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# An interprofessional team training intervention with an implementation phase in a surgical ward: A controlled quasi-experimental study

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## ABSTRACT

Despite a growing awareness of the importance of interprofessional teamwork in relation to patient safety, many hospital units lack effective teamwork. The aim of this study was to explore if an interprofessional teamwork intervention in a surgical ward changed the healthcare personnel's perceptions of patient safety culture, perceptions of teamwork, and attitudes toward teamwork over 12 months. Healthcare personnel from surgical wards at two hospitals participated in a controlled quasi-experimental study. The intervention consisted of six hours of TeamSTEPPS team training and 12 months for the implementation of teamwork tools and strategies. The data collection was conducted among the healthcare personnel in the intervention group and the control group at baseline and at the end of the 12 month study period. The results within the intervention group showed that there were significantly improved scores in three of 12 patient safety culture dimensions and in three of five perceptions of teamwork dimensions after 12 months. When comparing between groups, significant differences were found in three patient safety culture measures in favor of the intervention group. The results of the study suggest that the teamwork intervention had a positive impact on patient safety culture and teamwork in the surgical ward.

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Interprofessional teamwork; implementation; patient safety culture; TeamSTEPPS; team training; surgical healthcare personnel



## Introduction

In complex hospital organizations, the quality of patient care depends upon professions working together in interprofessional teams (WHO, 2010). Despite a growing awareness of the importance of teamwork, many hospital units lack effective teamwork, with negative consequences for the patient (Leonard, Frankel, & Knight, 2012; O'Connor et al., 2016). The complexity of surgical care, coupled with the limitations of human performance, make it critically important that healthcare personnel have efficient interprofessional teamwork (Yngman-Uhlin, Klingvall, Wilhelmsson, & Jangland, 2016). In this paper, the impact of a teamwork intervention in a surgical ward is studied

## Background

Interprofessional teamwork involves different health professions which share a team identity, and work closely together in an integrated and interdependent manner to solve problems and deliver healthcare services (Reeves, Lewin, Espin, & Zwarenstein, 2010). To ensure effective teamwork, all healthcare professionals need competency in teamwork (Vincent, Burnett, & Carthey,

2014). Team competencies refer to the behaviors, cognitions and attitudes that individuals use to coordinate their efforts toward a shared goal (King et al., 2008). An effective method to improve healthcare personnel's teamwork competencies is team training (Salas, Paige, & Rosen, 2013). Team training is defined as "a set of tools and methods that form an instructional strategy," and is a methodology designed to educate team members with the competencies necessary for optimizing teamwork (Salas, Cooke, & Rosen, 2008, p. 1003). Reviews report that team training can positively impact teamwork, such as learning transfer measured by improved teamwork (O'Dea, O'Connor, & Keogh, 2014), patient safety culture (Weaver et al., 2013) and patient outcomes (Hughes et al., 2016). The majority of studies of interprofessional team training in hospitals have been conducted in special care units (Mayer et al., 2011; Sonesh et al., 2015) such as in the operating room (OR) (Armour Forse, Bramble, & McQuillan, 2011; Neily et al., 2010), where Neily et al. (2010) demonstrated an 18% reduction in mortality after OR team training. While special unit teams most often are gathered around the patient, the wards have a more geographic dispersion of team members (O'Leary et al., 2010). Surgical wards differs from medical wards in that surgeons are less available because they are often admitted to surgery (Yngman-Uhlin et al., 2016). Some studies on interprofessional team training have been conducted in medical wards, but

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there is limited research from the context of surgical wards (Aaberg & Wiig, 2017; Hughes et al., 2016). Furthermore, since surgical wards are an area of high risk of adverse events (de Vries, Ramrattan, Smorenburg, Gouma, & Boermeester, 2008) this is an important context to study. There are few studies from this context that have reported on the sustainability of the impact of teamwork interventions (Rosen et al., 2018). A post-training implementation is of importance for the transfer of the learning and development of patient safety culture in clinical practice (Weaver, Dy, & Rosen, 2014).

Several team training programs have been developed, but many of them are context- or discipline-specific (Teamwork and Communication Working Group, 2011). The Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) was chosen for this study because it is an evidence-based teamwork program (2014). Previous TeamSTEPPS studies have shown promising results regarding patient safety culture (Lisbon et al., 2014; Thomas & Galla, 2013) attitudes toward teamwork (Wong, Gang, Szyld, & Mahoney, 2016) and perceived teamwork (Budin, Gennaro, O'Connor, & Contratti, 2014; Tibbs & Moss, 2014). However, the impact on surgical wards is uncertain.

TeamSTEPPS aims to optimize team performance in all types of healthcare teams and contexts to integrate teamwork competencies into practice (2014). The overall aim of the program is to improve the patient safety and the quality of care (King et al., 2008; TeamSTEPPS 2.0, 2014). The TeamSTEPPS program is built on five key principles, which are team structure and four team competencies (Leadership, Situation Monitoring, Mutual Support and Communication (Alonso & Dunleavy, 2012; TeamSTEPPS 2.0, 2014). Each of the four team competencies has a set of tools or strategies that team members are supposed to utilize to ensure effective teamwork (King et al., 2008). Team decision-making is an additional team competency not included in the TeamSTEPPS program but is also pointed out as a key team competency in the literature (Reader, 2017; Salas, Cannon-Bowers, & Johnston, 2014).

The aim of this study was to explore if an interprofessional teamwork intervention in a surgical ward changed the healthcare

**Table 1.** Baseline profiles of the two surgical wards.

Specialties	Intervention ward	Control ward
	Gastrointestinal surgery and Urology	Gastrointestinal surgery and Ear, nose and throat
Beds (n)	20	26
Occupied beds per year <sup>1</sup> (%)	87	91
Length of Stay (mean days)	3.46	3.50
Non-clinical nurses FTE <sup>2</sup> (n)	2.60 (3)	2.93 (3)
Nursing assistants FTE <sup>2</sup> (n)	4.95 (7)	3.26 (5)
Physicians FTE <sup>2</sup> (n)	13 (14)	12 (12)
Registered nurses FTE <sup>2</sup> (n)	17.25 (25)	25.5 (40)
Nurse/bed-ratio	1.1	1.1

<sup>1</sup>2015

<sup>2</sup>FTE = Full-time employees

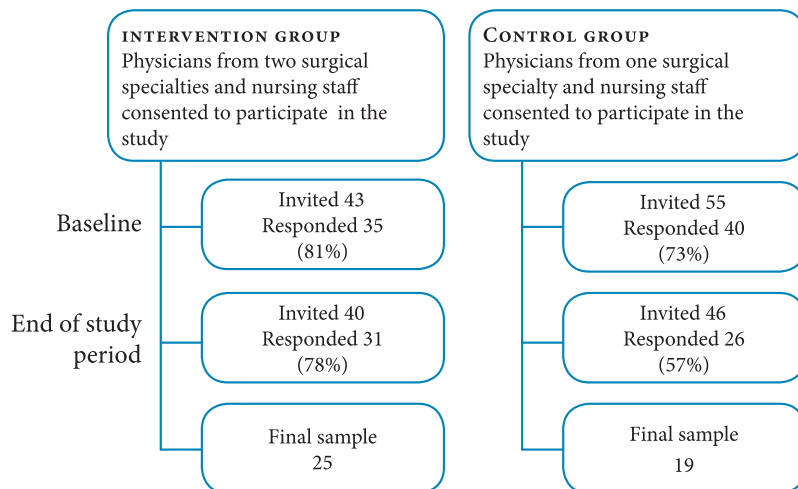
personnel's perceptions of patient safety culture, perceptions of teamwork, and attitudes toward teamwork over 12 months.

## Methods

### Research design, setting and sample

The study had a controlled quasi-experimental design (Eccles, Grimshaw, Walker, Johnston, & Pitts, 2003) and was carried out in two surgical wards in two different hospital trusts in Norway. The intervention group consisted of healthcare personnel (nursing assistants, physicians and registered nurses) from a combined gastrointestinal surgery and urology ward, which was selected for convenience. The control group consisted of healthcare personnel from a combined gastrointestinal surgery and ear, nose and throat ward from another hospital. The control ward was selected based on similarity to the intervention group despite being at another location, which helped to avoid the contamination effect (Polit & Beck, 2017) (see Table 1 for profiles of the two study wards)

After obtaining consent from the management, all eligible healthcare personnel from the two wards were invited to participate in the study. The initial number of invited participants was 98; distributed as 43 from the intervention group and 55 from the control group (Figure 1).



**Figure 1.** Flowchart of the study samples.

## The intervention

The TeamSTEPPS program (2014) was translated into Norwegian by a translation agency, and the translated version was reviewed by the researchers. Kotter's model for leading change was used to guide the implementation in a stepwise fashion (Kotter, 2012). Kotter (2012) includes eight steps that are supposed to be followed in order to achieve success with the change work (see Figure 2). Each of these steps is organized into three phases that align with the TeamSTEPPS model of change, and the phases is described below. Further details of the intervention are described elsewhere (Aaberg, Hall-Lord, Husebo, & Ballangrud, 2019).

### Phase 1 – set the stage and decide what to do – assessment and planning

Site assessments of the potential study sites were conducted (TeamSTEPPS 2.0, 2014), and the leaders of the intervention ward considered their ward's readiness for the TeamSTEPPS program. Two of the authors (ORA, RB), two nurse leaders, and two physician leaders from the intervention ward attended master training and were certified as TeamSTEPPS instructors. The researchers and the leaders of the hospital ward jointly developed a plan for training and implementation.

### Phase 2 – make it happen – training and implementation

A mandatory six-hour interprofessional team training (TeamSTEPPS fundamentals) was conducted for 41 participants during work hours over a three-week period (Aaberg & Ballangrud, 2017). All respondents in the intervention group participated in the six hours of initial team training. In addition to classroom training (lectures, videos and role play), the course consisted of two high-fidelity simulation sessions with a focus on communication and teamwork using one urology scenario and one gastrointestinal surgery scenario. In addition, champions from all professions and a former patient were identified and assigned as members of a Change Team. They developed a vision and an action plan based on identified patient safety issues in the ward and aligned with the organizational goals. One TeamSTEPPS tool was implemented approximately every month, and the "tool of the

month" was communicated through weekly newsletters, staff meetings and posters. One of the authors (ORA) coached the implementation by giving and gathering input from site visits and e-mail communications with the leaders and the clinical nurse specialist, and as a member of the Change Team.

### Phase 3 – make it stick – sustainment

The Change Team continued to meet, worked with different areas of patient safety and teamwork, and continued the implementation of tools and strategies. Milestones were celebrated along the way, and 75 minutes of classroom TeamSTEPPS refresher training was held for the nursing staff during work hours after 5 months and 11 months, and for physicians with a 20 minutes classroom refresher training after 5 months. The implemented tools and strategies became a part of the daily routines in the ward.

An overview of the intervention is illustrated in Figure 3. The control group received no formal team training activities during the study period.

## Measurements

In addition to demographic information about respondents (gender, age, profession and time employed in the ward), data from four questionnaires were collected to explore the impact of the intervention.

The Hospital Survey on Patient Safety Culture (HSOPS) is a questionnaire for assessing healthcare personnel's perceptions of the patient safety culture within their workplace (Sorra & Dyer, 2010). It consists of 44 items, with 42 of the items composed into 12 dimensions. Nine dimensions aim to measure patient safety culture at the unit level: Teamwork Within the Unit, Communication Openness, Supervisor/Manager's Expectations and Actions Promoting Patient Safety, Staffing, Organizational Learning – Continuous Improvement, Feedback and Communication About Error, Nonpunitive Response to Errors, Frequency of Events Reported and Overall Perceptions of Patient Safety in the Unit. Three dimensions are measuring patient safety culture at the hospital level: Hospital Management Support for Patient Safety, Teamwork across Units and Handoffs and

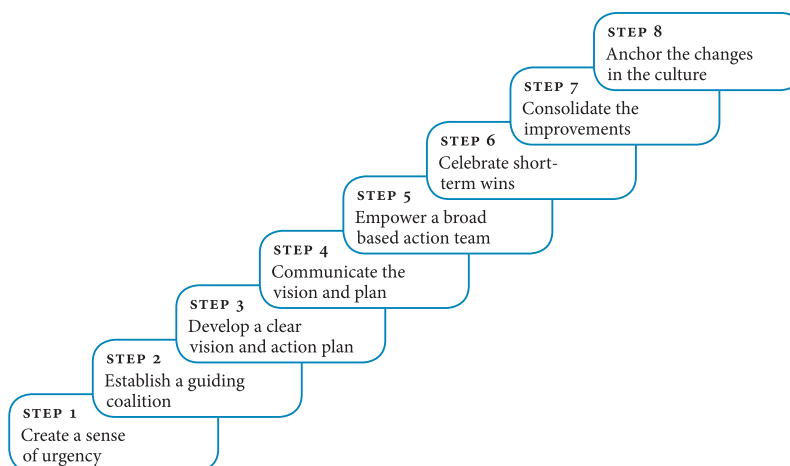


Figure 2. Kotter's eight steps for organizational change (Kotter, 2012).

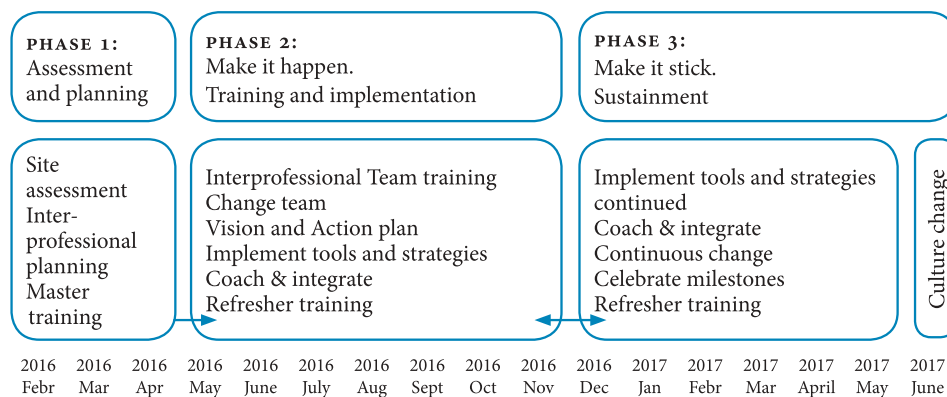


Figure 3. Model of the TeamSTEPS intervention.

Transitions. These items use a 5-point Likert response scale of “agreement” or “how often,” from 1 = “Strongly Disagree” to 5 = “Strongly Agree” or 1 = “Never” to 5 = “Always” (five choices with “neither” in the middle). In addition, there are two single items: Patient safety grade, which asks respondents to provide an overall grade on patient safety for their work unit (A = Excellent, B = Very Good, C = Acceptable, D = Poor, E = Failing), and Number of Events Reported, to indicate the number of adverse events they have reported over the past 12 months (No events, 1 to 2 events, 3 to 5 events, 6 to 10 events, 11 to 20 events or 21 events or more). A total of 18 items in the questionnaire are negatively worded (Sorra & Dyer, 2010). Overall Perceptions of Patient Safety, Number of Events Reported, Frequency of Events Reported, and Patient Safety Grade are defined as safety outcome measures (Jones, Skinner, Xu, Sun, & Mueller, 2008).

The TeamSTEPS Teamwork Perceptions Questionnaire (T-TPQ) is a self-report questionnaire developed to measure individuals’ perceptions of group-level teamwork in the workplace and it is related to the five key components of teamwork of the TeamSTEPS program. It has 35 items composed of responses (from 1 = “Strongly agree” to 5 = “Strongly disagree on a 5-point Likert response scale) to seven statements into each of the five dimensions: Team structure, Leadership, Mutual Support, Situational Monitoring and Communication (Keebler et al., 2014).

The Collaboration and Satisfaction About Care Decisions in Team Questionnaire (CSACD-T) is composed of nine items regarding collaboration and satisfaction with team decision-making about patient care. This questionnaire was developed from the nurse-physician Collaboration and Satisfaction About Care Decisions Questionnaire (CSACD) (Baggs, 1994). The nine-item CSACD-T questionnaire has response options on a Likert scale ranging from 1 to 7. The first six items measure attributes of collaboration in teams, with response options ranging from 1 (strongly disagree) to 7 (strongly agree). The seventh item measures the level of global collaboration, with the response options ranging from 1 (no collaboration) to 7 (complete collaboration). The last two items consider satisfaction with team decisions and have response options ranging from 1 (not satisfied) to 7 (very satisfied) (Aaberg, Hall-Lord, Husebø, & Ballangrud, 2019).

The TeamSTEPS Teamwork Attitude Questionnaire (T-TAQ) measures individuals’ general attitudes of teamwork

in healthcare, and includes the five components of teamwork: Team Structure, Leadership, Mutual Support, Situational Monitoring and Communication. It has 30 items that are statements for which the individuals give their agreements on each item on a Likert scale (1 = “Strongly disagree” to 5 = “Strongly agree”). Four items are negatively worded (Baker, Amodeo, Krokos, Slonim, & Herrera, 2010).

The Norwegian versions of the questionnaires were used. The T-TPQ (Ballangrud, Husebø, & Hall-Lord, 2017), CSACD-T (Aaberg et al., 2019), and T-TAQ (Ballangrud, Husebø, & Hall-Lord, 2019) were translated into the Norwegian language in line with back translation procedures and psychometrically tested among Norwegian hospitals’ healthcare personnel, conducted by the study team (Ballangrud et al., 2017). The HSOPS questionnaire was translated and psychometrically tested by Olsen (2008).

### Data collection

The surveys were distributed through e-mail using a web-based platform (SurveyXact). The leaders in the two study groups provided e-mail addresses. An information e-mail was sent one week prior to the distribution of the surveys, and reminders were sent to those who had not responded after one week, two weeks and three weeks. The surveys were distributed at baseline (February-March 2016) and at the end of the 12 month study period (June 2017).

### Data analysis

To explore the impact of the intervention, scores from respondents who had answered at both baseline and at the end of the 12 month study period were included. Negatively worded items of HSOPS and T-TAQ were reversed. The items of the questionnaires were computed according to the defined dimensions (Sorra et al., 2016) by adding the mean to a total score, and dividing the score by the number of items in the dimension. The data was analyzed by using SPSS version 24 (IBM, Armonk, NY). In order to test for statistically significant differences between the intervention and control group at baseline, a Mann Whitney U-test was performed for each dimension and for the single items. The mean total score of CSACD-T and the mean scores of each dimension of



the HSOPS, T-TPQ and T-TAQ were analyzed through the use of a paired t-test to check for changes from baseline to the end of the 12 month study period within both groups. To assess the magnitude of the improved dimensions, effect sizes (ES) were calculated by the mean score at the end of study period subtracted by the mean baseline score, and then divided by the baseline standard deviation (Durlak, 2009). We applied Cohen’s standards for effect size as follows: small effect 0.2, medium effect 0.5, and large effect 0.8 (Cohen, 1988). The two single items of HSOPS were analyzed with a Wilcoxon Signed Rank test within groups and with a Mann Whitney U-test between groups. Linear mixed effects models were used to compare differences between the two groups (Bolker et al., 2009). The models had terms for group, time, the interaction between group\*time and with a person random effect. A *p*-value of < .05 was considered to be statistically significant for all analyzes.

**Ethical considerations**

The Norwegian Center for Research Data approved the study (ref. no. 46323), and approvals from the hospital administrations were given. The study was conducted according to the Declaration of Helsinki’s ethical principles for research (The World Medical Association, 2013). The survey included information about the aim of the study, confidentiality and voluntary participation, whereas completion of the surveys was regarded as informed consent. The study protocol was registered retrospectively with registration date 2017/05/30 and trial registration number ISRCTN13997367 (Ballangrud et al., 2017).

**Results**

The number of participants who responded to the surveys at both baseline and at the end of a 12 month study period was 44, distributed as 25 from the intervention group and 19 from the control group. Demographics of the respondents are reported in Table 2. There was one significant difference between the two samples at baseline: employment time in the ward.

Only 6% of the healthcare personnel in the control group had worked on the ward for more than 16 years, whereas 42%

of the healthcare personnel in the intervention group had worked there for that long a period of time.

The baseline mean scores and comparisons between intervention group and control group are shown in Table 3. Only 4 of 25 measures were significantly different between the groups: the HSOPS measures Supervisor/Manager Expectations & Actions Promoting Patient Safety, the Patient Safety Grade, and the T-TPQ Situation Monitoring and Leadership dimensions.

**Patient safety culture**

Results within the intervention group showed significantly higher scores in the three dimensions, Teamwork Within Unit, Communication Openness, and Supervisor/Manager Expectations and Actions Promoting Patient Safety, at the end of the 12 month study period. There were no significant changes in any of the patient safety culture measures within the control group (Table 4). Significant differences between the two groups were found in three patient safety culture measures: Teamwork Within Unit, Overall Perceptions of Patient Safety, and Patient Safety Grade, all in favor of the intervention group (Table 4 and Table 5).

**Table 3.** Baseline scores and comparisons between the two study groups.

	Intervention group	Control group	<i>p</i> <sup>2</sup>
	Mean (SD) <sup>1</sup>	Mean (SD) <sup>1</sup>	
HSOPS <sup>3</sup>			
Teamwork Within Unit	3.78 (.52)	4.07 (.63)	.08
Communication Openness	3.81 (.49)	3.89 (.51)	.75
Supervisor/Manager Expectations & Actions Promoting Patient Safety	4.11 (.56)	3.81 (.62)	<b>.02</b>
Staffing	3.52 (.46)	3.26 (.69)	.20
Learning and Continuous Improvement	3.76 (.51)	3.88 (.57)	.41
Feedback and Communication About Error	3.77 (.59)	3.72 (.62)	.20
Nonpunitive Response to Errors	4.13 (.49)	4.05 (.71)	.40
Frequency of Events Reported	2.86 (.66)	3.13 (.79)	.15
Overall Perceptions of Patient Safety	3.65 (.58)	3.90 (.51)	.35
Hospital Management Support for Patient safety <sup>4</sup>	3.28 (.60)	3.14 (.61)	.74
Handoffs and Transitions <sup>4</sup>	3.49 (.45)	3.55 (.27)	.88
Teamwork Across Units <sup>4</sup>	3.40 (.53)	3.35 (.47)	.82
Number of Events Reported <sup>5</sup>	2.24 (.78)	2.42 (1.07)	.10
Patient Safety Grade <sup>5</sup>	3.67 (.57)	4.00 (.47)	<b>.04</b>
T-TPQ <sup>6</sup>			
Team structure	3.95 (.43)	4.03 (.56)	.05
Leadership	4.16 (.39)	3.64 (.73)	<b>.001</b>
Situation monitoring	3.70 (.43)	3.97 (.51)	<b>.02</b>
Mutual support	3.83 (.44)	3.86 (.52)	.06
Communication	3.81 (.39)	3.94 (.42)	.05
CSACD-T <sup>7</sup>			
Team decision-making	4.69 (.92)	4.80 (.89)	.16
T-TAQ <sup>8</sup>			
Team structure	3.84 (.32)	3.88 (.41)	.80
Leadership	4.34 (.36)	4.26 (.49)	.23
Situation monitoring	4.05 (.44)	4.06 (.33)	.72
Mutual support	3.94 (.45)	4.04 (.35)	.26
Communication	4.04 (.39)	3.91 (.30)	.14

<sup>1</sup>Standard Deviation  
<sup>2</sup>Mann Whitney U-test  
<sup>3</sup>HSOPS = Hospital Survey of Patient Safety Culture Questionnaire  
<sup>4</sup>Hospital level dimensions (HSOPS)  
<sup>5</sup>Single items (HSOPS)  
<sup>6</sup>TeamSTEPPS Teamwork Perceptions Questionnaire  
<sup>7</sup>Collaboration and Satisfaction about Care Decisions in Team Questionnaire  
<sup>8</sup>TeamSTEPPS Teamwork Attitudes Questionnaire

**Table 2.** Demographic information about respondents.

	Intervention group	Control group	<i>p</i> <sup>1</sup>
	n = 25	n = 19	
<b>Profession</b>			.99
Nursing assistants	3 (12)	2 (10)	
Physicians	4 (16)	3 (16)	
Registered nurses	18 (72)	14 (74)	
<b>Age</b>			.18
≤ 30 years	4 (16)	4 (22)	
31–50 years	12 (48)	12 (67)	
≥51 years	9 (36)	2 (11)	
Missing		1	
<b>Sex</b>			.09
Female	22 (88)	16 (89)	
Missing		1	
<b>Employment time in the ward</b>			<b>.03</b>
0–5 years	2 (8)	7 (39)	
6–15 years	12 (50)	10 (55)	
≥16 years	10 (42)	1 (6)	
Missing	1		

<sup>1</sup>Pearson Chi square test

**Table 4.** Patient safety culture dimension scores.

	Intervention group n = 25				Control group n = 19				Difference between groups
	Mean (SD <sup>1</sup> ) after 12 months	Mean change from baseline to 12 months (95% CI <sup>2</sup> )	p <sup>3</sup>	ES <sup>4</sup>	Mean (SD <sup>1</sup> ) after 12 months	Mean change from baseline to 12 months (95%CI <sup>2</sup> )	p <sup>3</sup>	ES <sup>4</sup>	p <sup>5</sup>
<b>HSOPS<sup>6</sup></b>									
Teamwork Within Unit	4.06 (.48)	.27 (.04, .51)	.03	.54	3.93 (.51)	-.13 (-.36, .10)	.24	-.22	.02
Communication Openness	4.02 (.53)	.26 (.05, .47)	.02	.43	3.92 (.61)	.00 (-.29, .29)	1.0	.06	.13
Supervisor/Manager Expectations & Actions Promoting Patient Safety	4.33 (.51)	.28 (.07, .49)	.01	.39	3.92 (.59)	.11 (-.20, .41)	.47	.18	.33
Staffing	3.52 (.62)	.01 (-.23, .25)	.96	.00	3.38 (.60)	.12 (-.20, .44)	.44	.14	.55
Organizational Learning & Continuous Improvement	3.93 (.61)	.21 (-.03, .45)	.09	.33	3.79 (.58)	-.09 (-.31, .14)	.42	-.16	.08
Feedback Communication About Error	3.97 (.46)	.20 (-.02, .42)	.08	.34	3.81 (.62)	.07 (-.20, .34)	.57	.15	.46
Nonpunitive Response to Errors	4.29 (.60)	.13 (-.15, .42)	.34	.33	4.00 (3-5)	.00 (-.23, .37)	.63	-.07	.76
Frequency of Events Reported	2.96 (.82)	.12 (-.11, .36)	.29	.15	3.37 (.48)	.18 (-.27, .62)	.41	.30	.81
Overall Perceptions of Patient Safety	3.92 (.57)	.25 (-.02, .52)	.07	.47	3.67 (.66)	-.24 (-.62, .15)	.21	-.45	.03
Hospital Management Support for Patient Safety <sup>7</sup>	3.20 (.77)	-.03 (-.29, .24)	.84	-.13	2.78 (.87)	-.32 (-.71, .08)	.11	-.59	.20
Handoffs and Transitions <sup>7</sup>	3.34 (.57)	-.22 (-.45, .01)	.08	-.33	3.50 (3-4)	-.15 (-.41, .11)	.23	-.19	.81
Teamwork Across Units <sup>7</sup>	3.31 (.54)	-.08 (-.28, .12)	.42	-.17	3.14 (.55)	-.21 (-.48, .06)	.11	-.45	.40

<sup>1</sup>Standard Deviation<sup>2</sup>Confidence Interval<sup>3</sup>Paired t-test<sup>4</sup>Effect size<sup>5</sup>Linear Mixed Effect Models<sup>6</sup>Hospital Survey of Patient Safety Culture Questionnaire<sup>7</sup>Hospital level dimensions**Table 5.** Patient safety culture single item scores.

	Intervention group n = 25			Control group n = 19			Difference between groups
	Mean (SD <sup>1</sup> ) baseline	Mean (SD <sup>1</sup> ) after 12 months	p <sup>2</sup>	Mean (SD <sup>1</sup> ) baseline	Mean (SD <sup>1</sup> ) after 12 months	p <sup>2</sup>	p <sup>3</sup>
<b>HSOPS<sup>4</sup></b>							
Number of Events Reported	2.24 (.78)	2.15 (.72)	.44	2.42 (1.07)	2.78 (1.22)	.31	.15
Patient Safety Grade	3.67 (.57)	3.92 (.56)	.06	4.00 (.47)	3.71 (.85)	.10	.01

<sup>1</sup>Standard Deviation<sup>2</sup>Wilcoxon Signed Rank test<sup>3</sup>Linear Mixed Effect Models<sup>4</sup>Hospital Survey of Patient Safety culture

## Teamwork

The results within the intervention group showed significantly higher scores after 12 months in three T-TPQ dimensions: Situation Monitoring, Mutual Support, and Communication. Within the control group there was a significantly higher score in the T-TPQ Leadership dimension after 12 months. No significant changes were found in CSACD-T and T-TAQ neither within the groups nor between the groups (Table 6).

## Discussion

Results from the study suggest that the TeamSTEPPS intervention had a positive impact on healthcare personnel's perceptions of teamwork and patient safety culture in some domains. The improved patient safety and teamwork dimensions with medium to large effect size indicate a practical effect of the intervention (Sun, Pan, & Wang, 2010). The impact of the intervention was also demonstrated by positive differences between the groups in three patient safety culture

measures, while the perceptions of the T-TPQ Leadership dimension was significantly different in favor of the control group. However, the heterogeneity of the impact also defines some areas for future research.

The improved measures of the HSOPS indicate a change in the safety culture in the intervention ward. Two outcome measures, Overall Perceptions of Patient Safety and Patient Safety Grade, differed significantly between the groups in favor of the intervention group. Together with the improved scores in Teamwork Within Unit, the results suggests a benefit to the patient safety culture due to the intervention.

Seen in light of the patient safety focus in the TeamSTEPPS intervention, the increased score in Communication Openness within the intervention group is particularly interesting. Communication Openness is about speaking up freely if seeing something that may negatively affect a patient, and it is also about questioning team members with more authority when necessary (Sorra et al., 2016). The hierarchy within hospital organizations is a common problem in patient safety, in which healthcare personnel have not always felt that they can speak up across professional boundaries (Leape, 2015).

**Table 6.** Teamwork dimension scores.

	Intervention group n = 25				Control group n = 19				Difference between groups
	Mean (SD <sup>1</sup> ) after 12 months	Mean change from baseline to 12 months (95% CI <sup>2</sup> )	p <sup>3</sup>	ES <sup>4</sup>	Mean (SD <sup>1</sup> ) after 12 months	Mean change from baseline to 12 months (95% CI <sup>2</sup> )	p <sup>3</sup>	ES <sup>4</sup>	
<b>T-TPQ<sup>6</sup></b>									
Team Structure	4.08 (.44)	.13 (-.03, .30)	.10	.30	4.03 (.34)	-.00 (-.27, .26)	.98	.00	.33
Leadership	4.15 (.63)	-.01 (-.20, .18)	.93	-.03	4.01 (.60)	.38 (.01, .74)	<b>.04</b>	.51	<b>.04</b>
Situation	4.06 (.54)	.40 (.22, .58)	<b>.001</b>	.84	4.13 (.36)	.12 (-.05, .38)	.13	.31	.08
Monitoring									
Mutual Support	4.03 (.50)	.21 (.03, .39)	<b>.03</b>	.45	4.03 (.45)	.17 (-.05, .39)	.11	.32	.80
Communication	4.02 (.53)	.26 (.06, .47)	<b>.02</b>	.54	3.99 (.26)	.05 (-.13, .23)	.58	.12	.12
<b>CSACD-T<sup>7</sup></b>									
Team decision-making	4.95 (1.03)	.26 (-.15, .66)	.20	.28	5.10 (1.16)	.30 (-.26, .86)	.28	.34	.90
<b>T-TAQ<sup>8</sup></b>									
Team Structure	3.96 (.46)	.12 (-.05, .29)	.16	.38	3.87 (.55)	-.05 (-.26, .17)	.65	-.02	.21
Leadership	4.41 (.55)	.07 (-.15, .29)	.51	.19	4.35 (.64)	.07 (-.29, .43)	.69	.18	.99
Situation	4.26 (.51)	.21 (-.04, .46)	.09	.48	4.10 (.43)	.03 (-.15, .20)	.75	.12	.25
Monitoring									
Mutual Support	4.05 (.47)	.11 (-.05, .27)	.17	.28	4.08 (.89)	.04 (-.12, .20)	.61	.11	.53
Communication	3.99 (.60)	-.06 (-.30, .19)	.65	-.13	3.99 (.49)	.08 (.11, .28)	.38	.27	.39

<sup>1</sup>Standard Deviation

<sup>2</sup>Confidence Interval

<sup>3</sup>Paired t-test

<sup>4</sup>Effect size

<sup>5</sup>Linear Mixed Effect Models

<sup>6</sup>TeamSTEPPS Teamwork Perceptions Questionnaire

<sup>7</sup>Collaboration and Satisfaction About Care Decisions in Team Questionnaire

<sup>8</sup>TeamSTEPPS Teamwork Attitudes Questionnaire

Our results are in line with Spiva et al. (2014), who found increased scores in Teamwork Within Unit and Communication Openness in the two intervention wards. The results in the present study are also supported by results from other hospital contexts (Jones, Skinner, High, & Reiter-Palmon, 2013; Mayer et al., 2011; Thomas & Galla, 2013). Although different contexts, the results in the present study seem to be similar and may therefore be generalizable.

The positive changes within the intervention group in Supervisor/Manager Expectations and Actions Promoting Patient Safety indicate that the healthcare personnel experienced that their leaders had a focus on patient safety during the project period. Leaders have a special responsibility to facilitate a teamwork climate characterized by psychological safety (Salas et al., 2008). The importance of leaders in implementation studies, which also includes leadership from physicians, is well documented in the literature (Ginsburg & Tregunno, 2005; Rosen et al., 2018).

The improvement in three out of four teamwork dimensions within the intervention group suggests a benefit to teamwork due to the intervention. The teamwork tools and strategies implemented in the ward targeted these three areas of teamwork. Previous TeamSTEPPS studies that have utilized the T-TPQ have heterogeneous results. In a study from an oncology unit, improvements were found in two dimensions (Gaston, Short, Ralyea, & Casterline, 2016), whereas Tibbs and Moss (2014) found no changes in their study from the OR. The negative result of the Leadership dimension in the present study, can be explained by a lower baseline score in the control group. This should be further studied to determine its cause and importance.

As in Spiva et al. (2014) we did not find improvements in any of the teamwork attitude scores. Our results can be explained by that the respondents in both groups having favorable attitudes toward teamwork at baseline. High baseline scores may indicate a ceiling effect and leave little room for improvements, which may be due to a lack of sensitivity in the measurement tool (Polit & Beck, 2017). Even though attitudes is a predictor of individual's behavior (Glasman & Albarracin, 2006), changes in teamwork and patient safety are dependent on many other factors. More sensitive measures may be needed to evaluate the attitudinal outcomes.

Previous studies that have utilized Kotter have reported difficulties with maintaining a sense of urgency throughout the change period, with the most challenging being to anchor the change in the culture (Baloh, Zhu, & Ward, 2017). In spite of that all the steps by Kotter were followed during the 12 month study period, the improvements in teamwork and patient safety of culture were relatively modest in the current study. One explanation for the results may be related to context (Ginsburg & Tregunno, 2005). The surgical ward is a context with a high activity level, where healthcare personnel work under very high pressure (Yngman-Uhlin et al., 2016), thus making it hard to find time for change work in their daily practice. Another explanation is a resistance to change, which is well known as a challenge in improvement work (Suter et al., 2013). Additionally, stress caused by requirements of new behaviors may serve as a barrier to change (Ginsburg & Tregunno, 2005). Motivational issues rooted in professional cultures and hierarchical systems (Ginsburg & Tregunno, 2005) may also have influenced the study results.



Realist synthesis reviews have identified underlying causal mechanisms in implementation studies and found that active engagement from physicians as the most preferable mechanism for success (Gillespie & Marshall, 2015). In the present study, physicians were involved from the planning phase to facilitating the team training, as well as being members of the change team. However, the physicians in surgical wards are also members of other teams, e.g., in the OR and outpatient clinics. Because the other units did not receive the intervention, the physicians could not use the new tools in those teams, which may have influenced the results of this study.

The Kotter model has been criticized for only focusing on organizational and situational change, and does not address the personal behavior that accompanies change (Clay-Williams & Braithwaite, 2015). According to Clay-Williams and Braithwaite (2015), change is also psychological, as organizational change may impact the professional identity of the individual healthcare personnel.

### Study limitations

There are limitations that may affect this study and the interpretation of the results. The two samples of healthcare personnel were small, based on convenience, and not randomized. For practical reasons randomization is not always possible in complex intervention studies (Taylor, Ukoumunne, & Warren, 2015). The major challenge in non-randomized studies is to be certain that the observed effect is caused by the intervention and not explained by other factors (Groenwold, Hak, & Hoes, 2009). An unequal distribution of participant characteristics in the groups may hinder the comparability of outcome and lead to confounding bias (Deeks et al., 2003). However, the only demographic variable that differed between the two groups of healthcare personnel in our study was the employment time in the ward. Since long-term employees may persist more with organizational changes, they may need more time to adapt to the changes (Cullen, Edwards, Casper, & Gue, 2014). The effect of participating in research, the Hawthorne effect, may have influenced the results and contributed to study bias (McCambridge, Witton, & Elbourne, 2014). Another possible bias is the attrition of the samples which was less of a problem in the intervention group than in the control group. In addition to drop-outs, natural exchanges in employees may explain parts of the attrition, which is a common problem with longitudinal studies in healthcare (Ployhart & Vandenberg, 2010). Another limitation was that only self-reported measurements were used in this study. Although self-report questionnaires are a common method for measuring teamwork in healthcare (Rosen et al., 2012), not all changes may be captured. For ethical reasons we did not collect demographic information about the non-responders. Furthermore, as researchers we had no control on secular changes in the study wards during the study period, and time alone may have influenced the study results (Chen, Hemming, Stevens, & Lilford, 2016; Craig et al., 2008). Because of the study limitations, caution must be taken in generalizing the results.

## Conclusions

The results of the study suggest that TeamSTEPPS is a useful program in a surgical ward context for improving healthcare personnel's scores in patient safety culture and perceptions of teamwork after a 12 month study period. The findings indicate that the TeamSTEPPS training and implementation had significance for the healthcare personnel in this surgical ward, which may give further motivation to implement TeamSTEPPS in surgical wards. There is a need for additional studies to examine whether these results have significance. Moreover, investigating factors influencing the results, and studies investigating the impact on patient outcomes, are desirable.

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## Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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