The relevance of intervention participants' process appraisal for change in well-being and lean work processes of entire teams

Aggravated by an ageing population with increasing healthcare demands and ever more costly technology, healthcare organisations are under strong economic pressure (Graban 2012). At the same time, healthcare organisations rely on a healthy workforce to ensure a high quality service (Pelikan et al. 2001). These goals of high efficiency, productivity and quality of service on the one hand, and employee well-being on the other hand, do not need to be conflicting interests, and could therefore be incorporated into a joint initiative (Graban 2012; Stenfors-Hayes et al. 2014). Lean management is an approach that aims to enhance the efficiency, productivity and quality of an organisation by improving work processes to reduce 'waste' (Womack & Jones 1996). Waste is considered as any human activity, which absorbs resources but creates no value from a customer's perspective (Womack & Jones 1996). Examples for waste are overproduction, waiting time caused by upstream activities not delivered on time, or processing steps that are not really needed. While lean management is widespread in other work sectors such as manufacturing, it is gradually being adopted by healthcare organisations to improve effectiveness while ensuring high quality (Stenfors-Hayes et al. 2014). Existing studies on lean implementation mainly investigated its effects on organisational performance, but empirical evidence regarding its effects on employees' well-being is scarce and contradictory (Hasle et al. 2012; Ulhassan et al. 2014). Stenfors-Hayes et al. (2014) have thus recommended combining the classic lean management approach with an employee well-being perspective. This study followed their recommendation by examining a lean implementation approach considering employees' well-being, which was implemented within 29 nursing wards of a Swiss university hospital.

This expanded lean implementation approach was based on so-called Kaizen (Japanese for 'improvement') or Rapid Process Improvement workshops (e.g. Nelson-

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Peterson & Leppa 2007). The scope of the lean workshops was supplemented by one session explicitly devoted to the participatory analysis and improvement of employees' working conditions and well-being based on a survey-feedback method. Hence, the workshops aimed to not only improve working conditions by developing leaner work processes, but also to enhance employees' well-being. As is often the case in organisational health interventions, the workshops were conducted with employee representatives in all nursing wards, meaning that team representatives – instead of whole teams – participated in workshops and developed action plans that aimed to improve working conditions and health of their teams (Egan et al. 2007; Bergerman et al. 2009; Nielsen et al. 2010). The goal of such organisational health interventions is to generate a positive effect on the work situations and well-being of all team members, irrespective of whether they directly participated in the workshops. Intervention workshops should thus be designed and implemented in a way that triggers a collective dynamic and allows for crossover effects between workshop participants and all other team members. Outputs of such workshops, such as action plans, have to be implemented afterwards by all team members. The chance for successful implementation of such action plans is presumably higher when different perspectives are considered during the development phase, if the plans are well elaborated and expected to have an effect by those who developed them.

Although the lean workshops implemented in the context of this study follow a standardised format, they were not assumed to have the same effect on all nursing teams, as different nursing wards differed in their context and process factors. Context and process factors have been shown to influence the effectiveness of an intervention (Fridrich et al. 2015; Nielsen & Randall 2013; Nielsen & Abildgaard 2013; Biron 2012). With regard to process factors, for example, action plans developed by workshop participants vary in topics addressed and also in their quality.

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This study investigated which characteristics of a lean implementation process are critical to enable a collective dynamic and crossover effects from participants involved in the intervention to all team members. Specifically, the study examined the relevance of three characteristics of a lean implementation process for leaner work processes and affective well-being in nursing teams. The implementation process is defined as 'the time-limited enactment of all steps and elements of the original intervention plan' (Fridrich et al. 2015, p.4). In the following, the three characteristics of the implementation process examined in this study, namely workshop quality appraisal, outcome expectancy and participation rate on team-level, are described. Further, we hypothesise why these characteristics were assumed to relate to leaner work processes and change in well-being in entire teams. For all three process factors, we hypothesized collective dynamics triggered by these, which in turn are supposed to lead to alterations in entire teams' lean work processes and well-being (Fridrich et al. 2015; Karanika-Murray & Biron 2013). This change process triggered by the implementation of lean workshops is difficult to observe directly. Thus, this study worked with an indirect measurement of the effects of the change process by measuring the intended outcomes of the intervention. Figure 1 gives an overview of the conceptual research model with observed implementation process predictor variables, hypothetical – because unobserved – change process mechanisms, and observed team outcome variables.

[Insert Figure 1 about here]

Implementation process factors: Workshop quality appraisal, outcome expectancy, participation rate on team-level

Workshop quality appraisal. The perceived quality of an intervention element has proven to be an important factor in process evaluation (Fridrich et al. 2015; Nielsen et al. 2007). Fridrich et al. (2016a) identified five important facets for the process appraisal of intervention elements: valence, complexity, novelty, relevance and involvement. *Valence*

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refers to the affective appraisal of an intervention element, *complexity* refers to the level of comprehensibility of an intervention element, *novelty* refers to the innovative content being conveyed and *relevance* refers to whether people perceive the contents as relevant and valuable for themselves. Finally, *involvement* refers to the extent to which an individual experiences activation, the possibility to participate and to put forward their own experiences, opinions and needs. The more favourable an appraisal of an intervention element, the greater the likelihood of positive work-stress-related and well-being outcomes (Murta et al. 2007; Daniels 2011). Moreover, a positive appraisal of workshop quality affects satisfaction with workshop outputs, which in turn influences outcome expectancy (Fridrich et al. 2016a). While a positive appraisal of the intervention element quality yielded positive outcomes in the participants directly involved in the intervention element, no studies have examined the effects on entire teams, including those team members not directly involved in, for example, developing the action plans.

Another important process appraisal factor is *outcome expectancy*, which is 'the anticipation of a positive or negative experience resulting from a given event or behavior' (Fridrich et al. 2016b, p.4). Bandura's (2004) social-cognitive theory describes outcome expectancy as one of its key elements, and all of the prominent theories of health behaviour change use it as a key determinant to explain human behaviour (Schwarzer 2008; Prochaska & Velicer 1997; Ajzen 1991).

In contrast to workshop quality appraisal, outcome expectancy has an explicit focus on future behaviour. Outcome expectancies involve a future-oriented reality check, whereby workshop contents and outputs are evaluated against their chances of realisation, considering possible obstacles, and the chances of creating positive effects. On the contrary, workshop quality is a multifaceted construct, which evaluates more the actual workshop and less the outcomes of the workshop itself, such as the successful implementation of the action plans.

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Thus, it is a rather past-oriented measure. Additionally, while the workshop atmosphere and thus the quality appraisal can be very positive, this positive energy is not always transferred to the implementation phase or spread to the team members who were not involved in the workshops. Thus, outcome expectancy is an important process factor worth examining, independent of workshop quality appraisal.

Existing research supports the importance of outcome expectancies on individual-level outcomes. In the context of organisational research, outcome expectancies were, for example, positively associated with perceived impacts of a stress management intervention (Fridrich et al. 2016b). Outcome expectancies have also been shown to influence the willingness to support an activity (Feather & Newton 1982; Feather et al. 2012). While there is sufficient evidence for the importance of outcome expectancy for individual outcomes, there is no study, which examined the effects on entire teams, including team members who do not participate in intervention workshop activities.

For both implementation process factors – workshop quality appraisal and outcome expectancy – it is hypothesised that participants with a positive quality appraisal and a high outcome expectancy act as facilitators and motivators when they return to their teams (Karanika-Murray & Biron 2013). Action plans developed in these workshops then need to be implemented by all team members to successfully result in the intended changes in lean work processes and employee well-being. We assumed that this implementation of action plans is more likely to succeed if the team members involved in their development motivate their colleagues and support a joint implementation because they believe in the positive effects. Additionally, a positive attitude towards the intervention project and the developed action plans might directly affect team members' well-being. The positive attitude and motivation stemming from the opportunity to participate in changing one's work processes and characteristics can crossover to all team members and result in a more positive attitude and

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enhanced affective well-being of the entire team (Bakker et al. 2009; Westman 2001; Karanika-Murray & Biron 2013). In other words, workshop participants' emotions from the workshop can spread to team members and directly affect their well-being at work. Depending on the appraisal of workshop quality and the associated outcome expectancy, workshop participants return to their team environment with a more or less positive or negative mood and energy related to the lean implementation project. Contagion theory of emotions explains how emotions linked to positive or negative events at work can spread to work colleagues (Bakker et al. 2009). If the participant appraises the workshop very positively and has high expectancies of its effects, we assumed that the associated positive energy from the workshop activities will spread from the active participants to all members of their team and lead to enhanced affective well-being, and vice versa.

In addition to the above explicated hypothesised change process mechanisms, it is assumed that a positive outcome expectancy is an indicator of relevant and realistic action plans with a high likelihood for successful implementation in teams, which in turn influences positive change in lean work processes and well-being in teams.

The abovementioned considerations about the unobserved change process triggered by participants' workshop quality appraisal and outcome expectancy led to the following observable hypotheses:

Hypothesis 1: A high workshop quality perceived by the directly-involved participants is associated with (a) leaner work processes and (b) enhanced affective well-being of team members.

Hypothesis 2: A high outcome expectancy of the workshop participants is associated with (a) leaner work processes and (b) enhanced affective well-being of team members.

Another implementation process indicator that has often been reported as a side remark, but less often integrated in the evaluation analysis, is the *participation rate on team-*

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level (e.g. Füllemann et al. 2015). Participation rate is the relative number of team members directly involved in the workshops and the development of action plans compared to the total number of team members. Participation rate at the team level is expected to moderate the effects of workshop quality and outcome expectancy on changes in lean work processes and the well-being of entire teams, as hypothesised above. The greater the proportion of people actively participating and involved in a change process, the more change energy can be mobilised through the diffusion of ideas, beliefs, emotional states and behaviours and through interpersonal influences (Füllemann et al. 2015; Karanika-Murray & Biron 2013). The more people in a team that are positively affected by the workshop and convinced about its positive outcomes, the more people potentially act as facilitators in spreading the ideas and promoting the action plans developed in the workshops. This enhances the chance that the action plans are successfully implemented by the entire team, thus affecting positive change of lean work processes and affective well-being. Related to the argument about the relative number of facilitators who can spread the ideas and promote the developed action plans is the possibility of contagion of emotions (Bakker et al. 2009). The chance of emotional contagion is higher in the case of a high participation rate. Thus, depending on the perception of the workshop and its potential effects, a high participation rate boosts the effects on team members' affective well-being at work. Taken together, the two arguments of more facilitators and the contagion of emotions linked with a high participation rate led to the following two hypotheses:

Hypothesis 3: Participation rate at the team level interacts with workshop quality appraisal; as such, the relationships between workshop quality and (a) leaner work processes and (b) change in affective well-being of team members, respectively, are stronger when the participation rate is high.

Hypothesis 4: Participation rate at the team level interacts with outcome expectancy; as such, the relationships between outcome expectancy and (a) leaner work processes and (b)

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change in affective well-being of team members, respectively, are stronger when the participation rate is high.

Method

Study design and data collection

We collected data within a lean implementation project of medical/nursing wards of a university hospital in the German-speaking part of Switzerland. The main element of the project was a four-day lean workshop (see 'Lean workshops' below), which was implemented step-wise in 29 nursing wards between May 2013 and December 2014. The four workshop days were spread out over four to six weeks. To evaluate the overall changes induced by the lean workshops, an *online employee survey* was applied at two time points, one at pre-intervention (t1) and one at a six-month follow-up in each ward (t2). The workshops started four to six weeks after the first online survey. All employees of the wards were invited to participate in the online surveys voluntarily. The survey covered working conditions and employee well-being. The response rates to the online employee surveys were 57% at t1 and 59% at t2.

The second part of the data collection consisted of a *paper-pencil process evaluation questionnaire* which was distributed to the workshop participants after the second and the fourth workshop day. The questionnaire covered workshop quality appraisal and outcome expectancies. To link the online survey and paper-pencil questionnaire data, the study participants were asked to generate an anonymous identification code. This study used data from the first evaluation questionnaire after the second workshop day because at this point, most of the content inputs were delivered and action plans developed. After the second workshop day, the workshop participants returned to their teams and started implementing the developed action plans. Day three and four of the workshops served predominantly to monitor and reflect on the implementation process and readjust action plans. While day one and two of

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the workshops were mostly held on two consecutive days or held within a short time, days three and four varied more and usually spanned a longer period to allow time to implement the action plans.

Lean workshops

In order to implement the lean strategies within medical/nursing wards, the university hospital conducted adapted rapid process improvement workshops – in short *lean workshops* – at each ward sequentially. The main goal of these lean workshops was to identify the best mix of skills and grades per nursing ward, thereby applying the lean principles of identifying value, mapping the value stream, creating flow, establishing pull within and between nursing wards, and seeking perfection (Womack & Jones 1996). Additionally, the project explicitly focused on improving the inter-professional collaboration between nursing and medical staff along the lean principles.

The hospital's internal project managers implemented the four standardised workshop days within four to six weeks at each nursing ward. The participants were representatives of the respective wards and all supervisors. The workshops took place at the internal training centre of the hospital, and site visits for so-called Gembas (gemba is a Japanese term for 'the real place') were implemented to observe movement of employees, waste and disorder. During the workshop sessions, the participants and internal process managers analysed the results of the Gembas and discussed current and future targeted value-added processes and (inter-professional) collaboration within the team. Next, the participants created several action plans to optimise the value-added processes and inter-professional collaboration (see Table 1). During the second workshop day, the workshop participants developed additional action plans to simultaneously improve the team climate, working conditions and well-being among the employees of the nursing wards. Using a survey feedback method based on representative survey data, the workshop participants could build on the teams' results of the pre-

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intervention employee surveys to prioritise the key working conditions that needed to be improved, e.g. job control, workload or supervisor behaviour.

[Insert Table 1 about here]

Study participants

Workshop participants. In total, n = 180 employees participated in the workshops, which corresponds to 20% of all nurses in the involved wards. The number of workshop participants ranged from three to thirteen, giving an average of six participants. All workshop participants (n = 180) completed the workshop evaluation questionnaires at the end of the second workshop day, resulting in a response rate of 100%.

Employee survey participants. All employees working in the 29 nursing wards were invited to participate in the online employee surveys (N = 918 nurses). However, only those participants who had completed the survey before and after the workshop implementation were included in the study sample. The final study sample consisted of n = 203 nurses from 29 nursing wards. Of the participants, 85.2% were female, the average age was 36.20 years (SD = 11.28), and 10.7% of the participants were ward managers.

Measures

Outcome Measures

Lean work processes were measured using a retrospective impact assessment scale consisting of three items that measured the intervention impact on lean work processes perceived by all employees from a retrospective viewpoint (cf. Jenny et al. 2015; Fridrich et al. 2016b). To introduce the scale, employees were shortly reminded of the activities of the intervention and then asked to rate the overall perceived impact of the entire intervention in their nursing ward. A sample item is, “Did the activities of the lean implementation project lead to less waste of material?” The items were rated on a seven-point Likert scale ranging from 1 (*no, not at all*) to 7 (*yes, very much*). Participants rated the items at the follow-up

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measurement point. The lean work processes scale showed a good internal consistency with Cronbach's $\alpha = .81$.

Affective well-being at work was operationalised by two scales measuring positive and negative activation at work (Tellegen et al. 1999; Watson et al. 1999; Schallberger 2005; Warr 1990). We used four items of the PANAVA-scale developed by Schallberger (2005) to measure the *positive activation* of individuals and adapted them to the work context. The PANAVA scale consists of ten opposite adjective pairs measuring the three subfactors of valence, positive activation and negative activation. Participants indicated on a seven-point continuum for each adjective pair which adjective corresponded best with their feelings during the previous weeks at work. The four adjective pairs measuring positive activation were energetic/drowsy, active/sleepy, enthusiastic/sluggish and excited/dull. The subscale for positive activation showed good internal consistencies at both measurement points (t1: $\alpha = .82$; t2: $\alpha = .82$). We also used four items of the PANAVA-scale developed by Schallberger (2005) to measure the *negative activation* of individuals and adapted them to the work context. The four adjective pairs measuring negative activation were distressed/at rest, angry/placid, nervous/calm and fearful/relaxed. The subscale for negative activation showed good internal consistencies at both measurement points (t1: $\alpha = .80$; t2: $\alpha = .81$). To assess change over time in affective well-being, we used difference scores between the measures before and after workshop implementation. The adequacy of difference scores to measure individual change over time is subject to a persisting debate (e.g. Allison 1990; Rogosa 1995; Cronbach & Furby 1970). The critiques of difference scores mainly focused on concerns with their reliability. In choosing our approach to measure change over time we refer to Rogosa (1995), who states that the difference score approach is a reliable measure of change if individual differences in true change exist. This means, that in the case of moderate correlations between pre- and post-intervention measures and similar variances across time, the difference score is

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as reliable as the pre- and post-intervention measures themselves (Rogosa 1995). The correlations of the study variables and their standard deviations shown in Table 2 indicate that the use of difference scores is justified.

Process Measures

Workshop quality appraisal. The workshop quality appraisal was measured using a ten-item scale developed by Fridrich, Jenny and Bauer (2016a). The scale consists of ten opposite adjective pairs covering the five facets of complexity, relevance, novelty, valence and involvement. The workshop participants were asked to indicate their perceptions of the workshop on a seven-point continuum for each adjective pair. Sample adjective pairs are comprehensible/incomprehensible and relevant/irrelevant. The workshop quality appraisal scale showed a satisfactory internal consistency of Cronbach's $\alpha = .76$.

Outcome expectancy. Outcome expectancies were measured using three items that captured whether the workshop participants expected the workshops including developed action plans to trigger positive changes in their personal working conditions, their team and the work processes within the team (Fridrich et al. 2016b). A sample item is, "Do you think the workshop will have a positive effect on your work?" The outcome expectancy items were rated on a seven-point Likert scale ranging from 1 (*no, not at all*) to 7 (*yes, very much*) and showed a good internal consistency of Cronbach's $\alpha = .80$.

Participation rate in workshops. We defined the team-level participation rate in workshops as the proportion of team members that participated in the workshop. That means the absolute number of workshop participants of a team was divided by the absolute number of team members at the time of workshop implementation. Team size is commonly used as a covariate at the team level in multilevel studies. Because of its high correlation with participation rate, $r = -.67$, the analyses were not controlled for team size in this study.

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Data Analyses

The hypotheses were tested by multilevel analyses using the mixed procedure in IBM SPSS version 19. Model fits were estimated using the maximum likelihood (ML) method. We assessed the intra-class correlation coefficient ICC(1) to identify the proportion of the variance explained by the grouping structure of the data. An ICC(1) of 1%, 10% or 25% indicates a small, medium or large effect of the group context, respectively (LeBreton & Senter 2008). Further, we calculated the ICC(2), which indicates the reliability of the group mean (Bliese 2000), and the James, Demaree and Wolf (1984) mean $r_{WG(J)}$ agreement index, which indicates within-group agreement in the corresponding measures (Chen et al. 2004).

All variables with no meaningful zero point were centred according to the recommendations of Enders and Tofighi (2007). Individual level variables were centred at the group mean, whereas group level variables were centred at the grand mean. To test the hypotheses, we first estimated a model without explanatory variables (intercept-only model). In steps 2 to 4, the three predictor variables on the team level, namely workshop quality, outcome expectancy and participation rate, were included in a step-wise manner. The fifth step consisted of adding the interactions of participation rate with workshop quality and outcome expectancy, respectively. Besides deviance, we used the Akaike (AIC) and Bayesian (BIC) information criterion indices to test the model fit, because the latter two also work for comparing non-nested models. For all three indices, smaller values indicate a better fit of the model to the data.

Results

Descriptive statistics and aggregation analysis

Table 2 displays the means, standard deviations, scale reliabilities and Pearson correlation coefficients of the individual level variables, while Table 3 reports the means, standard deviations, values of ICC(1) and ICC(2), the mean $r_{WG(J)}$ values and the Pearson

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correlation coefficients of the study variables at the team level. The ICC(1) values showed that between 13% and 14% of the variance in the three outcome variables depended on team membership, representing a medium effect of the grouping structure. The data thus confirmed a multilevel structure and indicated multilevel analyses. The aggregated team-level predictor variables of workshop quality and outcome expectancy showed a moderate reliability of the team means according to the ICC(2) values and a strong agreement within teams according to the mean $r_{WG(J)}$ values (see Table 3).

[Insert Tables 2 and 3 about here]

Multilevel analyses and hypotheses testing

Workshop quality (H1a* and *H1b)

Workshop quality did not significantly relate to leaner work processes (see Table 4). Although Step 2 in Table 4 indicates a significant contribution of workshop quality in explaining variance of lean work processes, this contribution became insignificant when outcome expectancy was added to the model in Step 3. However, workshop quality related to change in affective well-being (see Table 5 for positive activation and Table 6 for negative activation). Step 3 in Table 5 shows that workshop quality was associated with enhanced positive activation of entire teams over time. Similarly, Step 3 in Table 6 indicates that workshop quality related to a reduction of negative activation in entire teams over time. With regard to the non-significant relationship of workshop quality with change in lean work processes, *Hypothesis 1a* was not supported. Regarding the significant relationship of workshop quality with change in affective well-being at work, *Hypothesis 1b* was supported.

Outcome expectancy (H2a* and *H2b)

Outcome expectancy of workshop participants significantly related to leaner work processes as perceived by the entire team (see Step 3 in Table 4). However, outcome expectancy was not associated with change in positive and negative activation of entire teams

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(Tables 5 and 6). Thus, with regard to the significant relationships of outcome expectancy with leaner work processes, *Hypothesis 2a* was supported. Concerning the non-significant relationships of outcome expectancy with affective well-being, *Hypothesis 2b* was not supported.

[Insert Tables 4, 5 and 6 about here]

Interaction of participation rate and workshop quality (H3a* and *H3b)

Concerning the hypothesised interaction effect of participation rate and workshop quality on the outcomes leaner work processes and change in affective well-being of teams, Step 5 in Tables 4, 5 and 6 indicate no support for the assumptions. The data therefore failed to support *Hypotheses 3a* and *3b*.

Interaction of participation rate and outcome expectancy (H4a* and *H4b)

Concerning the hypothesised interaction effect of the participation rate and outcome expectancy on the outcomes of leaner work processes and change in affective well-being, Step 5 Tables 4, 5 and 6 yielded no moderation effect of participation rate and thus did not support *Hypotheses 4a* and *4b*.

Discussion

What characteristics of a lean implementation process are critical to enable a collective dynamic and crossover effects from participants involved in the intervention to all team members? The present study investigated this research question by examining whether the process factors of workshop quality and outcome expectancy, as well as their interactions with participation rate, explained positive change in lean work processes and affective well-being of entire teams.

The results of the study yielded different patterns for workshop quality appraisal and outcome expectancy. Workshop quality, appraised by the team representatives who participated in the workshop, related to enhanced affective well-being in entire teams, but did

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not relate to leaner work processes. By contrast, outcome expectancy was associated with leaner work processes, but not associated with change in affective well-being in teams. How can this differential pattern of results be explained? It could be said that workshop quality is a better predictor of affective well-being outcomes than the more factual outcome of leaner work processes. Returning to the hypothesised nature of collective dynamics triggered by high workshop quality, outlined in the introduction, this result indicates the more direct contagion effect of the positive attitude of workshop participants towards the lean implementation and developed action plans. This positive attitude and motivation associated with the chance to participate in changing work processes for the better has seemingly crossed over to all team members, resulting in enhanced affective well-being at work. Workshop quality appraisal can thus be considered less important for the successful implementation of action plans and leaner work processes in teams. The study results highlight the difference between the two process appraisal factors, outcome expectancy and workshop quality; that is, evaluating one's expectations of the outcomes of lean implementation involves an evaluation of the chances of realising the workshops' outputs. In the case of high outcome expectancy, the workshop participants are convinced about the realisation of the developed action plans and their positive outcomes. This makes them motivate their team members by convincing them of the advantages of the plans and encouraging them to consequently engage in their realisation. This in turn leads to leaner work processes in teams, but does not affect team members' emotional well-being. To summarise, different aspects of the lean implementation process related to different aspects of the intended outcomes of the lean implementation. The more holistic appraisal of workshop quality was associated with change in emotional well-being at work, whereas the more realistic appraisal of outcome expectancy was associated with leaner work processes.

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The hypothesised interaction effects of the participation rate and the two process factors – workshop quality and outcome expectancy – were not supported in the present study. We suggested that a larger proportion of team members participating in the workshops and developing action plans would increase the change energy in the case of high quality workshops and outcome expectancies. Two arguments help to explain why these moderation effects could not be supported in the present study. First, the objects of research were nursing teams, which comprised different professional groups. The protocol for the selection of workshop participants requested at least one representative from each professional group. This requirement might have been sufficient to ensure that all the important perspectives were included in the development of meaningful action plans. Thus, the representativeness of all professional groups, rather than the quantity of representatives, might have ensured a successful implementation of the action plans. Second, the result of the moderation analyses should be interpreted with caution in light of the relatively small range of workshop quality and outcome expectancy results, with a variability of 1.5 and 2 points on a scale ranging from 1–7. The high mean levels and the relatively small range imply that overall workshop participants ascribed the workshops a high quality and had high outcome expectancies. Interaction effects are difficult to detect in the case of small variability in the variables of interest. Hence, it still seems possible to find an interaction between participation rate with workshop quality and outcome expectancy if more variation exists in these process factors. Future research is therefore recommended in this regard. However, in practice, organisations are interested in consistently providing high quality intervention components. These range restrictions reflect the organisational reality and the results can thus be generalised in this regard.

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Study Limitations and Directions for Future Research

The study has several limitations that should be considered when generalising the conclusions. First, the lean workshops, including the implementation of the developed action plans, are one of many influencers of well-being in teams. Such contextual influences could not be controlled for in the present study, but are part of the natural environment in which the study interfered. Aspects of the context in the underlying skill-grade-mix project have been analysed and reported elsewhere, using retrospectively assessed qualitative data from focus groups (Inauen et al. 2016). Moreover, data on the implementation process of an intervention per se can only be obtained from intervention-involved teams. Thus, control groups would not provide meaningful data for the purpose of the present study. More evidence is therefore needed not only from the same context but also from other organisational and sectorial contexts to generalise the conclusion drawn from the present study. As this study was not designed to directly observe the mechanisms of the change process as depicted in Figure 1, future studies could focus explicitly on detecting if and how affective, motivational contagion processes take place among team members, how action plans are rated by team members and how this is related to their process of implementation.

A second limitation concerns the possibility of common method bias related to the operationalisation of the variables of interest (Podsakoff et al. 2012). The scales used to measure workshop quality and affective well-being at work are operationalised using the same item characteristics, namely opposite adjective pairs. The same is true for outcome expectancy and lean work processes, which use a similar operationalisation method. What counteracts this potential method bias is that the process appraisal scales and the outcomes, namely lean work processes and affective well-being, were measured at different time points with a time lag of four to five months, and the participants differed in both data collections. Data for the implementation process appraisal were obtained from the representatives who

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participated in the lean workshops, whereas the outcome indicators were obtained from all team members, including those who were not directly involved in the workshops. These two procedural remedies – obtaining measures from different sources and the temporal delay of measurements – minimise common method bias (Podsakoff et al. 2012). Nonetheless, future studies could use research scales with different properties to investigate the relationships found in this study. Moreover, future studies could be designed to also include the patient perspective as an outcome measure, e.g. patient waiting time or satisfaction with services.

Conclusion and Implications

The initial question of this study asked whether intervention participants' process appraisals relate to change in lean work processes and affective well-being of entire teams. The results of this study affirmed this question, as high workshop quality led to increased affective well-being, whereas high outcome expectancy led to leaner work processes in teams. Thus, both process appraisal factors are appropriate indicators to be monitored and optimised during the implementation of lean workshops to ensure positive results for entire teams. In practice, we suggest assessing the participants' process appraisal in the early stage of implementing the workshops. If indicated, adaptations could be made to the workshop contents and formats for the subsequent implementation of workshops to optimise their effectiveness concerning both, leaner work processes and employee well-being.

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Table 1

Topics and contents of the four-day skills-grades-mix workshops implemented in nursing wards

Topics	Contents
Day 1: Laying the foundations: Analysis of current value stream	Gemba: Analysing current value stream, process steps and covered distance, and identifying general waste. Analysing interactions between employees, defining fields of action and formulating concrete action plans to be implemented
Day 2: Concreting the target process	Presenting and discussing employee survey results on psychosocial working conditions, team climate, employee well-being and work life balance. Defining fields of action. Formulating concrete action plans to be implemented. Introducing the hospital's overall lean strategy: lean game. Planning upcoming implementation of action plans.
Day 3: Implementation	Developing target skills-grades profiles specific to each ward. Developing or validating checklists. Evaluating first implementations of action plans. Adapting action plans.
Day 4: Implementation and evaluation	Developing detailed target value stream based on developed skills-grades profiles. Performing quality audits of project and action plans. Visiting site of implemented action plans.

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Table 2

Means, standard deviations, scale reliabilities (Cronbach's α) and correlations of the study variables at the individual level (N = 203)

Variables at individual level	*M*	*SD*	α	1	2	3	4	5	6
1. Positive Activation t1	4.80	1.06	.82						
2. Positive Activation t2	4.77	1.02	.82	.58***					
3. Δ Positive Activation	-0.02	0.95	.64	-.49***	.43***				
4. Negative Activation t1	3.37	1.18	.80	-.68***	-.47***	.24***			
5. Negative Activation t2	3.32	1.12	.81	-.39***	-.69***	-.30***	.48***		
6. Δ Negative Activation	-0.06	1.17	.72	.30***	-.18*	-.53***	-.55***	.47***	
7. RIAL	3.45	1.51	.81	.06	.20**	.16*	-.05	-.28***	-.22**

Note. Δ = Difference Scores between t2 and t1. RIAL = Retrospective Impact Assessment Concerning Lean Work Processes. Pearson correlation coefficients are reported. *$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed).

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Table 3

Means, standard deviations, intra-class correlation and correlations of the study variables at the team-level (N = 29)

Variables at team level	*M*	*SD*	ICC(1)	ICC(2)	mean $r_{WG(J)}$	1	2	3	4	5	6	7	8	9
1. Positive Activation t1	4.66	0.72	.16	.58	.46									
2. Positive Activation t2	4.73	0.55	.10	.44	.51	.56**								
3. Δ Positive Activation	0.07	0.61	.14	.53	.44	-.67***	.23							
4. Negative Activation t1	3.53	0.69	.12	.48	.24	-.81***	-.46*	.53**						
5. Negative Activation t2	3.38	0.56	.06	.29	.35	-.47*	-.64***	-.02	.47*					
6. Δ Negative Activation	-0.15	0.64	.14	.53	.24	.45*	-.07	-.58**	-.64***	.37*				
7. RIAL	3.42	0.84	.13	.49	.19	.05	.12	.05	.07	-.20	-.26			
8. Participation Rate	.21	0.07	–	–	–	.17	.18	-.05	-.17	-.25	-.03	.21		
9. Workshop Quality	6.10	0.40	.37	.60	.78	-.33	.08	.45*	.43*	-.05	-.49**	.27	.02	
10. Outcome Expectancy	5.75	0.45	.37	.61	.77	-.00	.19	.16	.14	-.06	-.20	.47**	.14	.58**

Note. Δ = Difference Scores between t2 and t1; RIAL = Retrospective Impact Assessment Concerning Lean Work Processes; ICC(1) = intra-class correlation coefficient 1; ICC(2) = intra-class correlation coefficient 2; mean $r_{WG(J)}$ = mean within-group agreement coefficient. Pearson correlation coefficients are reported.
*$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed).

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Table 4

Multilevel analysis for changes in lean work processes (RIAL)

	Step 1		Step 2		Step 3		Step 4		Step 5	
Variable	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*
Fixed effects										
Intercept	3.45 (.15)	23.77***	3.42 (.12)	28.50***	3.43 (.11)	30.43***	3.43 (.10)	33.38***	3.41 (.11)	29.76***
Workshop quality (WQ)			0.96 (.30)	3.21**	0.47 (.36)	1.31	0.45 (.33)	1.37	0.53 (.36)	1.47
Outcome expectancy (OE)					0.72 (.33)	2.22*	0.62 (.31)	2.00*	0.56 (.33)	1.71†
Participation rate (PR)							2.26 (1.38)	1.64	2.83 (1.75)	1.61
WQ x PR									2.13 (5.42)	0.39
OE x PR									0.20 (5.77)	0.06
Random effects (variance)										
τ_{00} (group)	0.263		0.089		0.051		0.003		0.003	
σ^2 (residual)	1.985		2.010		1.989		2.009		2.006	
Model fit parameters										
Deviance	690.23		682.56		677.83		675.61		675.30	
AIC	696.23		690.56		687.83		687.61		691.30	
BIC	705.99		703.57		704.10		707.13		717.32	

Note. AIC = Akaike information criterion; BIC = Bayesian information criterion.
[a] PE = Unstandardised parameter estimate with standard error in brackets.
*$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed).
†$p < .10$.

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Table 5

Multilevel analysis for changes in positive activation at work

	Step 1		Step 2		Step 3		Step 4		Step 5	
Variable	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*
Fixed effects										
Intercept	0.01 (.09)	0.13	-0.01 (.09)	-0.08	-0.01 (.09)	-0.14	-0.01 (.09)	-0.13	0.01 (.09)	0.07
Workshop quality (WQ)			0.42 (.23)	1.80†	0.61 (.28)	2.20*	0.61 (.28)	2.20*	0.53 (.29)	1.85†
Outcome expectancy (OE)					-0.30 (.24)	-1.23	-0.30 (.25)	-1.19	-0.24 (.26)	-0.93
Participation rate (PR)							-0.07 (1.18)	-0.06	-0.81 (1.44)	-0.56
WQ x PR									-3.65 (4.38)	-0.83
OE x PR									1.15 (4.47)	0.26
Random effects (variance)										
τ_{00} (group)	0.120		0.109		0.090		0.090		0.087	
σ^2 (residual)	0.788		0.780		0.784		0.784		0.783	
Model fit parameters										
Deviance	544.88		541.69		540.29		540.28		539.50	
AIC	550.88		549.69		550.29		552.28		555.50	
BIC	560.81		562.93		566.83		572.13		581.97	

Note. AIC = Akaike information criterion; BIC = Bayesian information criterion.
[a] PE = Unstandardised parameter estimate with standard error in brackets.
$^{\dagger}p < .10$; *$p < .05$ (two-tailed).

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Table 6

Multilevel analysis for changes in negative activation at work

	Step 1		Step 2		Step 3		Step 4		Step 5	
Variable	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*	PE[a] (*SE*)	*t*
Fixed effects										
Intercept	-0.98 (.12)	-0.84	-0.06 (.10)	-0.59	-0.06 (.10)	-0.57	-0.06 (.10)	-0.57	-0.04 (.11)	-0.33
Workshop quality (WQ)			-0.79 (.25)	-3.18**	-0.88 (.31)	-2.83*	-0.88 (.31)	-2.83*	-0.89 (.33)	-2.71*
Outcome expectancy (OE)					0.13 (.28)	0.47	0.13 (.28)	0.46	0.16 (.30)	0.53
Participation rate (PR)							0.01 (1.32)	0.01	0.01 (1.64)	0.01
WQ x PR									1.56 (4.97)	0.31
OE x PR									-3.31 (5.11)	-0.65
Random effects (variance)										
τ_{00} (group)	0.193		0.091		0.090		0.090		0.087	
σ^2 (residual)	1.180		1.181		1.181		1.181		1.180	
Model fit parameters										
Deviance	627.38		618.81		618.59		618.59		618.16	
AIC	633.38		626.81		628.59		630.59		634.16	
BIC	643.30		640.04		645.13		650.44		660.63	

Note. AIC = Akaike information criterion; BIC = Bayesian information criterion.
[a] PE = Unstandardised parameter estimate with standard error in brackets.
*$p < .05$; **$p < .01$ (two-tailed).

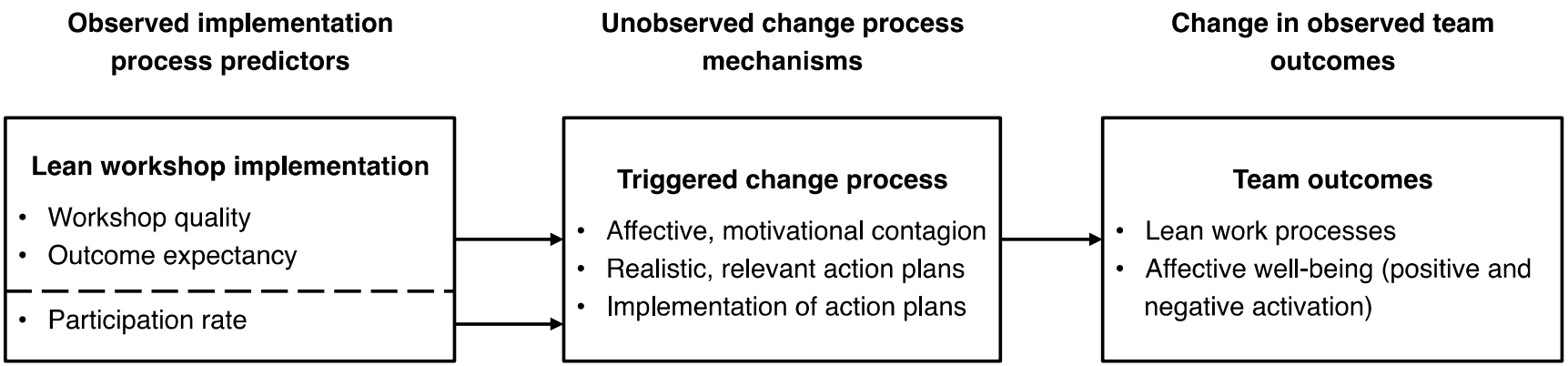

Figure 1. Overview of conceptual research model with observed implementation process predictor variables, unobserved change process mechanisms, and observed team outcome variables

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