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The social benefits of kaizen initiatives in healthcare: an empirical study

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Abstract

Purpose – The purpose of this paper is to identify the most influential determinants of healthcare employees' problem-solving capabilities and attitudes towards kaizen initiatives, and clarify how these determinants are related to social outcomes.

Design/methodology/approach – Drawing on the input-process-outcome framework, applied to kaizen initiatives, the determinants of the input and process factors are embodied in hypotheses concerning the direct effects of input and process factors on social outcomes and the indirect effects of input factors on social outcomes resulting from process factors. The hypotheses are tested through multiple regressions using data from 105 kaizen initiatives drawn from two hospitals.

Findings – Of the 14 determinants investigated, goal clarity, team autonomy, management support, goal difficulty and affective commitment to change (ACC) are the most influential determinants of kaizen capabilities and/or employees' attitude. Goal clarity, goal difficulty, team autonomy and management support are also found to influence social outcomes directly and/or indirectly through ACC, internal processes and/or an action orientation.

Practical implications – The results support healthcare practitioners to understand how to establish "focused kaizen" actions to leverage specific determinants that positively influence social outcomes.

Originality/value – This study provides an original contribution to the literature concerning effective kaizen initiatives in healthcare operations by empirically testing a comprehensive model of the relationship between kaizen initiative determinants and social outcomes. Unlike previous studies, which are mostly anecdotal or focused on one or few determinants, this research adopts a holistic view, and investigates a pluralist set of determinants on social outcomes through a systematic and quantitative approach.

Keywords Survey, Lean, Kaizen, Social outcomes, Healthcare

Paper type Research paper

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1. Introduction

This paper investigates kaizen initiatives in the healthcare sector. According to previous studies (e.g. Melnyk *et al.*, 1998; Farris *et al.*, 2008), a kaizen initiative can be defined as a structured project performed by a multi-disciplinary team with the aim of improving a targeted work area or process in a given timeframe. As in the manufacturing sector (Farris *et al.*, 2009), kaizen initiatives in healthcare not only allow improving the operational aspects of a work area (Holden, 2011; Costa and Godinho Filho, 2016) (e.g. increasing quality and reducing costs; hereafter technical outcomes), but also help developing employees' problem-solving capabilities (or kaizen capabilities (KCs)) (Dickson *et al.*, 2009; Poksinska *et al.*, 2017) and a positive attitude towards continuous improvement (Lee and Bruvold, 2003; Sobek II and Smalley, 2008) (hereafter social outcomes). In particular, the development of social outcomes is critical for achieving technical outcomes (Joosten *et al.*, 2009; Mazzocato *et al.*, 2016) as well as for creating a continuous improvement (or kaizen) mindset (Boscari *et al.*, 2016; Danese *et al.*, 2017b), which is crucial to sustain benefits of kaizen initiatives in the long term (Ballé and Régnier, 2007; Andersen *et al.*, 2014).

Despite the relevance of social outcomes for kaizen initiatives in healthcare, studies on this stream fail to provide a clear picture of their determinants. Only few studies on kaizen initiatives in healthcare identify some determinants that are likely to affect social outcomes, e.g., team autonomy (Bahensky *et al.*, 2005) or management support (Dickson *et al.*, 2009). Moreover, the evidence of these relationships is often anecdotal and speculative (see e.g. Graban and Swartz, 2013). This limitation is also highlighted by a few recent literature reviews on the broader stream of research on lean (Danese *et al.*, 2017a) and lean healthcare (e.g. Holden 2011; Costa and Godinho Filho, 2016). In fact, these reviews analyse previous studies on kaizen initiatives and other improvement projects coherent with principles and methods for waste reduction (typically referred as lean) and conclude that the majority of contributions in this field does not measure, or even discuss, the effect of the improvement initiatives on employees, and therefore empirical research is needed.

Finally, evidence is fragmented, as studies on kaizen initiatives in healthcare typically focus on the impact of one or few determinants (see e.g. Bahensky *et al.*, 2005; Jimmerson *et al.*, 2005). Therefore, a systematic analysis of the empirical relations between determinants and social outcomes of kaizen initiatives in healthcare is needed.

Our study aims to provide a better understanding of the determinants of kaizen initiatives and their relationships with social outcomes in healthcare by addressing the following research questions:

RQ1. What are the most influential determinants of social outcomes in kaizen initiatives in healthcare?

RQ2. How are they related to social outcomes?

To frame the relevant literature and develop our hypotheses, we use the model developed and tested by Farris *et al.* (2009) in the manufacturing sector, as this study provides a systematic framework for analysing the relationships between determinants and social outcomes in kaizen initiatives. Additionally, this is the only model that considers a comprehensive set of determinants and, dividing them into input and process factors, studies the mechanisms through which they impact social outcomes. The use of this model is aligned with scholars' recommendations suggesting to adapt models from other sectors to study specific phenomena in healthcare (Sundstrom *et al.*, 2000; Lemieux-Charles and McGuire, 2006). In order to address *RQ1*, we develop two hypotheses, posing that input and process factors are positively related to KCs (*H1*) and attitude (*H2*), and tested them through a backward regression procedure. Starting from the whole set of input and process factors, this step-procedure allows us to identify a subset of significant variables which can be

considered the most influential determinants of KCs or attitude among the whole set of input and process variables, and a subset of variables, discarded by the procedure, which are the less influential ones. In order to address *RQ2*, in line with the input-process model applied by Farris *et al.* (2009), we test the mediation role of process factors on the link between input factors and social outcomes (*H3*).

We think that addressing these research questions is of paramount importance. In fact, there are peculiarities of the healthcare sector suggesting that best practices or mechanisms like kaizen initiatives cannot be simply imported from manufacturing (Lozeau *et al.*, 2002). In particular, specific characteristics of the sector, such as the high education level of employees, heterogeneity of professional languages, clinical compliance, complicated workplaces, and the fact that patients (and not goods) are processed, may affect the relationships between determinants and social outcomes in kaizen initiatives. Therefore, given the possible different results between manufacturing and healthcare sectors and the lack of a systematic analysis in healthcare, we argue that an investigation of the relationships between determinants and social outcomes of kaizen initiatives in healthcare is needed. The paucity of studies providing specific guidelines on how to successfully manage kaizen initiatives in healthcare (Holden, 2011) prevents managers to understand how designing and implementing kaizen initiatives to extract the knowledge needed for improvement (capabilities) and to create a positive attitude towards continuous improvement and the achievement of the kaizen initiative's goal.

We adopt a survey-based approach to test our hypotheses, using data collected from 105 kaizen initiatives in two hospitals. The remaining part of the paper is organised as follows. Section 2 reviews the relevant literature. Section 3 presents the methodology and results. Section 4 discusses the findings. Conclusions, limitations and directions for future research are presented in Section 5.

2. Literature review

2.1 Theoretical framework

This study uses Farris *et al.*'s (2009) model as a theoretical framework to analyse the determinants of social outcomes of kaizen initiatives in healthcare (Figure 1). Besides being one of the few contributions focusing on the social benefits of kaizen initiatives, it is the only study providing a systematic and deep treatment of this phenomenon. Farris *et al.* (2009) combined the extant research on team effectiveness and kaizen initiatives in the

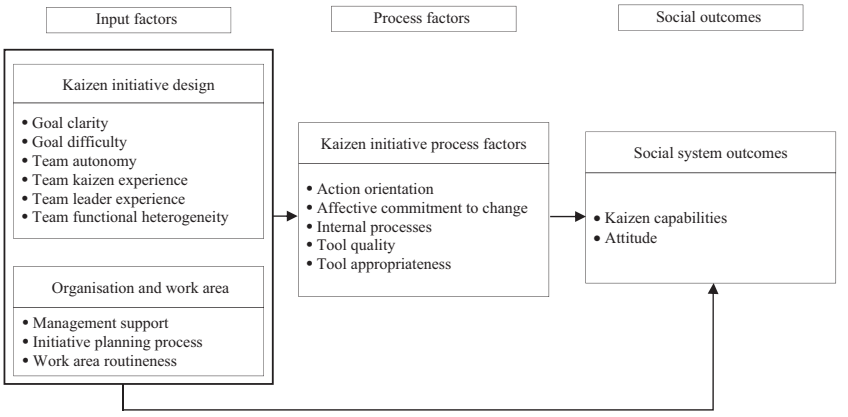

Figure 1.
Theoretical framework

Source: Adapted from Farris *et al.* (2009)

manufacturing sector to identify determinants of outcomes of kaizen initiatives and use the input-process-outcome framework (McGrath, 1964) to propose relationships between these variables. Although Farris *et al.*'s (2009) mention technical outcomes, they focus the scope of their study on social outcomes only, and in particular on the determinants of KCs and attitude that are the two underlying dimensions of social outcomes emerging from their construct validity analysis.

The following sections provide a description of the various elements of the framework and develop the hypotheses between determinants and social outcomes based on the current healthcare literature. Specifically, we consider three main streams of research. We start with reviewing studies on kaizen initiatives in healthcare. As in this stream a limited number of papers focuses on social outcomes and their determinants, we added contributions from the team effectiveness literature and the broader lean literature to clarify relationships between variables in Figure 1. We refer to team effectiveness studies considering that a kaizen initiative is a teamwork mechanism per definition (Farris *et al.*, 2009). In general, lean can be defined as a bundle of principles and methods and practices whose main aim is to eliminate waste from an organisation (Womack and Jones, 1996; Bortolotti *et al.*, 2015). We refer to lean as recent literature reviews on lean in healthcare identified kaizen initiatives as being among the most used lean methods (Mazzocato *et al.*, 2010; Costa and Godinho Filho, 2016), while lean principles typically guide kaizen initiatives in healthcare (Dickson *et al.*, 2009; Holden, 2011), revealing a close link between the two concepts. In order to make this more evident, Table I reports the studies used to support our hypotheses and the setting of each study. Although some studies address lean implementation in a broad sense, we consider them relevant for our study as they explicitly refer to kaizen initiatives or teamwork.

2.2 Social outcomes

The social system of any organisation is represented by "the people who work in the organisation and all that is human about their presence" (Pasmore, 1988, p. 25). This system is recognised as the cornerstone of kaizen initiative effectiveness (Farris *et al.*, 2009) because the evolution of the kaizen mindset in healthcare organisations depends on it (Ballé and Régnier, 2007). Indeed, most of the learning activities executed during kaizen initiatives aim to improve social outcomes in terms of employees' problem-solving capabilities (or KCs) and attitude. Specifically, KCs concerns team members' knowledge on continuous improvement and their problem solving and communication skills (Jørgensen *et al.*, 2003; Sobek II and Smalley, 2008). Instead, employee's attitude is related to the level of enthusiasm, willingness of participating in improvement initiatives (Jimmerson *et al.*, 2005) and the comfort to work with others (Graban and Swartz, 2013).

2.3 Inputs and process factors and their influence on social outcomes

2.3.1 Inputs factors. The input factors include determinants related to the design of kaizen initiatives (i.e. goal clarity, goal difficulty, team autonomy, team kaizen experience, team leader experience and team functional heterogeneity), the organisational support to kaizen initiatives and the stability of the daily work activities (i.e. management support, initiative planning process and work area routineness).

Goal clarity represents a shared understanding among team members of the initiative goals and activities to be performed to achieve targeted improvement outcomes (Lemieux-Charles and McGuire, 2006; Langabeer *et al.*, 2009). Several studies on kaizen initiatives in healthcare stress the importance of having clearly defined, understood and accepted goals (e.g. Wennecke, 2008; Simon and Canacari, 2012). It is expected that this input factor positively affects social outcomes in kaizen initiatives in healthcare. In fact, as highlighted by the past research on team effectiveness in healthcare, goal clarity affects

Source	Setting
Vinokur-Kaplan (1995)	Teamwork in three hospitals
Bahensky *et al.* (2005)	A kaizen initiative in the radiology department of an US hospital
Jimmerson *et al.* (2005)	Lean implementation, including the use of a team approach to problem-solving, in different units (e.g. anatomical pathology lab, pharmacy) of an US hospital
Mickan (2005)	Teamwork in various healthcare settings (e.g. primary healthcare, community mental health)
Lemieux-Charles and McGuire (2006)	Teamwork in various healthcare settings (e.g. hospitals)
Ballé and Régnier (2007)	Teamwork "kaizen activities" in lean implementation in a French hospital ward
Jimmerson (2007)	The use of the team approach to problem solving in various departments of an hospital
Dickson *et al.* (2009)	Lean implementation, including a kaizen initiative, in the emergency department of an US hospital
Fine *et al.* (2009)	Lean implementation, including the use of kaizen initiatives, in five Canadian hospitals
Kimsey (2010)	One kaizen initiative in the central sterile processing department in the Lehigh Valley Health Network (USA)
Mazzocato *et al.* (2010)	Lean implementation, including kaizen initiatives and the use of a team approach to problem-solving, in a wide variety of healthcare settings
Poksinska (2010)	Lean implementation, including kaizen initiatives and the use of a team approach to problem solving, in a wide variety of healthcare settings
Holden (2011)	Lean implementation, including kaizen initiatives and the use of a team approach to problem-solving, in emergency departments
De Souza and Pidd (2011)	Lean implementation, including kaizen initiatives and the use of a team approach to problem-solving, in nursing department; audiology in UK's National Health Service (NHS)
Deneckere *et al.* (2012)	Teamwork in healthcare (e.g. hospitals)
West (2012)	Teamwork in healthcare[a]
West and Lyubovnikova (2013)	Teamwork in healthcare (e.g. hospitals)
Andersen *et al.* (2014)	Lean implementation, including kaizen initiatives, in hospitals
Drotz and Poksinska (2014)	Lean implementation, including the use of a team approach to problem-solving, in three Swedish healthcare institutions (care centres and a physiology unit in an hospital)
Ghosh and Sobek II (2015)	The use of the team approach to problem-solving in various departments of an US hospital
Hung *et al.* (2015)	Lean implementation, including the use of a teamwork, in an US ambulatory care delivery system

Note: [a]No further specifications about the setting are provided in the study

Table I.
Previous studies on the healthcare literature relevant for the hypotheses development

team members' attitude, as it promotes a high level of participation in the team (Mickan, 2005) and acts as an incentive for collaboration (West and Lyubovnikova, 2013). Conversely, a lack of clear goals is linked to low collaboration and possibly low levels of well-being and high stress (West, 2012). Moreover, goal clarity is also important for developing employees' capabilities, including a better communication of ideas among members of a team (Mickan, 2005).

Goal difficulty outlines challenging interventions and the need of various skills to reach initiative goals (West and Lyubovnikova, 2013). Also goal difficulty can influence social outcomes in terms of KCs and attitude. Previous reviews of the teamwork healthcare literature suggest that when goal difficulty is high, goal achievement requires that the various skills owned by the different team members should be shared through cooperation, which eventually enhances their communication skills and ability to interact (e.g. Deneckere *et al.*, 2012; West and Lyubovnikova, 2013). Studies on kaizen initiatives in healthcare

acknowledge goal difficulty as an important task design characteristic (e.g. Jimmerson, 2007; Natale *et al.*, 2014). However, Jimmerson (2007) suggests to avoid too large or complex goals as their achievement can lead to unfocused and frustrating situations due to the involvement of too much diverse skills, therefore decreasing the willingness of participating to the initiative and precluding learning.

Team autonomy concerns the freedom given to a team to execute changes in a work area and how and when implement them during a kaizen initiative (Kirkman and Rosen, 1999). In a study of a kaizen initiative in a US hospital, Bahensky *et al.* (2005) observe that team autonomy may contribute to enhance employees' communication skills during their interactions with other team members and other employees outside the team. Similarly, a relationship between team autonomy and employees' capabilities is observed by Drotz and Poksinska (2014) when investigating teamwork in three lean implementations in healthcare. They also conclude that autonomy given to teams is related to a positive employees' attitude, as team members feel respected and valued when the improvement decisions are made by themselves.

Team functional heterogeneity represents the professional diversity of team members that participate to kaizen initiatives, and is related to the different job categories of team members, i.e., doctors, technicians, nurses, administrative staff (Mazzocato *et al.*, 2010; West and Lyubovnikova, 2013). De Souza and Pidd (2011) and Mazzocato *et al.* (2010), referring to kaizen initiatives and teams for problem-solving, highlight the relevance of forming teams with staff from various functions. According to Mazzocato *et al.*'s (2010) literature review of lean in healthcare, the functional heterogeneity of kaizen and other problem-solving teams is linked to improvements of employees' capabilities; it provides an opportunity to team members to collaborate with employees with a different professional background, therefore improving their knowledge about the current situation and different ways to improve it (e.g. errors in a procedure and how to achieve a better service). Moreover, previous studies on teamwork suggest team functional heterogeneity being also related to employees' willingness to participate in future teamwork activities (e.g. Vinokur-Kaplan, 1995). This positive attitude of team members might be explained by the opportunity to interact and cooperate with employees with different professions, which may increase their engagement to work.

Team kaizen experience refers to the general experience developed by team members about kaizen initiatives, while team leader experience refers to the leadership experience developed by a team leader in guiding kaizen initiatives (Farris *et al.*, 2009). As a conclusion of his literature review of kaizen initiatives and lean implementations in emergency departments, Holden (2011) identifies learning from previous experiences as an important factor for the development of employees' capabilities. For example, newer members can benefit from colleagues' past experiences about what are the more appropriate improvement tools for a specific problem and how to use them. Past experience is also related to a positive attitude of team members. Kimsey's (2010) study of a kaizen initiative in healthcare found that the experience a leader gained from past projects helps to better guide the team during an improvement initiative, increasing members' commitment.

Management support and initiative planning process integrate all the resources provided for the kaizen initiative implementation. Specifically, management support refers to the resources provided during the kaizen initiative (e.g. materials, equipment, support by other employees) whereas initiative planning process represents the resources provided prior to the kaizen initiative (e.g. time for setup activities). Some studies on kaizen initiatives in healthcare suggest that managerial support before and during kaizen initiatives may contribute to improve social outcomes in healthcare, as employees can test and execute their own improvement ideas without impediments, enhancing their motivation to participate

actively and enthusiastically in the kaizen initiatives (e.g. Dickson *et al.*, 2009). Based on the analysis of previous literature on kaizen initiatives and lean implementations in healthcare, Andersen *et al.* (2014) suggest that creating a supportive environment (e.g. providing sufficient training and resources) helps employees using their skills and creativity, in addition to be more motivated in improving their work area.

Work area routineness represents the regularity of activities in a work area. It is expected that this characteristic positively affects social outcomes in kaizen initiatives in healthcare. According to Ballé and Régnier's (2007) study of teamwork "kaizen activities" for implementing lean in a French hospital ward, work area routineness is related to the enhancement of employees' capabilities, including adoption of new problem-solving skills and better awareness of waste within their work area. This view is also supported by Farris *et al.*'s (2009) study on kaizen initiatives in the manufacturing sector, which demonstrates that work area routines have a positive effect on KCs.

2.3.2 Process factors. Process factors concern variables related to interactions of team members (within the team and with other employees of the organisation) and their shared knowledge, beliefs and attitudes when working in team (Cohen and Bailey, 1997). Following Farris *et al.* (2009), process factors in kaizen initiatives are: action orientation (AO), affective commitment to change (ACC), internal processes (IPs), tool quality and tool appropriateness.

AO represents the preference of team members to experiment improvement ideas in the work area rather than spend a lot of time analysing and planning potential improvements before action (Farris *et al.*, 2009). It is expected that AO may contribute to improve employees' capabilities and attitude in kaizen initiatives in healthcare, because hands-on experiences help team members to immediately understand and recognise the benefits of kaizen initiatives, helping them to increase their array of skills and their motivation to enhance the work area. This is in line with evidence from the lean healthcare literature. For example, Jimmerson *et al.*'s (2005) study of lean implementation through a team approach to problem solving in a US hospital found that experimenting on the field improved employees' enthusiasm for making improvements. Similarly, Fine *et al.*'s (2009) investigation of lean implementation – including the use of kaizen initiatives – in five Canadian hospitals concludes that "hands-on experience" in team contributes to enhance employees' understanding of lean principles and techniques.

ACC represents team members' strong belief in potential benefits deriving from the implementation of the continuous improvement philosophy in general, and the execution of kaizen initiatives in their work area. Various studies in the lean healthcare literature suggest a positive relationship between this process factor and social outcomes (e.g. Poksinska, 2010; Hung *et al.*, 2015). According to Hung *et al.* (2015), who studied lean implementation including the use of a teamwork in a US ambulatory care delivery system, ACC is vital to improve social outcomes as it contributes to promote cooperation and stimulates enthusiasm of team members. In addition, Poksinska's (2010) literature review indicates employees' commitment as crucial for any lean initiative – including kaizen initiatives – and suggests a relation between employees' commitment and their skills. In fact, employees feel that the change is valuable for their work area and, therefore, it is worth investing in developing the capabilities needed to achieve the improvement objective. This relationship is also supported by Farris *et al.* (2009) in the case of kaizen initiatives in the manufacturing sector, where they find that ACC positively affects employees' capabilities.

IPs represent the value and respect of employees concerning contributions, opinions and feelings of other team members, including employees of different professions. In their study of a kaizen initiative in a US hospital, Bahensky *et al.* (2005) observe that good interpersonal dynamics among team members favour the establishment of the right environment for generating new improvement ideas, and can positively affect communication. Ghosh and Sobek II (2015) investigate the use of team approach to problem solving in lean

implementation in various departments of a US hospital and observe that a shared understanding of problems affecting the work area and an open discussion about improvement ideas among the team members contribute to developing knowledge, confidence and enthusiasm of employees in a kaizen initiative.

Tool appropriateness refers to the suitability of a tool to address problems and achieve an initiative goal, while tool quality evaluates the goodness of the use of a tool during a kaizen initiative (Farris *et al.*, 2009). Ghosh and Sobek II (2015) observe a positive relationship between the use of structured tools (e.g. A3 problem-solving report) and social outcomes in team problem-solving initiatives. Similarly, Jimmerson *et al.* (2005) observe that the use of tools such as diagrams and A3 problem-solving reports within a work area contributes developing a shared understanding of problems and improving communication about improvement ideas. It is expected that this, in turn, favours the engagement of team members in a kaizen initiative (i.e. employees' attitude).

2.3.3 Hypotheses. Based on the above discussion on the relationships between input and process factors and social outcomes in healthcare, we hypothesise that:

H1. Input and process factors are positively related to KCs.

H2. Input and process factors are positively related to attitude.

2.4 Indirect relationships

The discussion below addresses whether input factors are related to social outcomes through process factors (i.e. mediating effect). The basic assumption of the input-process-outcome framework, which inspired Farris *et al.*'s (2009) model, is that input variables related to the design and context of kaizen initiatives can determine how team members interact and perform activities during kaizen initiatives (i.e. process factors), thus impacting on social outcomes. This model divides the variables into three major groups: input, process and outcomes, and hypothesises that input factors can impact outcomes not only directly but also indirectly via process factors. Thus, it allows to frame as a broad research hypothesis that process variables mediate the effect of input variables on social outcomes.

For instance, starting from this model, Farris *et al.* (2009) prove that acting on goal clarity positively affects attitude through IPs, as goal clarity fosters communication, sharing opinions and interactions in kaizen events, thus improving employees' enthusiasm and willingness of participating in kaizen initiatives. In the healthcare literature on team effectiveness, we can find some arguments supporting this logic and suggesting that input factors can be indirectly related to the improvement of employees' capabilities and attitude through kaizen initiative process factors (e.g. Lemieux-Charles and McGuire, 2006; West and Lyubovnikova, 2013). For example, West and Lyubovnikova (2013) suggest that goal clarity and goal difficulty are associated with IPs and these relationships serve as the foundation for the improvement of employees' capabilities. Indeed, when the goal is well defined and enough complex, the interpersonal dynamics among team members are better established as the clarity and difficulty of the goal foster cooperation and open communication (West and Lyubovnikova, 2013). In turn, this contributes developing knowledge on problem solving and improving employees' enthusiasm to participate in the kaizen initiative. Furthermore, team autonomy and management support may be associated with ACC, as healthcare workers, valuing the opportunity to use their creativity without any concerns and provided with sufficient resources to execute kaizen initiatives, would be encouraged to believe in the benefits of kaizen initiatives for themselves and the organisation. In turn, this incites healthcare workers to act more eagerly and enhance their employee capabilities.

Following the above reasoning, we hypothesise:

H3. Process factors mediate the effect between input factors and social outcomes.

3. Methodology

3.1 Sample selection and measurement instrument

This research uses data from two hospitals. To increase the reliability and validity of this study, we followed the selection criteria of Farris *et al.* (2009) (Table II). The selected hospitals have the same organisation type, as they are Italian public healthcare service organisations. Both hospitals are currently adopting the same process improvement strategy based on the systematic and frequent implementation of kaizen initiatives. Finally, both hospitals have a good experience in continuous improvement, as kaizen initiatives are performed from at least two years.

Both hospitals were contacted by e-mail and telephone to schedule a first meeting with their mid-level managers responsible for the kaizen programme. During the meetings, we explained the objectives of this study and the potential benefits for the selected organisations. Once agreed to participate to our study, these managers helped us to select the kaizen initiatives to be analysed and to contact all team members and facilitators (i.e. project coordinators, responsible for planning the project and guiding the team during the kaizen initiative). After the selection of the kaizen initiatives, the same managers responsible for the kaizen programmes were interviewed following a semi-structured interview protocol to collect data on organisational characteristics (Table II), organisation's approach to kaizen initiatives, characteristics of the different work areas, perceived benefits, problems and social implications from the selected kaizen initiatives. Then, for each kaizen initiative, two different questionnaires were used for data collection. Questionnaire 1 was administered to each team member, while questionnaire 2 was provided to the facilitator. The two questionnaires, adapted from Farris *et al.*'s (2009) study and translated from English into Italian, included objective and perceptual items that reflect concepts, practices and social outcomes related to kaizen initiatives (Table AI reports the English translation of the questionnaires).

As most of the questions are perceptual and based on past initiatives, we controlled for potential bias and inaccuracies that can affect retrospective data in order to improve measurement reliability (Maritan and Brush, 2003). First, for each kaizen initiative, we collected data from multiple respondents, i.e., team members (at least two) and facilitators. Respondents completed the questionnaires separately. Second, to ensure consistency of multiple responses, we conducted validity and reliability tests (see Section 3.3). Finally, we cross-validated data by examining different organisation's documents. For each kaizen initiative, we collected a copy of the kick-off meeting minutes, the progress reports and the final A3 report. Although not directly used in the analyses, we examined these documents to verify the accuracy of data collected, by controlling any contrasting data among organisations' documents and retrospective answers to our questionnaires. For example, we verified that data reported in the final A3 report was aligned with values concerning tool quality and appropriateness measurement scales; we controlled that the timeline presented in

Selection criterion	Description	Hospital A	Hospital B
1. Organisation type	Private/public hospital	Public	Public
	No. employees	3,000	1,800
	No. beds	639	400
2. Kaizen experience	First kaizen experience	2013	2014
3. Systematic use of kaizen initiatives	Yes/No	Yes	Yes
4. Kaizen initiative frequency during study period	Study period	2013-2015	2014-2016
	Average no. initiatives per year	40	24
	No. initiatives sampled	69	36

Table II.
Characteristics of the hospitals

the final A3 report was coherent with values of event planning process and AO; we analysed kick-off meeting minutes and progress reports and compared these documents with values of management support, goal clarity, goal difficulty and team autonomy; and so on. This procedure allowed us to further control for potential inaccuracies linked to our data collection instruments, as our data set was compared to documents prepared in real time, thus not prone to retrospective biases (Maritan and Brush, 2003).

We collected data from 105 kaizen initiatives. In total, 605 questionnaires were administered to team members, and 362 were returned, with a response rate of 60 per cent. Instead, all the 105 questionnaires administered to the facilitators were returned. We received answers from at least two team members for each kaizen initiative, allowing analyses of team-level properties.

In accordance with Joosten *et al.*'s (2009) arguments that both social and technical outcomes are necessary, we gathered data also on the technical outcomes of the kaizen initiatives considered in this study, to verify if they generated technical outcomes. From the A3 reports, we found that all the kaizen initiatives considered achieved (and sometimes exceeded) their initial goals. Most of the kaizen initiatives allowed to reduce waste that negatively affected the patients' waiting time, healthcare service costs and quality. Specifically, the most frequent technical outcome was the reduction of throughputs and queues due to time spent in non-value-adding activities (64 kaizen initiatives), followed by process and lay-out reorganisation to reduce the distance travelled to provide/consume healthcare services (21 kaizen initiatives). The remaining initiatives achieved heterogeneous outcomes such as patient comfort improvement, quality problems reduction (e.g. infections, errors, variability), inventory and material cost savings. Consequently, the boundary of this study concerns the relationship between the determinants and social outcomes in a sample of kaizen initiatives that achieved some technical outcomes.

3.2 Measurement scales validation

The measurement instrument is based on Farris *et al.* (2009). We evaluated the content validity of the scales through an extensive literature review (Bagozzi *et al.*, 1991) of healthcare studies, reported in Table AI. Additionally, a pilot test and a discussion with key informants from the two hospitals were conducted to check the content validity of the scales.

Confirmatory factor analysis (CFA) was used to assess the validity of the multi-item perceptual constructs, using LISREL 8.80 software. Two models were built for exogenous and endogenous constructs, respectively. For the former the results are $\chi^2 = 151.646$, $df = 95$, $\chi^2/df = 1.596$, $CFI = 0.950$, and $RMSEA = 0.071$; for the latter $\chi^2 = 436.976$, $df = 220$, $\chi^2/df = 1.986$, $CFI = 0.967$, and $RMSEA = 0.076$. The fit indexes of the two models are judged acceptable (Hair *et al.*, 2006).

As reported in Table AI, the factor loadings of all the items exceed 0.500 and are statistically significant, providing statistical evidence of convergent validity.

As concerns reliability, the composite reliability (CR) of multi-item scales results greater than the recommended threshold of 0.700, except for AO, although it is very close to the acceptable cut-off point of 0.600 (Hair *et al.*, 2006).

Discriminant validity was evaluated using the $\Delta\chi^2$ test (Bagozzi *et al.*, 1991). Two CFAs were conducted for all possible pairs of latent constructs. The first CFA assesses the model with an unconstrained correlation between the two constructs, whereas the second CFA evaluates the model with a correlation equal to 1. A significant χ^2 difference between these two nested models indicates that the two constructs are distinct. The values of $\Delta\chi^2$, which range from 5.20 to 437.00, are all statistically significant confirming the discriminant validity of the constructs.

Table III reports descriptive statistics and Pearson correlation coefficients.

Table III.
Descriptive statistics and Pearson correlations

Constructs	Mean	SD	GC	GD	ACC	IP	MS	TA	AO	KC	AT	WAR	TQ	TAP	TFH	TKE	IPP
GC	5.179	0.579															
GD	3.786	1.042	0.156														
ACC	4.832	0.666	0.692***	0.230*													
IP	5.095	0.607	0.707***	0.074	0.633***												
MS	4.227	0.880	0.377***	0.020	0.523***	0.213*											
TA	4.579	0.767	0.494***	0.029	0.437***	0.507***	0.346***										
AO	4.497	0.692	0.525***	0.117	0.473***	0.474***	0.253**	0.521***									
KC	4.796	0.667	0.767***	0.075	0.734***	0.596***	0.522***	0.581***	0.556***								
AT	4.778	0.753	0.737***	−0.033	0.637***	0.608***	0.495***	0.524***	0.407***	0.758***							
WAR	4.490	0.887	−0.053	0.200*	−0.012	0.063	−0.319**	0.098	0.128	−0.002	−0.058						
TQ	5.076	0.731	0.003	0.224*	−0.058	0.051	−0.156	0.131	0.006	−0.012	0.032	0.355***					
TAP	4.622	1.246	0.036	0.165	−0.096	0.034	−0.096	0.187	0.027	−0.006	0.034	0.137	0.605***				
TFH	0.344	0.207	0.043	−0.070	0.084	0.151	0.048	0.009	−0.043	0.074	0.152	−0.121	−0.064	−0.077			
TKE	0.205	0.205	0.185	0.099	0.106	0.028	0.112	0.105	0.198*	0.134	0.115	−0.033	−0.144	0.111	−0.103		
IPP	0.921	0.353	−0.023	−0.071	−0.128	0.003	0.002	0.178	−0.019	−0.082	−0.035	0.089	0.409***	0.559***	−0.148	0.012	
TLE	0.292	0.282	0.126	0.083	0.099	0.010	0.114	−0.019	0.151	0.103	0.088	−0.046	−0.269**	−0.132	−0.085	0.705***	−0.197*

Notes: GC, goal clarity; GD, goal difficulty; ACC, affective commitment to change; IP, internal processes; MS, management support; TA, team autonomy; AO, action orientation; KC, kaizen capabilities; AT, attitude; WAR, work area routineness; TQ, tool quality; TAP, tool appropriateness; TFH, team functional heterogeneity; TKE, team kaizen experience; IPP, initiative planning process; TLE, team leader experience. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

3.3 Team properties

As the unit of analysis is the team, data collected at individual level was aggregated at team level. To justify this aggregation, intra-class correlation coefficient (ICC) (Bliese, 2000) and within-group agreement (r_{wg}) (James *et al.*, 1984) were assessed at team level. The ICC scores of the items are all larger than the 0.200 suggested threshold, ensuring a sufficient team level association (Molleman, 2005). Additionally, the average r_{wg} values were calculated and range between 0.772 and 0.941, demonstrating strong within-group agreement (LeBreton and Senter, 2008).

3.4 Results

3.4.1 Most influential determinants of social outcomes in kaizen initiatives. In order to address *RQ1*, we tested *H1* and *H2* through a regression analysis following a backward selection procedure for each social outcome (Xu and Zhang, 2001). The backward regression is a step-procedure that starts with a hypothesis (sometimes the term "set of hypotheses" is used) posing a relationship between a set of independent variables (x) and one outcome (y) (Hair *et al.*, 2006). At each step of the selection procedure, the independent variable with the highest p-value is removed until all remaining variables are significant at 0.05 level.

Testing *H1* and *H2* through the backward procedure allowed us to identify two subsets of variables among the whole set comprising input and process variables: a subset of variables significantly related to KCs and attitude, and a subset of variables discarded by the procedure. The first subset is composed by the most influential variables among the initial whole set of input and process variables, while the second one contains the less influential variables. Thus, we can conclude for which subset of variables *H1* and *H2* are supported and for which subset of variables they are rejected.

The nested nature of our data set does not assure a priori that data at team level is uncorrelated within the same organisation. In order to avoid spurious statistical results due to correlations between observations, Farris *et al.* (2009) suggest to use generalised estimating equations (GEE) as a method that takes into account correlations between observations of the same cluster, i.e. teams within the same organisation. However, as pointed out by Horton and Lipsitz (1999), the estimation of the variance of GEE models is highly biased when the number of clusters is less than 20. Ballinger (2004) highlighted that models that assume standard errors ignoring correlation within the cluster should be preferred over variance estimates that incorporate the correlation in case of a small number of clusters. Therefore, as our observations are nested in only two clusters, we run a multiple regression using ordinary least squares estimation. Nevertheless, to avoid biases of our estimates, we controlled for correlation at organisational level. We computed ICC scores of the items at organisational level, and they are all lower than 0.200, suggesting that observations are uncorrelated within organisations (Molleman, 2005). To further support the validity of our results, we examined residual plots and partial regression plots and did not find any apparent departure from normality (residual plots) and linearity (partial regression plots). Finally, to avoid potential biases and limit endogeneity, we controlled the effects of organisation type and team size, as they may have an impact on social outcomes and therefore affect the results of our analyses.

As Table IV shows, Model 1 indicates that goal clarity, management support, team autonomy and ACC are significantly related to KCs, while Model 2 shows that goal clarity, management support, team autonomy and goal difficulty are significantly related to employees' attitude (AT). The two control variables – organisation type and team size – were not found significantly related to both outcomes. Based on this, we can conclude that *H1* is supported for goal clarity, management support, team autonomy and ACC; *H2* is supported for goal clarity, management support, team autonomy and goal difficulty.

Variable	Model 1 (y = KC) β	Model 1 (y = KC) p	Model 2 (y = AT) β	Model 2 (y = AT) p
Intercept	−3.410	0.073	−2.929	0.239
Organisation type	0.619	0.361	0.634	0.477
Team size	0.185	0.084	0.075	0.590
Goal clarity	0.459	0.000***	0.724	0.000***
Management support	0.122	0.029*	0.208	0.002**
Team autonomy	0.194	0.001***	0.160	0.032*
Affective commitment to change	0.250	0.003**		
Goal difficulty			−0.124	0.026*
R^2	0.855		0.799	
R^2 adjusted	0.731		0.639	

Notes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table IV.
Most influential determinants of kaizen capabilities and attitude

3.4.2 Mediation analysis. In order to test *H3*, we followed a modified version of Baron and Kenny's (1986) approach (Farris *et al.*, 2009). In particular, we employed a three-step mediation analysis procedure: first we executed separate regressions to verify the significance of relationships between each input factor and each process factor (coefficient a in Table V). For each significant relationship found in step 1, we regressed each social outcome on both input and process factors (step 2). If the process factor was found significantly related to a social outcome (coefficient *b* in Table VI), then we concluded that the process factor is a mediator of the relationship between input factor and social outcome. If also the input factor is significantly related to the social outcome (coefficient *c*'), the effect of the input factor on the social outcome is partially mediated, otherwise it is fully mediated. Finally, in step 3 we regressed each process factor resulting as mediator in step 2 on all input factors significantly related to it in step 1, to confirm whether these variables were still significant when simultaneously regressed (Table VII).

Our results show that ACC partially mediates the effect of goal clarity and management support on both social outcomes. ACC partially mediates the effect of goal difficulty on attitude and fully mediates its effect on KCs. IPs partially mediates the effect of team autonomy on both social outcomes. Finally, AO partially mediates the effect of goal clarity and team autonomy on KCs. To provide conclusive evidence, we calculated also the significance of these indirect effects and their asymmetrical confidence intervals (CIs) using PRODCLIN (MacKinnon and Fritz, 2007). Indirect effects had *z*-values greater than 1.96 and

Step 1 (z = mediator) Separate regression	z = ACC a (p-value)	z = IP a (p-value)	z = AO a (p-value)	z = TQ a (p-value)	z = TAP a (p-value)
Goal clarity	0.758 (0.000)***	0.758 (0.000)***	0.569 (0.000)***	0.003 (0.978)	0.068 (0.716)
Goal difficulty	0.175 (0.018)*	0.055 (0.451)	0.089 (0.233)	0.203 (0.022)*	0.218 (0.092)
Team autonomy	0.397 (0.000)***	0.450 (0.000)***	0.609 (0.000)***	0.141 (0.183)	0.294 (0.056)
Management support	0.452 (0.000)***	0.180 (0.029)*	0.216 (0.009)**	−0.161 (0.111)	−0.143 (0.332)
Team kaizen experience	3.031(0.281)	0.769 (0.780)	5.600 (0.043)*	−4.882 (0.144)	5.486 (0.260)
Team functional heterogeneity	2.378 (0.394)	4.184 (0.123)	−1.194 (0.666)	−2.152 (0.517)	−3.770 (0.436)
Initiative planning processes	−2.133 (0.192)	0.052 (0.974)	−0.312 (0.847)	8.091 (0.000)***	16.093 (0.000)***
Work area routineness	0.009 (0.902)	0.046 (0.521)	0.095 (0.192)	0.316 (0.000)***	0.178 (0.164)
Team leader experience	2.059 (0.316)	0.210 (0.917)	3.106 (0.124)	−6.663 (0.005)**	−4.767 (0.179)

Notes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table V.
Regression between inputs and process factors

Step 2 ($y =$ social outcome) Separate regression	$y =$ KC b (p-value)	c' (p-value)	$y =$ AT b (p-value)	c' (p-value)
Affective commitment to change	0.385 (0.000)***		0.271 (0.007)***	
Goal clarity		0.539 (0.000)***		0.692 (0.000)***
Affective commitment to change	0.747 (0.000)***		0.756 (0.000)***	
Goal difficulty		−0.074 (0.153)		−0.160 (0.015)*
Affective commitment to change	0.586 (0.000)***		0.560 (0.000)***	
Team autonomy		0.288 (0.000)***		0.306 (0.002)**
Affective commitment to change	0.627 (0.000)***		0.579 (0.000)***	
Management support		0.162 (0.015)*		0.214 (0.012)*
Internal processes	0.108 (0.233)		0.197 (0.065)	
Goal clarity		0.749 (0.000)***		0.748 (0.000)***
Internal processes	0.411 (0.000)***		0.524 (0.000)***	
Team autonomy		0.336 (0.000)***		0.293 (0.001)***
Internal processes	0.514 (0.000)***		0.599 (0.000)***	
Management support		0.353 (0.000)***		0.368 (0.000)***
Action orientation	0.211 (0.004)**		0.032 (0.722)	
Goal clarity		0.711 (0.000)***		0.880 (0.000)***
Action orientation	0.299 (0.006)**		0.107 (0.405)	
Team autonomy		0.339 (0.001)***		0.463 (0.000)***
Action orientation	0.452 (0.000)***		0.339 (0.000)***	
Management support		0.348 (0.000)***		0.402 (0.000)***
Action orientation	0.550 (0.000)***		0.450 (0.000)***	
Team kaizen experience		0.714 (0.764)		1.117 (0.704)
Tool quality	−0.120 (0.821)		0.028 (0.657)	
Goal difficulty		0.831 (0.000)***		0.898 (0.000)***
Tool quality	0.021 (0.813)		0.052 (0.611)	
Initiative planning processes		−1.523 (0.393)		−1.062 (0.597)
Tool quality	−0.011 (0.900)		0.056 (0.571)	
Work area routineness		0.002 (0.980)		-0.066 (0.451)
Tool quality	0.014 (0.872)		0.056 (0.561)	
Team leader experience		2.208 (0.296)		2.399 (0.313)
Tool appropriateness	0.033 (0.628)		0.050 (0.513)	
Initiative planning processes		−1.881 (0.337)		−1.451 (0.511)

Notes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table VI. Mediation analysis results

Step 3 ($z =$ process factor) Simultaneous regression	$z =$ ACC	$z =$ IP	$z =$ AO
Goal clarity	0.572 (0.000)***	0.677 (0.000)***	0.267 (0.004)**
Goal difficulty	0.107 (0.035)*		
Management support	0.258 (0.000)***	−0.103 (0.146)	−0.039 (0.556)
Team autonomy	0.065(0.347)	0.179 (0.020)*	0.504 (0.000)***
Team kaizen experience			2.784 (0.166)

Notes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table VII. Simultaneous regression of input factors on process factor

the 95 per cent CIs excluded zero, confirming the significance of the indirect relationships found in our previous analyses.

We should note that IP and AO, which result as mediators in our analyses, are not significant variables in the backward regression (Table IV). Unlike mediation analysis, backward regression considers simultaneously all input and process variables, and adopt a

step-procedure to identify the most influential variables. As a result, a mediator could not be significant in the backward regression. For instance, given that IP and AO are significantly correlated with ACC (the correlations are 0.633 and 0.473, respectively, and significant at 0.001 level), it is possible that in the overall model considering all the variables together (Table IV) only ACC is significant. This further evidence does not contrast the validity of IP and AO as potential mediators (as it results from the mediation analyses), but suggests that input and process variables may be also linked together, opening potential new opportunities for future research (see Section 5.1).

4. Discussion

4.1 Most influential determinants of social outcomes in kaizen initiatives

A first contribution of our paper to the literature is the identification of the most influential determinants of social outcomes in kaizen initiatives in healthcare. Past research on kaizen initiatives in healthcare outlines the importance of some factors related to kaizen initiative design (e.g. team autonomy; Bahensky *et al.*, 2005), organisational and work area characteristics (e.g. management support; Dickson *et al.*, 2009) and kaizen initiative process (e.g. AO; Jimmerson *et al.*, 2005). However, past research provides a fragmented picture of the phenomenon, as the different studies focused on one or few determinants, precluding the understanding of their relative importance. Instead, we combined several factors which can influence social outcomes in a comprehensive model. This holistic view of the phenomenon allowed us to find that, among the 14 factors of our theoretical framework (Figure 1), goal clarity, team autonomy, management support, goal difficulty and ACC are the most influential determinants of employees' capabilities and/or attitude in healthcare.

We found that both social outcomes are positively affected by goal clarity. This result is in line with past research on team effectiveness in healthcare (e.g. Mickan, 2005), while partially differs from Farris *et al.*'s (2009) study on kaizen initiatives in manufacturing, which find no evidence of significant direct relationships between these variables, but find a strong indirect effect through IPs. A possible explanation for the relevance of goal clarity in healthcare may be related to the lack of a common language about patient pathways across professions, which acts as a barrier for teamwork in this sector (Hollnagel *et al.*, 2013). Indeed, when employees have different professional languages, goal clarity is important as it aligns team members towards the "to-be state" and provides a "common mental model" (Senge, 1992) to gauge the success of transformations and their learning/reflection on improvement (positive impact on KCs). Goal clarity is also likely to reduce the concern that changes to tasks, procedures and processes that kaizen implies can compromise clinical compliance, namely the core "know how" and "know why" knowledge ensuring that a continued safe working practice is maintained (positive impact on attitude). On the contrary, an unclear goal, unendorsed by the team and vague in description, will generate friction amongst team members as actions undertaken or questions posed may be seen as antagonistic due to the lack of a common language (Hollnagel *et al.*, 2013), which in turn can cause demotivation and frustration within the team and ultimately a lack of willingness in investing time to develop problem-solving capabilities.

In addition, we found that team autonomy is a further influential variable for both social outcomes. This result is in line with past research in the healthcare literature, including contributions on kaizen initiatives (e.g. Bahensky *et al.*, 2005) and studies on lean and team problem-solving (e.g. Drotz and Poksinska, 2014). Instead, in manufacturing, Farris *et al.* (2009) find a relationship between team autonomy and employees' capabilities only. While in a typical manufacturing context workers perform routine activities designed by the organisation, healthcare employees are highly educated and quite independent in organising their daily job (Drotz and Poksinska, 2014). It is likely that the latter prefers to be

autonomous also when facing improvement activities, and this explains the relevance of team autonomy in healthcare, also in terms of employees' attitude. A rigorous adherence to a standardised process improvement cycle has the potential to remove discussion and autonomy (Seddon, 2008), thus creating passive and withdrawn behaviours and leading to poor social outcomes. In contrast, local team decision making and autonomy increase sensitivity and maintain a core focus on patient care within an atmosphere of questioning and "bounded" empowerment, encouraging healthcare professionals to be innovative and practice their activities as an art as well as a science (Guo and Hariharan, 2012).

Moreover, we found that management support is among the most influential determinants of both social outcomes, showing the relevance of allocating the right resources during a kaizen initiative. This result is in line with past research on kaizen initiatives in healthcare in that it shows that investments in resources enable teams to progress, enhancing their motivation to participate actively and enthusiastically in kaizen initiatives (e.g. Dickson *et al.*, 2009). It is also consistent with Farris *et al.* (2009), who find a positive relationship between management support and attitude in kaizen initiatives in manufacturing. However, different from manufacturing and in line with past contributions on lean and kaizen initiatives in healthcare (e.g. Andersen *et al.*, 2014), we found that the availability of resources also facilitates improvement of employees' capabilities.

As regards goal difficulty, our results show that this is among the most influential variables of employees' attitude, negatively affecting it, while it is not significant when considering capabilities. As explained in Section 2.3, in the healthcare literature, there are mixed arguments on the impact of goal difficulty. West and Lyubovnikova's (2013) work on teamwork found that the goal should be sufficiently complex for developing employees' capabilities. Instead, Jimmerson (2007) maintain that kaizen initiative goals must be perceived as suitable by team members to avoid frustrations and guarantee a positive attitude towards kaizen initiatives. Our research adds some additional light on this relationship and enriches the debate. In fact, though goal difficulty has a negative significant impact on employees' attitude in itself, if we look at its direct and indirect effects, we can see that it positively influences ACC which in turn positively impacts on attitude. This is different from what observed by Farris *et al.* (2009) in kaizen initiatives in manufacturing, as goal difficulty is positively related to employees' capabilities only.

Finally, we found that ACC – a strong belief in potential benefits of kaizen initiatives – is among the most significant determinants of KCs. This results is in line with past research on lean in healthcare analysing kaizen initiatives and the use of teamwork (e.g. Poksinska, 2010; Hung *et al.*, 2015) and with findings on kaizen initiatives in manufacturing (Farris *et al.*, 2009). This finding supports the idea that teams that recognise the existence of operational problems within their work areas and the potential benefits of kaizen initiatives are more willing to solve them and eager to invest their time in developing their problem-solving capabilities. In healthcare, time management is a particularly sensitive aspect for employees, as their absolute priority is patient care (Natale *et al.*, 2014). Therefore, it is crucial that team members believe that the kaizen initiative is not a waste of time, but will help them to improve patient satisfaction (Hasle, 2014), in order to have a positive impact on capability (Poksinska, 2010; Andersen *et al.*, 2014).

Overall, a final consideration regarding the comparison of kaizen initiatives in manufacturing vs healthcare is that our findings are partially in line with Farris *et al.*'s (2009) results on kaizen initiatives in manufacturing. In addition to the similarities and differences highlighted above and regarding goal clarity, team autonomy, management support, goal difficulty and ACC, unlike the present study, Farris *et al.* (2009) find that team functional heterogeneity is a major determinant of attitude, work area routines, team and team leader experience of KCs, and IPs of both social outcomes. A possible explanation for the differences between these studies may lie in the peculiarities of the contexts considered.

Characteristics such as heterogeneity of languages across professions, high education level and others could play a role in explaining the divergent results in manufacturing and healthcare contexts. However, future research is needed to identify these peculiar characteristics and explaining their influence.

4.2 Direct and indirect influence of determinants on social outcomes

As a second contribution of our work, we delved more deeply into the relationship between determinants and social outcomes by explaining how determinants are related to each other to affect employees' capabilities and attitude. It emerges that the input factors goal clarity, goal difficulty, team autonomy and management support influence social outcomes directly and/or indirectly through the process factors ACC, IPs and/or AO. This means that, in healthcare organisations, investments in resources, the development of team autonomy within a mutually agreed, not far complex and clearly articulated goal, enable teams to progress. These design and organisational support factors create the conditions to achieve good social outcomes because they activate high levels of IPs (i.e. relationship building), ACC and an AO during the teamwork process, which in turn lead to better social outcomes.

In healthcare, although professionals are trained to work in teams to recovery patients (Tanco *et al.*, 2011), the above organisational/managerial factors are often neglected when an improvement initiative is undertaken. Instead, the key of success is creating the right conditions for teamwork by building trust and giving support and empowerment to team members for learning how to improve their processes and systems. This activates the right mechanisms (process factors) to achieve high social outcomes.

Overall, the above results are in accordance with arguments from past research in healthcare supporting that some determinants can be indirectly related to the improvement of employees' capabilities and attitude through some mediating factors (Lemieux-Charles and McGuire, 2006; West and Lyubovnikova, 2013). However, these arguments lacked an empirical validation. Therefore, our empirical evidence of the mediating role of process factors in the context of kaizen initiatives in healthcare is novel and represents an original contribution of our study to the literature on kaizen initiatives in healthcare. An implication for the theory is that not all the determinants play the same role in affecting social outcomes. While some determinants have only a direct impact on employees' capabilities and/or attitude (AO, ACC and IPs), other factors (goal clarity, goal difficulty, team autonomy and management support) have a more complex role, i.e. direct and indirect influence on social outcomes. Thus, this research clarifies the mechanisms by which input factors affect social outcomes in kaizen initiatives, and therefore how it is possible to increase employees' capabilities and attitude by levering on input factors. The above-cited input factors can improve social performance in itself, but can also exert an effect on social outcomes through process factors.

Finally, the comparison of our results with those in Farris *et al.* (2009) shows that IPs can act as a mediator on both social outcomes, for team autonomy in our study and goal clarity in Farris *et al.*'s (2009) study. In addition, our research highlighted the importance of other two mediator factors (AO and ACC). While the result concerning AO cannot be compared with Farris *et al.*'s (2009) results, as it is not tested as a mediator in that study (the authors analyse as mediators only the process factors that are found significant direct predictors of social outcomes), the finding concerning ACC is in contrast, as Farris *et al.* (2009) do not find the latter as a significant mediator of any of the input variables. Again this difference may be due to the peculiarities of healthcare sector, and future research studies, in particular based on case study methodology, could be useful to advance some potential reasons about differences and similarities found.

4.3 Managerial implications

Our study supports managers in understanding how to set up ad hoc strategies and lever on specific determinants of kaizen initiatives to positively influence social outcomes in healthcare.

We suggest managers to support teams by agreeing a common and achievable goal and giving team members the autonomy to make changes. In this manner the kaizen initiative is likely to create learning cycles for the team, thus affecting social outcomes. The planning and support stage of a kaizen initiative seems to be fundamental as it allows the organisational management to assign resources for use by the team, such as time, management support, legitimacy and autonomy to self-organise around a common goal. This, in turn, improves directly social outcomes and indirectly through the activation of the right process mechanisms.

Overall, our results can be seen as a portfolio of actions that allows teams to develop a distinct identity with a purposive goal, which unites all efforts to improve the operations management system in an environment which respects questioning and inter-professional discussion. These activities are not common to daily work in healthcare due to an organisational hierarchy that structures a hospital around departments and speciality of knowledge rather than patient pathway or process in focus (Drotz and Poksinska, 2014). It is also unusual for staff to meet for improving a process rather than deciding what happens next to a patient. Specialist knowledge, different shift patterns preventing staff from meeting regularly and professional dissonance inhibit communication (Rich and Piercy, 2013), whereas this study finds how a kaizen initiative can promote such discourse, creates a common language and is disrespectful of traditional functional specialisation, thus improving social outcomes.

5. Conclusions

Past literature on kaizen initiatives in healthcare provides only a limited understanding of the determinants of social outcomes in kaizen initiatives. This is in stark contrast with the crucial role played by people and their cooperation in team in improving activities and operational performance in any healthcare organisations (Holden, 2011). Drawing on the input-process-output framework and Farris *et al.*'s (2009) model, our study provides a more comprehensive understanding of the phenomenon. Empirical findings from 105 kaizen initiatives in two hospitals not only clarify which are the most influential determinants of employees' capabilities and attitude, but also show how these variables are related. Specifically, social outcomes are influenced by determinants related to kaizen initiative design, organisational and work area management and kaizen initiative process. Moreover, some kaizen initiative process factors – i.e., AO, ACC and IPs – can act as mediators of the relationships between some input factors – i.e., goal clarity, goal difficulty, team autonomy and management support – and social outcomes.

5.1 Limitations and future research

A first limitation of our study is linked to the cross-sectional nature of the data. While we systematically investigated the determinants of initial social outcomes in kaizen initiatives, future studies based on longitudinal data may also analyse impacts in the long term. Indeed, it is important that kaizen initiatives are not viewed as a mechanism to achieve short-term benefits, but are integrated in a hospital's operations strategy to foster long-term cultural and behavioural change (Matthias and Brown, 2016) and to sustain technical outcomes (Bateman, 2005).

Second, our database includes kaizen initiatives in two public hospitals in Italy. While this choice helped to limit possible variability on variables not included in our framework, it may also affect the generalisability of our findings, precluding definitive conclusions about the relationships under study. Future research should assess the validity of our results across a variety of contexts, such as public and private hospitals, and/or hospitals in different countries (e.g. both developed and developing).

Third, our study includes some inconclusive results. We found that team functional heterogeneity, team kaizen experience, team leader experience, initiative planning process, work area routineness, tool quality and tool appropriateness are not among the most influential predictors of social outcomes. However, we cannot conclude from our results that these determinants are not relevant for improving social outcomes in kaizen initiatives in healthcare. In addition, the comparison of our study with Farris *et al.* (2009) shows some differences in terms of the most influential determinants of social outcomes in kaizen initiatives as well as the direct and indirect influence of determinants on social outcomes. We suggest further research to better explain these relationships.

Fourth, as mentioned in Section 3.4.2, we found that some variables, resulting as mediators according to the mediation analyses, were not significantly related to social outcomes in the backward regression. This evidence, together with some significant correlations between input and process variables, suggests us that the input-process model adopted in this research is likely to explain only some mechanisms through which input and process variables impact social outcomes, maybe not acknowledging other potential links interesting to be studied. Thus, future research based on case studies could help to identify some further propositions on the mechanisms through which input and process variables impact social outcomes, leading to a more complete research model complementing the input-process model.

Finally, though this research considers kaizen initiatives that achieved some technical outcomes, it does not investigate the relationship between the level and type of technical outcomes, social outcomes and their determinants. This could be a further hint for future studies.

References

Andersen, H., Røvik, K.A. and Ingebrigtsen, T. (2014), "Lean thinking in hospitals: is there a cure for the absence of evidence? A systematic review of reviews", *BMJ Open*, Vol. 4 No. 1, pp. 1-8.

Bagozzi, R.P., Yi, Y. and Phillips, L.W. (1991), "Assessing construct validity in organizational research", *Administrative Science Quarterly*, Vol. 36 No. 4, pp. 421-434.

Bahensky, J.A., Roe, J. and Bolton, R. (2005), "Lean sigma – will it work for healthcare", *Journal of Healthcare Information Management*, Vol. 19 No. 1, pp. 39-44.

Ballé, M. and Régnier, A. (2007), "Lean as a learning system in a hospital ward", *Leadership in Health Services*, Vol. 20 No. 1, pp. 33-41.

Ballinger, G.A. (2004), "Using generalized estimating equations for longitudinal data analysis", *Organizational Research Methods*, Vol. 7 No. 2, pp. 127-150.

Baron, M.A. and Kenny, D.A. (1986), "The moderator-mediator variable distinction in social psychological research: conceptual, strategic and statistical considerations", *Journal of Personality and Social Psychology*, Vol. 51 No. 6, pp. 1173-1182.

Bateman, N. (2005), "Sustainability: the elusive element of process improvement", *International Journal of Operations & Production Management*, Vol. 25 No. 3, pp. 261-276.

Bliese, P.D. (2000), "Within-group agreement, non-independence, and reliability: implications for data aggregation and analysis", in Klein, K.J. and Kozlowski, S.W.J. (Eds), *Multilevel Theory, Research, and Methods in Organizations*, Jossey-Bass, San Francisco, CA, pp. 349-381.

Bortolotti, T., Danese, P., Flynn, B.B. and Romano, P. (2015), "Leveraging fitness and lean bundles to build the cumulative performance sand cone model", *International Journal of Production Economics*, Vol. 162, April, pp. 227-241.

Boscari, S., Danese, P. and Romano, P. (2016), "Implementation of lean in multinational corporations: a case study of the transfer process from headquarters to subsidiaries", *International Journal of Production Economics*, Vol. 176, June, pp. 53-68.

Cohen, S.G. and Bailey, D.E. (1997), "What makes teams work: group effectiveness research from the shop floor to the executive suite", *Journal of Management*, Vol. 23 No. 3, pp. 239-290.

Costa, L.B.M. and Godinho Filho, M. (2016), "Lean healthcare: review, classification and analysis of literature", *Production Planning & Control*, Vol. 27 No. 10, pp. 823-836.

Danese, P., Manfè, V. and Romano, P. (2017a), "A systematic literature review on recent lean research: state-of-the-art and future directions", *International Journal of Management Reviews* (in press), doi: 10.1111/ijmr.12156.

Danese, P., Romano, P. and Boscari, S. (2017b), "The transfer process of lean practices in multiplant companies", *International Journal of Operations & Production Management*, Vol. 37 No. 4, pp. 468-488.

De Souza, L.B. and Pidd, M. (2011), "Exploring the barriers to lean health care implementation", *Public Money & Management*, Vol. 31 No. 1, pp. 59-66.

Deneckere, S., Euwema, M., Van Herck, P., Lodewijckx, C., Panella, M., Sermeus, W. and Vanhaecht, K. (2012), "Care pathways lead to better teamwork: results of a systematic review", *Social Science & Medicine*, Vol. 75 No. 2, pp. 264-268.

Dickson, E.W., Singh, S., Cheung, D.S., Wyatt, C.C. and Nugent, A.S. (2009), "Application of lean manufacturing techniques in the emergency department", *The Journal of Emergency Medicine*, Vol. 37 No. 2, pp. 177-182.

Drotz, E. and Poksinska, B. (2014), "Lean in healthcare from employees' perspectives", *Journal of Health Organization and Management*, Vol. 28 No. 2, pp. 177-195.

Farris, J., Van Aken, E.M., Doolen, T.L. and Worley, J. (2008), "Learning from less successful kaizen events: a case study", *Engineering Management Journal*, Vol. 20 No. 3, pp. 10-20.

Farris, J., Van Aken, E.M., Doolen, T.L. and Worley, J. (2009), "Critical success factors for human resource outcomes in kaizen events: an empirical study", *International Journal of production Economics*, Vol. 117 No. 1, pp. 42-65.

Fine, B.A., Golden, B., Hannam, R. and Morra, D. (2009), "Leading lean: a Canadian healthcare leader's guide", *Healthcare Quarterly*, Vol. 12 No. 3, pp. 32-41.

Ghosh, M. and Sobek, D.K. II (2015), "A problem-solving routine for improving hospital operations", *Journal of Health Organization and Management*, Vol. 29 No. 2, pp. 252-270.

Graban, M. and Swartz, J.E. (2013), "T", *he Executive Guide to Healthcare Kaizen: Leadership for a Continuously Learning and Improving Organization*, CRC Press, Boca Raton, FL.

Guo, L. and Hariharan, S. (2012), "Patients are not cars and staff are not robots: impact of differences between manufacturing and clinical operations on process improvement", *Knowledge and Process Management*, Vol. 19 No. 2, pp. 53-68.

Hair, J.F. Jr, Black, W.C., Babin, B.J., Anderson, R.E. and Tatham, R.L. (2006), *Multivariate Data Analysis*, Prentice-Hall, Englewood Cliffs, NJ.

Hasle, P. (2014), "Lean production – an evaluation of the possibilities for an employee supportive lean practice", *Human Factors and Ergonomics in Manufacturing & Service Industries*, Vol. 24 No. 1, pp. 40-53.

Herscovitch, L. and Meyer, J.P. (2002), "Commitment to organizational change: extension of a three-component model", *Journal of Applied Psychology*, Vol. 87 No. 3, pp. 474-487.

Holden, R.J. (2011), "Lean thinking in emergency departments: a critical review", *Annals of Emergency Medicine*, Vol. 57 No. 3, pp. 265-278.

Hollnagel, E., Braithwaite, J. and Wears, R.L. (2013), *Resilient Health Care*, Ashgate, Farnham.

Horton, N.J. and Lipsitz, S.R. (1999), "Review of software to fit generalized estimating equation regression models", *American Statistician*, Vol. 53 No. 2, pp. 160-169.

Hung, D., Martinez, M., Yakir, M. and Gray, C. (2015), "Implementing a lean management system in primary care: facilitators and barriers from the front lines", *Quality Management in Healthcare*, Vol. 24 No. 3, pp. 103-108.

James, L.R., Demaree, R.G. and Wolf, G. (1984), "Estimating within-group interrater reliability with and without response bias", *Journal of Applied Psychology*, Vol. 69 No. 1, pp. 85-98.

Jimmerson, C. (2007), *A3 Problem Solving for Healthcare: A Practical Method for Eliminating Waste*, Productivity Press, New York, NY.

Jimmerson, C., Weber, D. and Sobek, D.K. (2005), "Reducing waste and errors: piloting lean principles at Intermountain Healthcare", *Joint Commission Journal on Quality and Patient Safety*, Vol. 31 No. 5, pp. 249-257.

Joosten, T., Bongers, I. and Janssen, R. (2009), "Application of lean thinking to health care: issue and observations", *International Journal for Quality in Health Care*, Vol. 21 No. 5, pp. 341-347.

Jørgensen, F., Boer, H. and Gertsen, F. (2003), "Jump-starting continuous improvement through self-assessment", *International Journal of Operations & Production Management*, Vol. 23 No. 10, pp. 1260-1278.

Kimsey, D.B. (2010), "Lean methodology in health care", *Association of periOperative Registered Nurses Journal*, Vol. 92 No. 1, pp. 53-60.

Kirkman, B.L. and Rosen, B. (1999), "Beyond self-management: antecedents and consequences of team empowerment", *Academy of Management Journal*, Vol. 42 No. 1, pp. 58-74.

Langabeer, J.R., DelliFraine, J.L., Heineke, J. and Abbass, I. (2009), "Implementation of Lean and Six Sigma quality initiatives in hospitals: a goal theoretic perspective", *Operations Management Research*, Vol. 2 No. 1, pp. 13-27.

Laureani, A., Brady, M. and Antony, J. (2013), "Applications of Lean Six Sigma in an Irish hospital", *Leadership in Health Services*, Vol. 26 No. 4, pp. 322-337.

LeBreton, J.M. and Senter, J.L. (2008), "Answers to 20 questions about interrater reliability and interrater agreement", *Organizational Research Methods*, Vol. 11 No. 4, pp. 815-852.

Lee, C.H. and Bruvold, N.T. (2003), "Creating value for employees: investment in employee development", *The International Journal of Human Resource Management*, Vol. 14 No. 6, pp. 981-1000.

Lemieux-Charles, L. and McGuire, W.L. (2006), "What do we know about health care team effectiveness? A review of the literature", *Medical Care Research and Review*, Vol. 63 No. 3, pp. 263-300.

Lozeau, D., Langley, A. and Denis, J.L. (2002), "The corruption of managerial techniques by organizations", *Human Relations*, Vol. 55 No. 5, pp. 537-564.

McGrath, J.E. (1964), *Social Psychology: A Brief Introduction*, Holt, Rinehart and Winston, New York, NY.

MacKinnon, D.P. and Fritz, M.S. (2007), "Distribution of the product confidence limits for the indirect effect: program PRODCLIN", *Behavior Research Methods*, Vol. 39 No. 3, pp. 384-389.

Maritan, C.A. and Brush, T.H. (2003), "Heterogeneity and transferring practices: implementing flow manufacturing in multiple plants", *Strategic Management Journal*, Vol. 24 No. 10, pp. 945-959.

Matthias, O. and Brown, S. (2016), "Implementing operations strategy through lean processes within health care: the example of NHS in the UK", *International Journal of Operations & Production Management*, Vol. 36 No. 11, pp. 435-1457.

Mazzocato, P., Savage, C., Brommels, M., Aronsson, H. and Thor, J. (2010), "Lean thinking in healthcare: a realist review of the literature", *Quality and Safety in Health Care*, Vol. 19 No. 5, pp. 376-382.

Mazzocato, P., Stenfors-Hayes, T., von Thiele Schwarz, U., Hasson, H. and Nyström, M.E. (2016), "Kaizen practice in healthcare: a qualitative analysis of hospital employees' suggestions for improvement", *BMJ Open*, Vol. 6 No. 7, pp. 1-8.

Melnyk, S.A., Calantone, R.J., Montabon, F.L. and Smith, R.T. (1998), "Short-term action in pursuit of LongTerm improvements: introducing kaizen events", *Production and Inventory Management Journal*, Vol. 39 No. 4, pp. 69-76.

Mickan, S.M. (2005), "Evaluating the effectiveness of health care teams", *Australian Health Review*, Vol. 29 No. 2, pp. 211-217.

Molleman, E. (2005), "The multilevel nature of team-based work research", *Team Performance Management*, Vol. 11 Nos 3/4, pp. 113-124.

Natale, J., Uppal, R. and Wang, S. (2014), "Improving kaizen event success in healthcare through shorter event duration", *International Journal of Collaborative Enterprise*, Vol. 4 Nos 1/2, pp. 3-16.

Pasmore, W. (1988), *Designing Effective Organizations: The Socio-Technical Systems Perspective*, Wiley, New York, NY.

Poksinska, B. (2010), "The current state of Lean implementation in health care: literature review", *Quality Management in Healthcare*, Vol. 19 No. 4, pp. 319-329.

Poksinska, B.B., Fialkowska-Filipek, M. and Engström, J. (2017), "Does Lean healthcare improve patient satisfaction? A mixed-method investigation into primary care", *BMJ Quality & Safety*, Vol. 27, pp. 95-103.

Rich, N. and Piercy, N. (2013), "Losing patients: a systems view on healthcare improvement", *Production Planning & Control*, Vol. 24 Nos 10-11, pp. 962-975.

Seddon, J. (2008), *Systems Thinking in the Public Sector*, Triarchy Press, Axminster, UK.

Senge, P. (1992), *The Fifth Discipline*, Doubleday, New York, NY.

Simon, R.W. and Canacari, E.G. (2012), "A practical guide to applying lean tools and management principles to health care improvement projects", *AORN Journal*, Vol. 95 No. 1, pp. 85-103.

Sobek, D.K. II and Smalley, A. (2008), *Understanding A3 Thinking: A Critical Component of Toyota's PDCA Management*, Taylor & Francis, New York, NY.

Sundstrom, E., McIntyre, M., Halfhill, T. and Richards, H. (2000), "Work groups: from the Hawthorne studies to work teams of the 1990s and beyond", *Group Dynamics: Theory, Research, and Practice*, Vol. 4 No. 1, pp. 44-67.

Tanco, M., Jaca, C., Viles, E., Mateo, R. and Santos, J. (2011), "Healthcare teamwork best practices: lessons for industry", *The TQM Journal*, Vol. 23 No. 6, pp. 598-610.

Vinokur-Kaplan, D. (1995), "Treatment teams that work (and those that don't): an application of Hackman's group effectiveness model to interdisciplinary teams in psychiatric hospitals", *Journal of Applied Behavioral Science*, Vol. 31 No. 3, pp. 303-327.

Wennecke, G. (2008), "Kaizen-Lean in a week: how to implement improvements in healthcare settings in a week", *Medical Laboratory Observer*, Vol. 40 No. 8, pp. 28-31.

West, M.A. (2012), *Effective Teamwork: Practical Lessons from Organizational Research*, 3rd ed., Blackwell, Oxford.

West, M.A. and Lyubovnikova, J. (2013), "Illusions of team working in health care", *Journal of Health Organization and Management*, Vol. 27 No. 1, pp. 134-142.

Womack, J.P. and Jones, D.T. (1996), *Lean Thinking*, Simon and Schuster, New York, NY.

Xu, L. and Zhang, W.J. (2001), "Comparison of different methods for variable selection", *Analytica Chimica Acta*, Vol. 446 No. 1, pp. 477-483.

Further reading

Fabiene, E.E. and Kachchhap, S.L. (2016), "Determinants of employee's commitment among healthcare professionals", *International Journal of Academic Research in Accounting, Finance and Management Sciences*, Vol. 6 No. 2, pp. 44-52.

Appendix

Scale and items	Content validity[a]	Measure	Value	Factor loadings
Team member's questionnaire				
Goal clarity (CR = 0.907; AVE = 0.711)				
Our team had clearly defined goals	West and Lyubovnikova (2013), Langabeer *et al.* (2009)	6-point Likert type	Team average for scale	0.936
The performance targets our team had to achieve to fulfil our goals were clear				0.859
Our goals clearly defined what was expected of our team				0.811
Our entire team understood our goals				0.756
Goal difficulty (CR = 0.780; AVE = 0.651)				
Our team's improvement goals were difficult	West and Lyubovnikova (2013)	6-point Likert type	Team average for scale	–
Meeting our team's improvement goals was tough				0.967
It took a lot of skill to achieve our team's improvement goal				0.605
Team autonomy (CR = 0.868; AVE = 0.630)				
Our team had a lot of freedom in determining what changes to make to this work area	Bahensky *et al.* (2005), Drotz and Poksinska (2014)	6-point Likert type	Team average for scale	0.835
Our team had a lot of freedom in determining how to improve this work area				0.917
Our team was free to make changes to the work area as soon as we thought of them				0.832
Our team had a lot of freedom in determining how we spent our time during the event.				0.537
Management support (CR = 0.770; AVE = 0.538)				
Our team had enough contact with management to get our work done	Dickson *et al.* (2009)	6-point Likert type	Team average for scale	0.854
Our team had enough materials and supplies to get our work done				0.795
Our team had enough equipment to get our work done				–
Our team had enough help from our facilitator to get our work done				–
Our team had enough help from others in our organisation to get our work done				0.504
Affective commitment to change (CR = 0.898; AVE = 0.639)				
In general, members of our team believed in the value of this continuous improvement initiative	Herscovitch and Meyer (2002), Laureani *et al.* (2013)	6-point Likert type	Team average for scale	0.755
In general, members of our team thought that it was a mistake to hold this continuous improvement initiative (REVERSE)				–
Most of our team members thought that this continuous improvement initiative was a good strategy for this work area				0.825
Most of our team members thought that this continuous improvement initiative would have served an important purpose				0.866
Most of our team members thought that things would have been better with this continuous improvement initiative				0.800
In general, members of our team believed that this continuous improvement initiative was needed				0.744
Internal processes (CR = 0.933; AVE = 0.737)				

Table AI.
Summary of scales of questionnaires

(*continued*)

Scale and items	Content validity[a]	Measure	Value	Factor loadings
Our team communicated openly	West and Lyubovnikova (2013), Ghosh and Sobek II (2015)	6-point Likert type	Team average for scale	0.838
Our team valued each member's unique contributions				0.892
Our team respected each other's opinions				0.869
Our team respected each other's' feelings				0.877
Our team valued the diversity in our team members				0.813
Action orientation (CR = 0.591; AVE = 0.327)				
Our team spent as much time as possible in the work area	Jimmerson *et al.* (2005)	6-point Likert type	Team average for scale	0.634
Our team spent very little time in our meeting room				0.505
Our team tried out changes to the work area right after we thought of them				0.569
Our team spent a lot of time discussing ideas before trying them out in the work area				–
Kaizen capabilities (CR = 0.942; AVE = 0.702)				
Overall, this continuous improvement initiative increased our team members' knowledge of what continuous improvement is	Poksinska (2010), Mazzocato *et al.* (2010)	6-point Likert type	Team average for scale	0.923
In general, this continuous improvement initiative increased our team members' knowledge of how continuous improvement can be applied				0.758
In general, this continuous improvement initiative increased our team members' knowledge of our role in continuous improvement				0.778
In general, this continuous improvement initiative motivated the members of our team to perform better				0.754
Most of our team members could communicate new ideas about improvements as consequence of participation in this continuous improvement initiative				0.880
Most of our team members gained new skills as consequence of participation in this continuous improvement initiative				0.870
Overall, this continuous improvement initiative increased our team members' knowledge of the need for continuous improvement				0.883
Overall, this continuous improvement initiative increased our team members' interest in our work				–
Attitude (CR = 0.878; AVE = 0.707)				
Most of our team members liked being part of this continuous improvement initiative	Lee and Bruvold (2003), Poksinska (2010)	6-point Likert type	Team average for scale	0.912
Most members of our team liked to be part of continuous improvement initiatives in the future				0.859
In general, our continuous improvement initiative team members were comfortable working with others to identify improvements in this work area				0.743
Team kaizen experience				
Including this initiative, how many continuous improvement initiatives in total had you participated in until this initiative?	Mickan (2005)	Continuous	Log transformed	

(*continued*)

Table AI.

Scale and items	Content validity[a]	Measure	Value	Factor loadings
Facilitator's questionnaire				
Work area routineness (CR = 0.850; AVE = 0.657)				
The work the target work area did was routine	Ballé and Régnier (2007), Mazzocato *et al.* (2010)	6-point Likert type	Team average for scale	0.705
The target work area provided the same service most of the time				0.769
A given service required the same processing steps each time it was provided				0.939
Tool appropriateness				
(Respondents first listed the problem-solving tools used by the team). For each tool, please rate the team's use of the tool on appropriateness of using this tool to address the team's goals	Ghosh and Sobek II (2015), Jimmerson *et al.* (2005)	6-point Likert type	Team average of the average rating for each tool listed	
Tool quality				
(Uses the same tool list above.) For each tool, please rate the quality of the team's use of this tool				
Initiative planning process				
How many hours did you spend to plan the continuous improvement initiative?	Dickson *et al.* (2009)	Continuous	Log transformed	
Team functional heterogeneity				
Please fill-in the number of continuous improvement initiative team members in each job category (choices: physician, nurse, technician, other)	Mazzocato *et al.* (2010), Lemieux-Charles and McGuire (2006)	Continuous	$\sum_i p_i(\log\ 1/p_i)$ where p_i is the proportion of team members from each functional category	
Team leader experience				
Including this initiative, how many continuous improvement initiatives had the team leader conducted in the past three years? (up to the initiative)	Mickan (2005)	Continuous	Log transformed	

Table AI.

Notes: Italics represent items dropped because their factor loadings were lower than 0.500. [a]This column reports studies in healthcare which support the content validity of constructs

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