS supporting the development of clinical pathways (Niemeijer *et al.*, 2011, 2012; Mandahawi *et al.*, 2010; Martinez *et al.*, 2011; Improta *et al.*, 2019). However, most research on LM&SS in health care is conceptual and not empirical in nature (Seidl and Newhouse, 2012). Also, implementing LM&SS in non-manufacturing sector like health care is challenging (Aboelmaged, 2015) and health-care organizations struggle with interpreting and tailoring the concept to their own context (Anderson *et al.*, 2006). This is evident in health care by the lack of uniformity in the theoretical conceptualization of LM&SS (D'Andreanmatteo *et al.*, 2015). Compared to manufacturing practices (Zacharatos *et al.*, 2007; Birdi *et al.*, 2008; Lee and Peccei, 2008), the LM&SS toolbox of health-care organizations tends to be filled with a limited number of LM&SS practices (Poksinska, 2010; Stamatis, 2011; Radnor *et al.*, 2012). Some health-care organizations adopt separate practices from the LM&SS toolbox; other organizations embrace LM&SS as a systems approach (Waring and Bishop, 2010; Holden, 2011; Radnor, 2011; Van Lent *et al.*, 2012). The rationale for including LM&SS systems approach in our research is the importance to empirically examine the effects of multiple dimensions (Wright and Boswell, 2002; Shah and Ward, 2003). Moreover, the included systems approach consists of interrelated “soft” and “hard” LM&SS practices because results in hospitals depend, on the one hand, on routine and standardized processes and, on the other hand, on employees with the right customer mindset and capabilities to anticipate on changing demands from their customers (Shah and Ward, 2007).

2.2 Lean management and Six Sigma and employee well-being

One of the explanations of unsuccessful implementation of LM&SS is the heavy focus on tools and techniques at the expense of the human side of LM&SS (Bhasin, 2012; Cardon and Bribiescas, 2015; Coetzee *et al.*, 2016; Gao and Low, 2015; Jadhav *et al.*, 2014; Pakdil and Leonard, 2014; Coetzee *et al.*, 2019). LM&SS is controversial from the perspective of

employee well-being (Jackson and Mullarkey, 2000; Seppälä and Klemola, 2004; Bonavia and Marin-Garcia, 2011), and there is no agreement on the effect – positive or negative – of LM&SS on employee well-being (Godard, 2001; Conti *et al.*, 2006). Proponents argue that health-care organizations that embrace LM&SS to improve performance can simultaneously foster employee well-being (Graban, 2008; Bisgaard, 2009; Stamatis, 2011). For example, because of the nature of the process that requires employees to get engaged in a problem-solving process and improvement of the workflow, they feel more motivated to improve outcomes (Seppälä and Klemola, 2004). Opponents, however, say that LM&SS leads to higher performance yet lower employee well-being (Holden, 2011; Carter *et al.*, 2011, 2013). For example, recent systematic reviews conclude that LM&SS is negatively associated with worker satisfaction (Moraros *et al.*, 2016). The direction of the effect of LM&SS on employee well-being may depend on which aspect of well-being – happiness, trust and health – is distinguished. For the happiness aspect of well-being, researchers differ in their opinion. For example, studies by Graban, (2008), Stamatis (2011) and Collar *et al.* (2012) mention improved levels of commitment and satisfaction related to LM&SS initiatives. However, a large study by the Saskatchewan Union of Nurses (2014) showed that LM&SS had an overall negative effect on worker satisfaction and studies by Angelis *et al.* (2011), and White *et al.* (2014) discuss negative effects of LM&SS on worker commitment. Also, LM&SS may increase administrative and management tasks (Radnor, 2011; Waring and Bishop, 2010), which could lead to lower levels of job satisfaction and commitment of health-care employees. Based on the latter studies, which we found empirically more compelling than the studies that propose positive effect of LM&SS on satisfaction and commitment, we expect a direct negative effect of LM&SS on the happiness component of employee well-being (see *H1*). For the trust and health aspects of employee well-being, there is more agreement. Some researchers argue that LM&SS is “management by stress” because it “sweats” employees through faster work processes, standardizes jobs and increases social control through peer pressure (Graham, 1995; MacDuffie, 1995; Stanton *et al.*, 2014). Also, process standardization could limit employee autonomy and restrict employees from expressing themselves (Hasle *et al.*, 2012; Minh *et al.*, 2019). Furthermore, top-down implementation of LM&SS where changes are decided and implemented by management and consultants could reduce the trust of employees in their own decision latitude (Hasle, 2014). Reviews of studies that focus on trusting relationships and health effects of LM&SS seem to confirm this point of view as they report mainly negative effects (Landsbergis *et al.*, 1999; Parker, 2003; Holden, 2011; Carter *et al.*, 2011, 2013; Hasle *et al.*, 2012). In health care, jobs are demanding, and overload, loss of meaning and lack of autonomy are common factors for lower levels of employee well-being (McMahon, 2018). Although LM&SS may provide employees with resources (e.g. access to quality information, customer feedback and building relationships with suppliers), there is also a risk that employees are put under greater pressure and higher levels of control at work. Dove (1999), for example, mention that LM&SS leads to lower levels of flexibility and ability to react to new conditions and circumstances. Others state that standardization makes the job more specified and predetermined, which could increase time pressure and stress (Berggren, 1992; Koukoulaki, 2014). Based on the above described agreement in research regarding negative effects of LM&SS on trust and health aspects, we expect a direct negative effect of LM&SS on these two aspects of employee well-being (see *H1*):

H1. LM&SS has a direct negative effect on the happiness, trusting relationships and health of employees in hospitals.

2.3 Lean management and Six Sigma, human resource management and employee well-being

The importance of HRM is also more and more stressed in research on LM&SS (Anand and Kodali, 2009; Birdi *et al.*, 2008; Shah and Ward, 2003). For example, research shows that organizations that combine operation management practices, such as LM&SS, with HRM, outperform organizations using more traditional mass production systems (De Menezes *et al.*, 2010; MacDuffie, 1995; Zu and Fredendall, 2009). Where many studies so far have argued for the inclusion of HR practices in an LM&SS systems approach (Shah and Ward, 2007; Yang and Yang, 2013), we constructed a separate HRM systems approach for those LM&SS practices that are specifically HR-related. A rationale behind the construction of the separate HRM systems approach is that LM&SS practices such as process management and focus on metrics seem to be of a different order than, for example, LM&SS practices such as rewards and teamwork. Where the first two practices are usually directly linked to the adoption of LM&SS, it is likely that the last two practices have already been adopted for quite some time in health-care organizations. More specifically, while LM&SS often has a programmatic and temporary character, HRM is often a constant part of the business operations in hospitals. Because we included LM&SS and HRM separately in this article, we can investigate the effects and relationships of these two systems approaches combined and separately.

There is hardly research on the role of HRM regarding the relationship between LM&SS and employee well-being (Hasle *et al.*, 2012; Cullinane *et al.*, 2014). Although HRM is mostly viewed from an “optimistic” perspective, namely, that it positively affects employee well-being (Peccei *et al.*, 2013), a thorough understanding of how HRM impacts the relationship between LM&SS and the well-being of employees is necessary (Goodridge *et al.*, 2018). To explain the effects of HRM on LM&SS and employee well-being, the social exchange theory by Blau (1964) is commonly applied. This theory states that employees interpret management activities as indicative of the organizational support and care for them, and reciprocate accordingly in commitment, satisfaction and trust (Whitener, 2001; Van de Voorde *et al.*, 2012). According to Appelbaum *et al.* (2000), the adoption of management HR activities increases employees’ skills and motivation and provides opportunities to participate (so-called AMO theory). Subsequently, this process has a positive effect on employee well-being; it increases job satisfaction, commitment and trust, and, on the other hand, it reduces stress levels. HRM can be seen as a signaling system that constantly sends messages to employees to stress the attitudes and behaviors that are desired within the organization (Bowen and Ostroff, 2004; Ehrnrooth and Björkman, 2012). Therefore, we argue that HRM might be focused on buffering the negative effects of LM&SS on employee well-being (see *H1*). For example, if LM&SS is perceived by employees as a top-down cost reduction program (Drotz and Poksinska, 2014; Hung *et al.*, 2017), they could not feel valued, although they are the ones who are in the best position to offer suggestions for improving the efficiency of the work they do (Sim and Rogers, 2008). When the same employees are involved in the selection of efficiency projects (Antony *et al.*, 2016a) and thereby experience the opportunity to influence decision-making, these feelings could be buffered (Vaishnavi and Suresh, 2021). In addition, training and the full involvement and use of professional knowledge, skills and experience of employees could buffer negative effects of LM&SS on commitment and job satisfaction (Poksinska, 2010; Jiang *et al.*, 2012; Cullinane *et al.*, 2014). Furthermore, autonomy of employees related to day-to-day decision-making has been found to increase job satisfaction and psychological well-being while also reducing job pressure (Wall *et al.*, 1990; Jackson and Mullarkey, 2000; Cullinane *et al.*, 2014) and therefore could buffer the possible negative effects of LM&SS employee well-being. In addition, relating

performance appraisal and rewards to individual and team performance could buffer the possible negative effects of LM&SS on trusting relationships between employees and their employer. Finally, teamwork (sharing the burden) could buffer the possible negative effects of LM&SS on the health of employees. Also, teamwork could buffer negative effects of LM&SS on trust and commitment because it encourages trust and respect with each other (Marksberry, 2011) and stimulates sharing opportunities of development (Liker and Hoseus, 2008). Following this line of research, we expect that negative effects are buffered when HRM is high (*H2*):

H2. HRM positively moderates the relationship between LM&SS and employee well-being – happiness, trusting relationships and health – in hospitals.

There is extensive research that shows that bundling certain HR practices is more effective than the use of individual practices (Boselie *et al.*, 2005; Wall and Wood, 2005; Combs *et al.*, 2006; Hyde *et al.*, 2006; Jiang *et al.*, 2012). However, research on LM&SS, especially in health care, usually mentions a limited number of HR practices. For example, Antony *et al.* (2016a), Kennedy and Daim (2010), Tsironis and Psychogios (2016) and Honda *et al.* (2018) state that training is crucial when implementing LM&SS. Buestan *et al.* (2016) and Ahmed *et al.* (2018) argue that successful implementation of LM&SS depends on the participation of health-care staff and De Stobbeleir *et al.* (2011) refer to the importance of feedback. We expect that HR practices within our proposed HRM systems approach are strongly aligned with each other, because HR practices such as performance appraisal and rewards, employment security and work/life balance are predetermined in a national Collective Bargaining Agreement (CBA) for hospitals. Moreover, we argue that the effectiveness of any HR practice depends on the other practices in place. For example, teams that focus on problem-solving (HR practice teamwork) are effective when they can involve colleagues in improving the status quo (HR practice participation). Also, the HR practice training in LM&SS is effective when the participants in the training can take responsibly for their own tasks (HR practice job design). Following Delery (1998) and Veld *et al.* (2010), we propose that if all the HR practices fit within a coherent system, the effect of that system on the relationship between LM&SS and employee well-being should be greater than the sum of the individual effects from each practice alone. Therefore, we expect that the effect of HRM on the relationship between LM&SS and employee well-being in health-care organizations is stronger for a systems approach of HRM in comparison to a single HR practices approach (see *H3*). To test this hypothesis, we include single practices as well as a systems approach of HRM in our research (Figure 1):

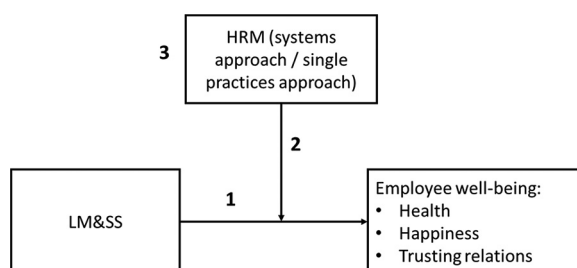


Figure 1.
Conceptual
framework for
examining
relationships between
LM&SS, HRM and
employee well-being

- H3. The positive moderating effect of HRM on the relationship between LM&SS and employee well-being in hospitals is stronger for a systems approach of HRM compared to a single HR practices approach.

3. Data and research methodology

3.1 Data sample

We focus on the internal service units, such as cleaning, logistics and food, within hospitals for two reasons. First, health-care professionals deliver care to a patient in combination with service processes delivered by internal service units. Second, cases of successful LM&SS initiatives in health care as discussed by Graban (2008), Bisgaard (2009) and Stamatis (2011) generally focus on service processes. Our study includes more than 40 units, while most of the above-mentioned studies usually focused on just one unit or department within hospitals. Although internal service units are commonly perceived as highly standardized work environments, such as fast-food restaurants or cleaning companies, it is important to consider internal service units in academic hospitals differently because care and service processes are highly blended in this context. Employees of most internal service units such as logistics, food, security and cleaning are usually part of multidisciplinary teams in hospitals (Palmore *et al.*, 2011; Wackerbarth *et al.*, 2015). Therefore, they perceive nurses and physicians as their direct colleagues and experience that their work is part of the chain of delivering a high quality of care. We realize that this may be less the case for some internal service units. For example, employees from the unit Purchase may have less direct contact with patients and employees of the unit Maintenance may be part of multidisciplinary teams on a project basis.

Our study includes all eight academic hospitals in The Netherlands (A to H). These hospitals provide highly specialized patient care, combined with specialized diagnosis and treatment, and are inextricably linked to scientific research and education. We described our research population with descriptive statistics at the unit level. The internal service units differ in size and structure. Moreover, both the intensity and time period of the application of LM&SS within the hospitals differ (see Table 1). To make sure that we construct a homogeneous sample and to create internal and external validity and reliability, we applied four criteria for participation in our research:

- (1) Similar services that occur at four or more academic hospitals are included.
- (2) At least ten employees and three supervisors per unit were required to reliably assess the theoretical concepts at the unit level.
- (3) Employees and supervisors (including temporary workers) who work at least one year at internal service units were included.
- (4) Outsourced services were excluded because these involve employees outside of the organization and are not being involved in LM&SS projects.

These criteria resulted in a sample of 1,668 employees and 218 supervisors from 42 units (response rate of 55%, varying from 20% to 96% per unit). The average group size per unit is 40 employees and 5 supervisors. The average age of the respondents is 45 years and the average percentage female is 13% (see Table 1). This relative low percentage can be explained by the technical focus of internal service units such as maintenance, logistics and security. Statistics of the Dutch labor market seem to confirm the representativeness of our sample: in 2017, only 13% of the employees that worked in a technical job were female (Central Bureau for Statistics). More than 80% of the respondents have a permanent contract

Hospital	# respondents	% female	$\bar{x}$ age	$\bar{x}$ years at internal unit service	$\bar{x}$ years at unit	$\bar{x}$ years in job	% permanent contract	% higher education	Time between start LM&SS and start data collection	Intensity of LM&SS
M		30		7						
A		26		10						
Hospital A	193	10%	44	10	7	7	83%	22%	>3 years	LM&SS projects, top down
Hospital B	224	12%	42	6	6	7	69%	12%	1-2 years	LM&SS projects, top down
Hospital C	220	12%	46	10	9	8	95%	18%	6 months-1 year	LM&SS bottom up
Hospital D	493	26%	42	8	8	7	83%	20%	2-3 years	LM&SS projects, top down
Hospital E	229	11%	44	11	9	8	82%	17%	6 months-1 year	LM&SS bottom up
Hospital F	239	14%	45	11	9	8	80%	25%	0-6 months	LM&SS projects, top down
Hospital G	98	5%	48	12	6	10	95%	11%	0-6 months	LM&SS bottom up
Hospital H	190	10%	47	11	7	6	68%	7%	1-2 years	LM&SS projects, top down
	1,886	13%	45	10	8	8	82%	17%		

(continued)

Table 1.
Sample of the
internal service units
of the eight academic
hospitals

Table 1.

Hospital	# respondents	Type of respondents	Logistics	Distribution of respondents per hospital per unit in percentages				
				Food	Cleaning	Maintenance	Service point	Purchase
<i>Hospital A</i>	193	Employees Supervisors	23% 3%	17% 3%	30% 5%	Not participating	12% 4%	Not participating
<i>Hospital B</i>	224	Employees Supervisors	35% 6%	24% 3%	15% 4%	Not participating	7% 1%	Not participating
<i>Hospital C</i>	220	Employees Supervisors	29% 2%	14% 3%	10% 1%	14% 2%	12% 1%	9% 2%
<i>Hospital D</i>	493	Employees Supervisors	19% 1%	24% 2%	26% 2%	10% 1%	5% 1%	3% 1%
<i>Hospital E</i>	229	Employees Supervisors	15% 3%	28% 7%	Not participating	19% 3%	7% 1%	8% 2%
<i>Hospital F</i>	239	Employees Supervisors	28% 2%	16% 2%	Not participating	23% 2%	14% 1%	7% 0%
<i>Hospital G</i>	98	Employees Supervisors	Not participating	Not participating	78% 8%	Not participating	Not participating	Not participating
<i>Hospital H</i>	190	Employees Supervisors	14% 2%	55% 2%	Not participating	9% 2%	14% 1%	Not participating
	1,886	Employees Supervisors	22% 2%	23% 3%	17% 2%	10% 1%	9% 1%	4% 1%

and only 17% received a higher education. Respondents work on average 10 years at the internal service units, and 8 years in their job. [Table 1](#) also reports the time period between the start of LM&SS and the start of our data collection per hospital. This time period could signal a time lag between LM&SS and performance effects in our analyses. In prior research, hardly any specific details are provided on the issue of this time lag ([Birdi et al., 2008](#)), but [Wright and Haggerty \(2005\)](#) refer to an average time lag of 19 months before an HR-related intervention takes effect in terms of performance. As LM&SS focuses on rapid performance improvement, the time lag of LM&SS on employee well-being and performance may be shorter.

3.2 Measures

To operationalize the theoretical concepts of LM&SS, HRM and employee well-being, we searched the literature for existing validated measurement instruments. Following a similar approach used by [Boselie et al. \(2005\)](#), we restricted our search to only articles that have appeared in prominent, international, refereed journals. This means that we had excluded books, reports, unpublished papers and dissertations. This criterion also excludes research published in non-English language journals with predominantly national readership. Only articles that presented empirical research, including validated measurement instruments, are selected. A further criterion for selecting measurement instruments is that each study reports research into the impact of multiple HRM and/or LM&SS practices on some measure of performance. This is in line with our understanding of the importance of empirically examining the effects of LM&SS and HRM simultaneously stressed by, for example, [Wright and Boswell \(2002\)](#) and [Shah and Ward \(2003\)](#). We searched the databases of PubMed, Scopus, Web of Science and PsycINFO using keywords such as *Lean, *Six Sigma, *total productive maintenance, *just in time, *total quality management, *continuous improvement, *operational management practices, *Toyota Production System, *Human Resource Management, *HRM, *High Performance Work System/Organization, *employee well-being, *employee empowerment, *commitment, *satisfaction, *stress, *need for recovery, *job strain and *trust. In consultation with experts in the field of LM&SS, HRM and methodological experts, we selected suitable empirical studies that include validated measurement instruments to operationalize the theoretical concepts of LM&SS, HRM and employee well-being in health care. Additionally, control variables were included (see [Table 1](#)). An English translator performed the English translation of our original surveys, and an independent native speaker of both Dutch and English did the back-translation.

3.2.1 Development and validation of measurement instruments. We included instruments in our survey[1] on LM&SS, HRM and employee well-being. [Table 2](#) shows the psychometric characteristics of these measurements. After the data was gathered, the stability of the scales was determined. Kaiser-Meyer-Olkin (KMO) and Bartlett's test were performed to investigate the underlying structure of the instruments. Item commonalities are considered "high" if they are all 0.80 or greater ([Velicer and Fava, 1998](#)), but this is unlikely to occur in real data. More common magnitudes in the social sciences are low to moderate commonalities of 0.40–0.70 ([Costello and Osborne, 2005](#)). Therefore, we will exclude items with a factor loading lower than 0.50. To measure reliability, Cronbach's alpha was used. Based on a review of the literature, [Taber \(2017\)](#) concludes that a value of 0.70 or greater is widely considered as a sufficient measure of reliability or internal consistency of an instrument. Therefore, we will exclude items with a value lower than 0.70.

LM&SS. Descriptions of LM&SS in health care range from a philosophy, a set of principles, to a collection of practices ([Shah and Ward, 2003](#); [Andersson et al., 2006](#)). We focus on practices rather than conceptualizing LMSS as a philosophy because practices with

Table 2.
Psychometric
characteristics
measures

	Respondents	<i>n</i>	No. of items	$\bar{x}$	σ	Cronbach's α	KMO statistics	ICC1 value	ICC2 value
A	LM&SS								
B	LM&SS systems approach (Cua <i>et al.</i> , 2001; Zu <i>et al.</i> , 2008)	208	41	3.52	0.21	0.83	0.72		
	HRM (Boon <i>et al.</i> , 2011)								
	Supervisors								
	Employee	1,571	6	3.64	0.66	0.84	0.80		
	Employee	1,580	9	3.16	0.74	0.92	0.90		
	Training and development								
	Employee	1,622	4	2.74	0.84	0.85	0.81		
	Performance appraisal and rewards								
	Employee	1,637	2	3.41	0.93	0.83	0.50		
	Employment security								
	Employee	1,616	3	3.36	0.69	0.69	0.65		
	Work/life balance								
	Employee	1,482	20	3.26	0.54	0.92			
C	HRM systems approach (excluding work/life balance)								
	Employee well-being								
1	Employee	1,636	5	3.39	0.71	0.86	0.85	0.06	0.71
	Happiness component [commitment (Allen and Meyer, 1990)								
	and satisfaction (Van Veldhoven <i>et al.</i> , 2002)]								
2	Health component (workload and need for recovery)	1,592	12	1.90	0.55	0.89	0.90	0.10	0.81
	(Van Veldhoven <i>et al.</i> , 2002)								
3	Trusting relationships component (Robinson, 1996)	1,619	7	3.69	0.74	0.87	0.84	0.13	0.86

a specific nature are most likely to be recognized by employees and supervisors. For example, the LM&SS practice “Customer relationship” reflects the philosophy of LM&SS to maximize value for the customer. Also, this practice could contain LM&SS tools and techniques such as VSM and Kano-model, to analyze the customer relationship. LM&SS practices represent what observable behaviors persons perform in the organizations and are therefore relevant considering the effect of LM&SS on employees. In addition, we conceptualized LM&SS as a system of interrelated “soft” and “hard” practices, in line with [Shah and Ward \(2007\)](#). The “hard” LM&SS practices that are part of our systems approach (quality information, process management, structured improvement procedure and focus on

	Description (Cua et al., 2001 ; McKone et al., 1999, 2001 ; Zu et al., 2008)	Special aspects in a health-care setting
Top management support	Top management accepts responsibility for quality, creates and communicates a vision focused on quality and encourages and participates in quality improvement efforts	Managers and physicians together form top management
Customer relationship	Customer needs and expectations are regularly surveyed. Customer satisfaction is measured. There is a close contact with key customers	Customers are not only patients, but also family members, caregivers, decision-makers and insurers
Quality information	Timely collected quality data are available to managers and employees and must be used for improvement	Delivering care is a complex process. Collecting accurate and reliable information is a challenge
Focus on metrics	Quantitative metrics are used to measure process performance and quality performance and set improvement goals. Business-level performance measures and customer expectations are integrated with process-level performance measures	
Process management	Statistical process control and preventive maintenance are applied. Managers and employees make efforts to maintain clean shop floors and meet schedules. There is an emphasis on mistake-proof process design	Safety and hygiene are crucial in a patient environment. A clean working environment and well-maintained devices are a requirement
Structured improvement procedure	There is an emphasis on following a standardized procedure in planning and conducting improvement initiatives. Teams apply the appropriate quality management tools and techniques	Professionals are trained to act with autonomy. Too much emphasis on standardization could evoke resistance
Supplier relationship	A small number of suppliers are selected based on quality and involved in product development and quality improvement. The organization provides suppliers with training and technical assistance	There are many areas of knowledge and practice. In general, each specialty has preference for certain suppliers and assortments

Table 3.
LM&SS practices

metrics) are focused on practices for improving processes and the “soft” elements (top management support, customer relationship and supplier relationship) are aimed at employees and relationships (McKone *et al.*, 1999, 2001; Cua *et al.*, 2001; Zu *et al.*, 2008; Bortolotti *et al.*, 2015; see Table 3). Also, to contribute to a more explicit and standardized definition of LM&SS for the health-care context, we highlighted, based on research on LM&SS in health care (D’andreamatteo *et al.*, 2015; Moraros *et al.*, 2016; Improta *et al.*, 2019; Henrique and Filho, 2020), special aspects for each LM&SS practice in a health-care setting. For example, in health-care LM&SS practice, “Customer relationship” is concerned with a wide variety of customers such as patients, caregivers, family members and health-care insurers. Also, in health-care LM&SS, “Top management support” relates to a complex hierarchical structure in which there are professional and functional silos (de Souza and Pidd, 2011).

Studies show that the way a manager acts, interacts and communicates with workers impacts the effects of LM&SS (D’Andreamatteo *et al.*, 2015), and therefore, we measured LM&SS on the supervisor level. We translated the original items from a manufacturing perspective (e.g. error rates, defect rates, scrap, defects, cost of quality) into a health-care perspective (e.g. mistakes, throughput time, productivity). During a pilot phase of our research project, we tested our survey. Based on the response of our test group, we removed items from the survey that were difficult for respondents to answer (24 items out of a total of 67 items), such as elements of the survey that focus strongly on the industrial context of plants (12 items), such as “Production is stopped immediately for quality problems.” In addition, respondents mention that items on product/service design (six items) were hard to understand, for example, “We design for manufacturability.” Also, respondents from our test group mention that items on SS role structure (six items) were not value-free. Some hospitals deliberately chose different name for Black Belts and Green Belts, and other hospitals refer to misunderstandings over these roles. Deleting items from a scale can affect its reliability and validity. Therefore, we first tested with a panel of experts in which they would agree that the test items appear to measure what the test is intended to measure (face validity). Based on the feedback of the panel of experts, we removed six more items. For example, we removed the items “Our customers visit our organization” and “We provide technical assistance to our suppliers.” The experts suggested that the removed items did not add extra value (for example, it is evident that customers visit the organization, that is inherent to a hospital) or multiple explanations could be given to an item (for example, what can be defined as technical assistance?). Second, we assessed how deleting the items would affect the internal consistency of the scale (Cronbach’s alpha) and we only removed items when this led to an improved internal consistency of the scale (albeit modestly). Also, we performed factor analysis and decided, based on the component matrix, which items tend to “load” lowest on the construct of LM&SS and therefore could be removed without affecting the validity of the scale. For 26 items, the internal consistency and validity of the scales were equal or improved and, therefore, we removed these items from the survey. We tested our shortened survey with the same test group, and the results of the reliability analysis and factor analysis support the psychometric quality of the measurement instruments (Cronbach’s α was 0.78 and KMO measure was 0.69). These findings were confirmed during our actual research: the consistency of the items designed to measure the LM&SS practices was 0.83 and the KMO measure was 0.72 (see Table 2).

HRM. Although research shows that HRM plays a vital role in shaping employee well-being (Alfes *et al.*, 2013; Kroon *et al.*, 2009; Peccei *et al.*, 2013; Veld and Alfes, 2017), there is no agreement about which HR practices should be incorporated (Boselie *et al.*, 2005; Paauwe, 2009; Paauwe *et al.*, 2013). Research that focuses on health care emphasizes the importance

of employee involvement, development and empowerment if LM&SS is to work (Dal Pont *et al.*, 2008; Gowen *et al.*, 2006; Subramony, 2009; Suárez-Barraza and Ramis-Pujol, 2010). Hasle (2014) additionally states that psychosocial factors at work (i.e. control, social support, rewards and demands) related to LM&SS are important to increase employee well-being. Consistent with this line of research, we included HR practices training and development, participation and job design, team working and autonomy, employment security, work/life balance and performance appraisal and rewards in our study (see Table 4).

We measured HR practices on employee level because research shows that the effect of HR practices resides in the perceptions that employees have of those practices (Nishii *et al.*, 2008). We included 27 items on HRM, measured with the scale by Boon *et al.* (2011) (for example, “My unit offers me work that gives me the opportunity to express myself”). Responses are given on a five-point Likert-type scale ranging from “completely disagree” (1) to “totally agree” (5). Except for the HR practice work–life balance ($\alpha = 0.69$), consistency of the items for measuring HR practices exceeded 0.70. We excluded the HR practice “work/life balance” from further analyses.

We analyzed, through structural equation modeling in LISREL, the factor structure of the HR practices to determine whether we should include a systems or single practice approach of HRM. However, the results of the LISREL analysis were inconclusive. For that reason, we analyzed through Chi-square tests which HRM approach – systems or single practice – explained the highest level of variance in regard to employee well-being by comparing the $-2\log$ likelihood value of the empty model (without any explanatory model) versus the HRM model (including single practices as well as a systems approach of HRM). A HR systems approach explained the highest level of variance regarding the components of employee well-being by comparing the $-2\log$ likelihood value of the empty model versus

	Description (Boon <i>et al.</i> , 2011)	Special aspects in a health-care setting
Participation and job design	Employees are involved in quality decisions and can take responsibility for their own tasks	Professionals are trained to act with autonomy. They are, together with their colleagues, responsible for delivering quality of care
Training and development	Both managers and employees receive training on quality management. There are opportunities to develop new skills and knowledge	Professionals are highly trained individuals with a specific expertise. Performing tasks or development outside their area of expertise is unusual
Performance appraisal and rewards	Employees receive feedback on quality performance of their team and are rewarded for quality improvement	Quality of care is highly appreciated and rewarded in health-care organizations
Team working and autonomy	Teams are formed to solve problems. Teams are encouraged to try to solve their problems as much as possible	Health care is usually provided by multidisciplinary teams of professionals and support services
Employment security	Employees have an employment contract that offers job security	Increasing expenditures create pressure on organizations
Work/life balance	Employees have the possibility to work flexible hours and arrange their work schedule	Consumers are increasingly putting higher demands and expectations on health-care professionals. Therefore, it is challenging to balance the needs of work and life for professionals

Table 4.
Typology of HR
practices

the HRM model. We included the fit indices of the end model (see Table 5) and these show that the differences between the model with single practices and the model with bundled practices varied from 1 to 63 in favor of the HRM systems approach. Therefore, we included the HRM systems approach in our further analyses. The included HR variables are standardized to prevent multicollinearity as our multilevel model contains interaction terms.

Employee well-being. Although employee well-being has become an important research topic, there is considerable variation in its conceptualization (Van de Voorde *et al.*, 2012). In the past 25 years, several broader conceptualizations of well-being have been proposed, including not only affect (Diener *et al.*, 1999), but also behavior and motivation (Ryff, 1989; Ryff and Keyes, 1995; Van Horn *et al.*, 2004; Warr, 1994, 2007). Moreover, well-being can be measured as a context-free (i.e. in relation to life in general) or as a domain-specific concept (e.g. at work or school). Because LM&SS is applied in organizations, we focus on employee well-being on work. Following Warr (1987), employee well-being at work can be broadly defined as the overall quality of an employee's experience and functioning at work (Peccei *et al.*, 2013). Following current HRM literature (Grant *et al.*, 2007; Van de Voorde *et al.*, 2012; Van de Voorde and Boxall, 2014), we include the happiness and trusting relationships component of well-being in our research (see Table 6). In addition, although the health component of employee well-being only received limited support in studies (Van de Voorde *et al.*, 2012), we argue that it is important to include this component, especially in the light of high levels of burnout among health-care employees (Reith, 2018). Subdividing well-being into these different components is important because dominant models within theory and research continue to focus largely on ways to improve performance with employee concerns

Table 5.
Chi-square test HRM
model

HRM model	Happiness component			Trust component			Health component		
	–2 log. Model 0	Difference single practices systems approach	df	–2 log. Model 0	Difference single practices-systems approach	df	–2 log. Model 0	Difference single practices-systems approach	Df
	3,524	63	10	3,744	39	10	2,716	1	10

Table 6.
Three components of
employee well-being

	Description (Van de Voorde <i>et al.</i> , 2012)	Special aspects in a health-care setting
Health	The physical or health dimension encompasses indicators related to employee health, such as workload, job strain and need for recovery	Health-care professionals perceive increased demands and expectations from customers
Happiness	The psychological or happiness dimension refers to subjective experiences of employees, i.e. their psychological well-being, for example, job satisfaction and unit commitment	Professionals highly value performing rewarding work
Trusting relationships	The relationship dimension of employee well-being focuses on the quality of trusting relationships between employees and their employer and colleagues	The hierarchical structure impacts the relations between employees and their employer and colleagues

mainly as a secondary consideration (Calvo-Mora *et al.*, 2013; Guest, 2017; Paauwe and Farndale, 2017).

We measured employee well-being on individual level. Regarding the health component of employee well-being, we used subscales of the Dutch standardized survey on the experience of work (Vragenlijst Beleving en Beoordeling van de Arbeid) (Van Veldhoven *et al.*, 2002) to measure workload and strain. The scale for strain captures small deficits in employee functioning at the end of, or just after, a workday (Van Veldhoven, 2005). Sample items include “Do you have too much work to do?” and “It takes me effort to focus in my free time after work.” Responses are given on the original four-point Likert-type scale ranging from “never” (1) to “always” (4). Several measures of intra-organizational trust are available. Differences between the measures are based on who is being trusted (Dietz and Den Hartog, 2006). We focused on trust between an employee and his or her direct supervisor, using the seven-item scale of Robinson (1996). One of the sample items was “I can expect my supervisor to treat me in a consistent and predictable fashion.” The responses are given on a five-point Likert-type scale ranging from “completely disagree” (1) to “totally agree” (5). The consistency of the items for measuring employee well-being practices was 0.84 or higher (see Table 2). To measure the happiness component of employee well-being, we included items on satisfaction and commitment. In contrast to the health and trusting relationships component, we measured the happiness component of well-being referring to the group level. Mason and Griffin (2002, 2005) show that assessing the satisfaction of the group directly, rather than simply aggregating the individual job satisfaction ratings of group members, explained additional variance in outcomes. Therefore, we translated the items on commitment and satisfaction from an individual level into a unit level perspective. To measure the satisfaction of employees, we used one other VVBA item: “All things considered, my colleagues are satisfied with their job.” Organizational commitment is measured using four items of the Affective commitment scale of Allen and Meyer (1990) (for example, “my colleagues feel like “part of the family” at their unit”). Responses are given on a five-point Likert-type scale ranging from “completely disagree” (1) to “totally agree” (5).

As control variables, we included the general characteristics of respondents (age, gender, educational level), general characteristics of the job (work unit, amount of years working for the organization, amount of years working in the specific work unit and job, type of labor contract) and general characteristics of the work unit (size). We dummy-coded categorical variables. Familiarity with LM&SS and experience in participating in LM&SS projects were also part of our control variables. Through correlation analysis, we determined which control variables to include in our analysis. We included effect sizes to prevent Type 1 error (false positive). Following Cohen (1992), we only included variables with effect sizes of 0.30 (medium) or higher in the regression analysis. No control variable exceeded the medium effect size of 0.30 and, therefore, no control variables were entered in the multilevel regression analysis.

3.3 Data preparation

We first inspected our data for several common problems. For example, we checked that variables have the right formats, removed or corrected deviating values (for example typo's), checked for plausible distributions and removed or corrected deviating high or low values. Also, we inspected the number of missing values (either user missing or system missing) for each variable and we specified missing values in our data set as “missing” in SPSS. As our data was collected from the single source of employees, we randomly split the units in half, obtaining values of the HRM perceptions from one half of the unit, and the employee well-being variables from the other half of the units. As these split sample results are robust

compared to the whole sample results, we concluded that the common method bias is unlikely to be a serious problem in our data. To support the aggregation of individual scores to unit level scores, we calculated ICC1 and ICC2 values (intra-class correlations; to measure inter-rater reliability) and tested whether the average scores differed significantly across units. The ICC1 values of the three components of employee well-being implied that 6%–13% of the variance in well-being can be attributed to the unit level (see Table 2). The ICC2 values ranged from 0.71 to 0.86 and exceeded the minimum value of 0.50 (Klein and Kozlowski, 2000). Hence, aggregation to the unit level is justified.

4. Data analysis

To test our hypotheses, multivariate regression analyses were done. We used hierarchical linear modeling (HLM; Bryk and Raudenbush, 1992) in SPSS because respondents in this study were clustered in 42 units. With nested data, observations are likely to be correlated, which violates the assumption of independence in ordinary least squares regression (i.e. error terms are not independent) (Veld and Alfes, 2017). This could lead to underestimation of standard errors, and estimates are more likely to be considered significant. Snijders and Bosker (2012) state that HLM provides more conservative tests of significance and decomposes variance into individual vs team effects. To test for the moderating effect of HRM on the relationship between LM&SS and employee well-being, we followed the procedure described by Baron and Kenny (1986).

Our findings show that the LM&SS bundle has no significant effect on the happiness and health components of employee well-being (see Table 7). In addition, we found a significant but weak direct positive effect of the LM&SS bundle on the trusting relationships component of well-being ($\beta = 0.07$) (see Table 7). Therefore, *H1* was not supported.

An existing relationship between LM&SS and employee well-being is a prerequisite for moderation (Hayes, 2009). Therefore, *H3* that focuses on the moderating role of HRM was not tested for the relationship between LM&SS and the health and happiness components of well-being. We tested the moderating effect of HRM on the weak direct positive effect of the LM&SS bundle on the trusting relationships component of well-being. However, the results were not significant. Therefore, *H2* that focuses on the moderating role of HRM was not supported.

As discussed in Section 3.2, we found that HR systems approach explained the highest level of variance regarding the components of employee well-being. Therefore, *H3* is supported.

Inspired by research that discusses direct effects of HRM on employee well-being (Alfes et al., 2013; Kroon et al., 2009; Veld and Alfes, 2017), we carried out additional analyses on

Table 7.

Hierarchical
multilevel analysis
LM&SS systems
approach – employee
well-being

Independent variable	Employee well-being		
	Happiness component	Trust component	Health component
Constant	3.37**	3.68**	1.88**
LM&SS systems approach	0.01	0.07*	0.04
–2 log likelihood	3,528.19	3,559.17	2,597.87
Variance individual level	0.03	0.09	0.03
Variance unit level	0.48	0.55	0.27
Explained variance individual level	69%	0%	64%
Explained variance unit level	5%	0%	51%

direct effects of HRM on employee well-being, to create a more thorough understanding of potential influencing factor related to employee well-being. Our results showed direct positive effects of HRM on the components happiness and trusting relationships of employee well-being ($\beta = 0.31$) and a weak direct negative effect of HRM on the health component of well-being ($\beta = -0.09$) (see Table 8). We also tested the relationship between a single practice approach of HRM and employee well-being. Although overall (see Table 8) a HR systems approach showed a higher explained variance on employee well-being, it is possible that only a few of the HR practices included are responsible for the established relationship and individual HR practices might exhibit different relationships with employee well-being (Van de Voorde *et al.*, 2012). We found that the single HR practice “participation and job design” most strongly positively affects the happiness and trusting relationship component of well-being (β ’s, respectively, 0.22 and 0.27; Figure 2).

5. Discussion

Given the challenges that health-care systems are facing, like ever-increasing costs, high expectations from patients, demographic changes and growing burn-out rates among health-care professionals, it is very likely that the application of LM&SS will grow rapidly in health care. However, the criticism on this method is significant. Although LM&SS in health care has been researched increasingly since early 2000

Table 8.
Hierarchical
multilevel analysis
HRM systems
approach –
employee well-being

	Happiness component Direct effect <i>B</i>	Employee well-being Trust component Direct effect <i>B</i>	Health component Direct effect <i>B</i>
Constant	3.38**	3.69**	1.89**
HRM systems approach	0.31**	0.31**	−0.09**
−2 log likelihood	3,182.29	3,227.37	2,553.22
Variance individual level	3%	39%	26%
Variance team level	39%	10%	3%

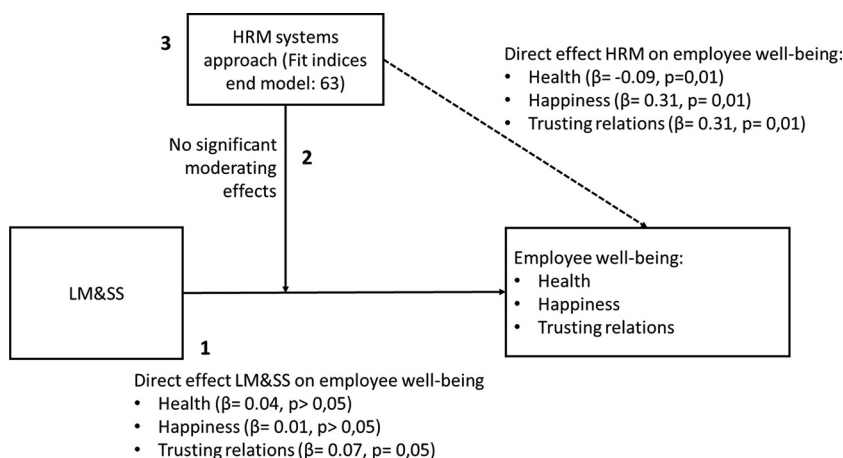


Figure 2.
Conceptual
framework for
examining
relationships between
LM&SS, HRM and
employee well-being,
including the
hypotheses and test
results

(Thompson *et al.*, 2003; Young *et al.*, 2004; Spear, 2005), its applicability and utility for health care remain unclear (Mazzocato *et al.*, 2010). And although evidence shows the importance of both employee well-being (Simons *et al.*, 2017; Haddow *et al.*, 2016; Leggat *et al.*, 2016) and HRM (Jørgensen *et al.*, 2007; Zacharatos *et al.*, 2007) for the success of LM&SS implementation, not much research has been done on this topic in the context of health care (Hasle *et al.*, 2012; Cullinane *et al.*, 2014), or the outcomes of research are contradictory (Seppälä and Klemola, 2004; Bonavia and Marin-Garcia, 2011). Therefore, this research is focused on the relationship between LM&SS and employee well-being in hospitals and how HRM moderates this relationship.

Several theoretical contributions of this paper can be distinguished. First, this research contributes to a more detailed understanding of both positive and negative effects of LM&SS on three components of well-being – happiness, trusting relationships and health – in hospitals. Although we expected differently, our study shows no significant effect of LM&SS on employee well-being. Therefore, we argue that our findings may lead to a new perspective on the ongoing discussion whether LM&SS positively or negatively impacts employees (Conti *et al.*, 2006). Based on the inconsistent evidence in earlier studies (Jackson and Mullarkey, 2000; Godard, 2001) and the absence of a relationship in our research, we argue that LM&SS is simply not designed to improve employee well-being. Although this may seem obvious, systematic reviews by D'Andreanmatteo *et al.* (2015) and Moraros *et al.* (2016) mention both efficiency and employee goals as drivers for applying LM&SS in health-care organizations. However, the driver for improving employee well-being is not visible in the way LM&SS is designed: especially in health care, LM&SS is often applied as a set of “hard” practices, concerning tools and techniques for improving processes (Poksinska, 2010; Stamatis, 2011). This is illustrated by LM&SS practices such as “focus on metrics” (the use of quantitative metrics to measure quality and process performance and to set improvement goals) and “process management” (e.g. statistical process control and error-proof process design). In line with our findings, Radnor *et al.* (2012) and Mamata *et al.* (2015) argue that the narrow focus on these “hard” practices led to a neglect of issues concerning people and relations. An explanation for our findings could be that we combined LM and SS in our research. SS focuses on precision and accuracy, in specific points of the processes, with statistical tools to improve the quality, while reducing the variation in performance (Antony and Kumar, 2012; Henrique and Filho, 2020). This description of SS indicates that employee well-being is not a central principle of this method. This is confirmed in studies that describe efforts to implement SS in health care (Chung and Kwon, 2016; Begen *et al.*, 2016), which strongly focus on supply chain principles and cost reduction. In contrary to SS, an essential element of the Lean philosophy is Respect for People (RFP) (Marksberry, 2011). Originally, Lean was derived from the Toyota Production System (TPS) and Toyota also developed the Toyota Way, which captures the essence of the organizational culture of the company. The Toyota Way is depicted as a house with two pillars – “RFP” and “continuous improvement” (Coetzee *et al.*, 2019). However, this is not widely understood among LM practitioners as research shows that LM implementation, in practice, mostly focused on continuous improvement of processes while ignoring or misunderstanding the RFP pillar (Cardon and Bribiescas, 2015). Hasle (2014) also states that there is a severe risk of creating a deteriorating working environment for the employees because of the implementation of LM. Summarizing, employee well-being is easily overlooked in the implementation of both LM and SS and

therefore we expect that including one of these methods in our research would give the same results on the effects on well-being.

The second contribution of this research is related to the moderating role of HRM on the relationship between LM&SS and employee well-being. Although research shows that HRM plays a vital role in shaping employee well-being (Peccei *et al.*, 2013), extensive research on the role of HRM regarding the relationship between LM&SS and employee well-being is limited (Hasle *et al.*, 2012; Cullinane *et al.*, 2014). Our results show that a buffering effect of HRM – what we expected based on theory – is less relevant because of the absence of an existing relationship between LM&SS and employee well-being. One explanation could be the fundamental different pace of HRM and LM&SS. Where LM&SS in health care is focused on improving short-term efficiency through short-cycle improvement projects (Drotz and Pokinska, 2014; Hung *et al.*, 2017), HRM is present constantly and requires that health-care organizations continue to send the same signals to employees about which behaviors and which attitudes are desired (Ehrnrooth and Björkman, 2012). We did include a time lag for LM&SS implementation to gain a better understanding of the relationship between implementation and employee well-being in the participating hospitals, but without any conclusive results. Another explanation could be found in the way we measured the concepts in this study. LM&SS was measured on supervisor level, and HRM and employee well-being were measured on employee level. It is possible that on the moment of our data gathering, a gap existed between supervisors and employees in the level of internalization of LM&SS. Usually, managers and supervisors are the first groups of employees that are impacted by strategic goals in hospitals. They decide, when simple cost-cutting measures are proven to be insufficient, to adopt LM&SS as a programmatic approach to achieve efficiency. In that sense, supervisors have had a head start when it comes to experiencing LM&SS and we can imagine that the impact of LM&SS on their well-being could be stronger compared to well-being measured on employee level. It is not unlikely that over time, when LM&SS practices are more and more internalized on employee level, the relationships between LM&SS and employee well-being also become stronger for this group.

Third, our research contributes to the academic knowledge on direct effects of HRM on employee well-being (Alfes *et al.*, 2013; Kroon *et al.*, 2009; Veld and Alfes, 2017). Through additional analyses, we found direct positive effects of HRM on *trust* and *happiness* of employees in health care. For the *health component*, we found a weak negative relationship between HRM and employee well-being. Van de Voorde *et al.* (2012) reached a similar conclusion in their review study and reported evidence on the positive effects of HRM on two components of employee well-being – happiness and trusting relationships – and a negative effect of HRM on the health component of well-being. These results are relevant considering the increasing shortage of health-care workers (WHO, 2013), and the challenge for health-care managers to retain highly dedicated and competent employees (Harmon *et al.*, 2003). Our findings suggest that these managers may positively affect the trust and happiness of their employees through a carefully chosen set of HR practices and at the same time applying LM&SS for the purpose it is designed: improving performance.

The fourth contribution of our research is that while many studies so far have argued for the inclusion of HR practices in an LM&SS systems approach (MacDuffie, 1995; Shah and Ward, 2003), our results argue for the application of a separate HRM systems approach. Dunsford and Reimer (2017) argue that research must acknowledge the fundamental dichotomy between the impersonal tasks required to provide health services, and human

factors. In that sense, separating LM&SS and HRM could be an opportunity for health-care organizations. A critical challenge that face LM&SS implementation is a lack of belief that it will work (Al Khamisi *et al.*, 2019). Employees might perceive LM&SS as something new and be hesitant to embrace the method (Snee, 2010), also because of the increasing internal and external pressure to work more efficiently. When the resistance to apply LM&SS is growing, health-care organizations can be flexible in reframing the method, while at the same time be tenacious in applying HRM systems approach.

The fifth contribution is the finding that the effect of a systems approach of HRM on well-being is significantly higher than the effect of a single practice approach. This agrees with Wright and Boswell (2002), Shah and Ward (2003), Harmon *et al.* (2003) and Rondeau and Wager (2001; Rondeau and Wager, 2010). Nevertheless, the single HR practice “Participation and job design” most strongly positively affects the happiness and trusting relationship component of well-being. An explanation could lie in the findings of Nishii *et al.* (2008) that show that not just the HR practices themselves, but rather employees’ perceptions of those practices are important for achieving desired outcomes. In the highly political and complex setting of health-care organizations, participation and job design are important. For example, by acting during an incident related to delivery of medicines, or actively participating in a multidisciplinary consultation regarding food for patients. Service employees perceive these HR practices as positive, and therefore, affecting their well-being.

Finally, we found that differences in the relationship between LM&SS, HRM and employee well-being cannot be explained by organizational factors, such as the size of units, or individual differences such as gender, age or education.

6. Conclusion

This research contributes to the empirical knowledge on the relationship between LM&SS and employee well-being in hospitals and how HRM moderates this relationship. Our study shows no or weak effects of LM&SS on employee well-being, and therefore moderating effect of HRM on this relationship is less relevant (Hayes, 2009). Inspired by research that discusses direct effects of HRM on employee well-being (Alfes *et al.*, 2013; Kroon *et al.*, 2009; Veld and Alfes, 2017), we found that HRM has a direct positive effect on particular components of well-being, i.e. trust and happiness of employees in health care. For the health component of well-being, our results show a weak negative effect of HRM. The strengths of this research are worth mentioning. First, the study includes data from workflow level (employees) as well as data from unit level and studies the relationships between concepts on both levels. The prior research conducted on LM&SS has been mainly focused on the organizational level of analysis. Second, we used the full sample of all Dutch academic hospitals. This is remarkable, given the increased competition between (academic) hospitals in The Netherlands. Third, while most of the earlier studies usually focused on one ward or department within a hospital, our sample consists of 42 units with 218 supervisors and 1,668 employees (response rate of 55%). Fourth, our study subdivides well-being into different components, which creates a more thorough understanding of LM&SS and outcomes in health care. Fifth, we incorporated a single practice approach as well as a systems approach of HRM, which made it possible to clarify the specific characteristics of HRM for LM&SS.

6.1 Implications

Many health-care organizations that struggle with both challenging efficiency targets as well as increasing personnel shortages have tried to find one cure for all their problems by embracing LM&SS. However, despite promising (sales) stories about LM&SS, for example,

that it leads to happy employees who have more time for the work they are passionate about, our results imply that LM&SS is designed to improve performance, not employee well-being. Therefore, health-care organizations should apply LM&SS to improve the quality and efficiency of their processes and an HR systems approach to improve employees' happiness and trusting relationships. In practice, this could mean that monitoring progress of LM&SS within hospitals should be done integrally: not only the number of LM&SS initiatives and their progress should be monitored, but also the happiness, health and trusting relationships of employees as well as performance indicators should be explicitly part of the "LM&SS dashboard" within hospitals. This conclusion also has impact on the positioning of LM&SS in health-care organizations. As LM&SS is meant to continuously improve performance and not employee well-being, it makes much more sense to make LM&SS part of the quality and safety department. HRM departments have a separate and equal important task to continuously foster the health, happiness and trusting relationships of the employees of their health-care organizations. Summarizing, in recent years, a great deal has been invested in LM&SS in health care: belts have been trained, improvement teams have been formed and LM&SS improvement approaches have been widely embraced. The results in this study demonstrate a cautiously optimistic view about LM&SS in health care, if it is applied in a targeted manner and if HRM is strategically aligned with the goals of LM&SS.

6.2 Limitations and future research

This study has some limitations. First, this study does not include performance measures. Proponents argue that LM&SS enables health-care organizations to boost performance (Grabau, 2008; Bisgaard, 2009; Stamatis, 2011). Yet, in their systematic analysis, Moraros *et al.* (2016) take a dim view of LM because of its financial costs and inconsistent benefits for process outcomes in health care. Therefore, it would be interesting to include performance measures in future research, as well as possible trade-offs between performance and employee well-being, related to LM&SS. Second, this study focused on cross-sectional data and cannot be used to establish cause and effect relationships. To create a deeper understanding of the intervention–outcome relationships, we tried to include a time lag for implementation of LM&SS, but we found no relationship with outcomes. Longitudinal research is needed to study cause–effect relationships between LM&SS, HRM and both performance and employee well-being, including possible trade-offs. Third, we only included the internal service units of *academic* hospitals. Future research should expand to health-care professionals and direct care processes because there is still a lack of research to explore in detail the implementation of LM&SS and its interaction with existing care practices (Waring and Bishop, 2010) as well as research on the effects of LM&SS on well-being of highly skilled employees (Hasle, 2014). Also, it would be interesting to include performance indicators such as the efficacy of the treatment and risk of recurrence and patient experiences. Fourth, a selection of LM&SS practices was measured at the employee level, because of the fact that employees indicated that LM&SS practices “process management,” “supplier relationship,” “structured improvement procedure” and “focus on metrics” were too distant and abstract concepts for them. Future research could include employee-rated LM&SS measures as well as objective measures of LM&SS implementation rated by supervisors. Also, when it comes to the health of employees, our results gave insufficient convincing evidence on the relationship between LM&SS and HRM. The health of health-care employees is an important issue (Taris *et al.*, 2013; Drenth, 2016). Therefore, future research should include a more thorough investigation of the relationship between LM&SS, HRM and early burnout signs, need for recovery and workload. In addition, the different outcomes for the three components of employee well-being – happiness, trusting relationships and health – indicate that it is important to unravel the concept of well-being in future research.

Note

1. The survey is available upon request.

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