

# BMJ Open Patient safety in transitional care of the elderly: effects of a quasi-experimental interorganisational educational intervention

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## ABSTRACT

**Objective** The study objective was to assess the effects of an interorganisational educational intervention called the 'Meeting Point' on patient safety culture among staff in hospital and nursing home wards.

**Design** The study employs a quasi-experimental, non-randomised design with a hospital and nursing home intervention group and a hospital and nursing home control group. The study uses one preintervention and two postintervention survey measurements. The intervention group participated in an educational programme 'The Meeting Point' including interorganisational staff meetings combining educational sessions with a discussion platform focusing on quality and safety in transitional care of the elderly.

**Results** The results show a stable development over time for the patient safety culture factor 'Handoff and transitions', and small improvements for 'Overall perceptions of patient safety culture' and 'Organisational learning - continuous improvement' for the hospital intervention group. No similar development was reported in the nursing home intervention group, which is most likely explained by ongoing organisational changes. Qualitative data show the existence of ongoing initiatives in the hospital to improve transitional care, but not all were connected to the 'Meeting Point'.

**Conclusion** The 'Meeting Point' has the potential to be a useful measure for healthcare professionals when aiming to improve patient safety culture in transitional care. Further refinement of the key components and testing with a more robust study design will be beneficial.

## INTRODUCTION

Transitional care, including patient handovers and care transitions, can be seen as the actions designed to ensure coordination and continuity of care as patients transfer across different levels of care and/or locations (eg, from a hospital to a nursing home) or between units of care within the same location.<sup>1</sup> Care transitions represent a vital risk to vulnerable elderly patients in need of multiple healthcare services due to possible breaches in information exchange, responsibility, competence, organisation of work

## Strengths and limitations of this study

- The study is the first to assess the effects of an interorganisational educational programme on assessments of patient safety culture among staff in hospital and nursing home wards.
- A strength is the mixed methods design with the qualitative data collection providing information on contextual factors and measures to improve transitional care in the hospital and nursing home wards, with a possible influence on the reports on patient safety culture.
- There was a stable development over time for the safety culture factor 'Handoff and transitions', and small improvements for 'Overall perceptions of patient safety culture' and 'Organisational learning - continuous improvement' for the hospital intervention group. However, based on the qualitative data we cannot conclude that the improvements were solely connected to the 'Meeting Point'.
- Sample size estimates were conducted to measure the effects of the intervention. The study was limited by the relatively small nursing home intervention group, which also underwent some structural changes during the study period.

tasks, and involvement of patients and next-of-kin.<sup>2,3</sup> As such, patient handovers and care transitions have become a focused area of healthcare delivery worldwide.<sup>4,5</sup>

Transitional care has links to patient safety culture, as cultural composites in both hospital and nursing homes include handoffs and transitions.<sup>6,7</sup> Handoffs and transitions are operationalised as transfers of patient care information across units of care and during shift changes, when care plans change or when patients are transferred between a hospital and nursing home. Little is known about how improvements in transitional care affect staff perceptions of patient safety culture in their respective hospital or nursing home wards. Patient safety culture can contain interorganisational features in



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addition to being a factor of patient safety culture in the hospital and nursing home setting. Staff in hospital and nursing homes in one geographical area share care responsibilities and care practices for older patients moving across levels of care, and they collaborate to organise good care processes.<sup>8</sup> Therefore, improvements in interorganisational patient safety culture may be one way to improve transitional care.

Reports on cross-level (eg, between hospital and nursing home) and cross-unit (eg, between hospital wards) patient safety culture measures are lacking in the literature. So far, most strategies have been concerned with single-organisation measures, such as leadership walk rounds, team-based strategies and training programmes.<sup>9</sup> Engaging staff in interorganisational learning collaboratives has been reported useful in changing organisational practices and improving the quality of care process.<sup>10</sup> Discussion platforms and job rotation are also measures suggested for improving transitional care.<sup>11 12</sup> It is also argued that educational interventions offered to staff in interorganisational settings are particularly relevant to reflect the functional whole of stakeholders involved in transitional care and the complexity of transitional care, fostering a common understanding and responsibility for patient care during care transition situations.<sup>13-16</sup>

In an observational study of 41 transitional care situations (hospital admission and discharge) of older patients, we identified several challenges to quality in transitional care and suggested intraorganisational staff meetings as one useful improvement measure.<sup>3</sup> We designed an educational intervention called the 'Meeting Point' including interorganisational staff meetings with staff across care levels (hospital and nursing home) and across care units (hospital emergency, medical wards) within the same hospital location.<sup>17</sup> In this article, we report results from a quasi-experimental study assessing the effects of the 'Meeting Point' on patient safety culture among staff in hospital and nursing home wards. The 'Meeting Point' combines educational sessions with a discussion platform with the objective of improving staff perceptions of hospital and nursing home patient safety culture, and their competencies in patient safety in transitional care.

In this article, we hypothesise the following:

Participation in an educational intervention programme for transitional care has a positive effect on healthcare staff's perception of patient safety culture in the hospital and nursing home wards (H1).

To assess possible short-term and long-term effects of the 'Meeting Point' intervention on staff perceptions of patient safety culture, we included one preintervention and two postintervention measurements, one directly after the 'Meeting Point' and one after 12 months. A qualitative component was included to gather insight into the contextual factors that could influence reports of patient safety culture and to identify ongoing measures to

improve transitional care following the 'Meeting Point' intervention.

## METHODS

### Study design and setting

The study design includes a quantitative and a qualitative component and can be described as a concurrent embedded mixed method study.<sup>18</sup> To assess the effects of the 'Meeting Point', the study employs a quasi-experimental, non-randomised design with a hospital and nursing home intervention group, along with a hospital and nursing home control group, including three quantitative survey measurements on patient safety culture. A qualitative component positioned after the 'Meeting Point' involved data collection at follow-up meetings with staff in the hospital and nursing home wards.

The study was conducted between September 2013 and February 2015. It involved a city-based university hospital in the Western Norwegian Regional Health Authority and three nursing homes in the hospitals' belonging city (population approximately 128 000). Five hospital wards at the city-based university hospital were included in the study (three wards in the medical division and two wards in the emergency department (ED)). Nursing home wards from three different nursing homes in the city were included.

The study wards were selected based on their similarity in terms of number of staff and ward type and included based on the ward leaders' interest in participation, using one preintervention and two postintervention survey measurements. One medical hospital ward, one emergency ward and two nursing home wards were assigned to the intervention group based on leader and staff willingness to participate at the 'Meeting Point'. Two medical hospital wards, one ward of the ED, and short-term and long-term wards in one nursing home participated as a control group. [Table 1](#) presents the characteristics of the intervention group and control group wards.

### Quantitative data collection

Healthcare professionals in the intervention and control groups received a pretest survey measurement (T1) in September 2013 prior to the intervention, and a post-test survey measurement (T2) in February 2014 immediately after the educational intervention programme. A 12-month follow-up survey measurement (T3) was conducted in February 2015 in order to assess long-term effects of the intervention on patient safety culture perceptions among hospital and nursing home professionals. Sample sizes were estimated using power analysis. We hypothesised that the intervention group's reporting of patient safety culture would improve by 10% following participation in the intervention. The required sample size for the two-sample t-test comparisons of the means (with a power of 80%) was estimated to be 75 people for the intervention group and 150 people for the control group. Thus, a total sample size of 225 people was targeted.<sup>17</sup>

**Table 1** Characteristics of intervention and control groups in hospital and nursing homes, response rates, participants at ‘Meeting Point’ and ‘follow-up’ meetings

City-based university hospital		Wards	Staff (n)	Response 2013			Response 2014			Response 2015			Participants Meeting Point			Participants Meeting Point			Participants Meeting Point		
Section	T1 n (%)			T2 n (%)	T3 n (%)	T1 n (%)	T2 n (%)	T3 n (%)	seminar 1	seminar 2	seminar 3	seminar 1	seminar 2	seminar 3	seminar 1	seminar 2	seminar 3	seminar 1	seminar 2	seminar 3	
Intervention	Internal medicine	Pulmonary medicine	52	31 (60)	26 (50)	22 (42)	33	14	17	12											
	Emergency medicine	Emergency	21	9 (43)	13 (62)	6 (28)	17	11	14	3											
Control	Internal medicine	Renal medicine	52	40 (78)	25 (48)	23 (44)				1											
	Internal medicine	Infection medicine	46	29 (63)	22 (48)	17 (37)				2											
	Emergency medicine	Emergency	46	38 (83)	31 (67)	22 (48)				1											
			n=217	147 (68)	117 (54)	91 (42)	50	25	33	20											
Municipality nursing home		Wards	Staff receiving the survey questionnaire	Response 2013			Response 2014			Response 2015			Participants Meeting Point			Participants Meeting Point			Participants Meeting Point		
Nursing home	T1 n (%)			T2 n (%)	T3 n (%)	T1 n (%)	T2 n (%)	T3 n (%)	seminar 1	seminar 2	seminar 3	seminar 1	seminar 2	seminar 3	seminar 1	seminar 2	seminar 3	seminar 1	seminar 2	seminar 3	
Intervention	Nursing home	Intermediate	15	11 (73)	10 (67)	5 (33)	5	8	6	4											
	Nursing home	Intermediate	25	21 (84)	13 (52)	9 (36)	10	8	7	7											
Control	Nursing home	Short term and long term	83	50 (60)	53 (64)	41 (49)				5											
	Total			n=123	82 (68)	76 (62)	55 (45)	15	16	13	16										

### Study participants

Study participants were healthcare professionals, including nurses, nursing assistants, medical doctors and ward leaders. The intervention and control groups were selected based on their similarity in terms of number of staff and ward type. The healthcare professionals in the hospital intervention group were employed in the medical ward for pulmonary diseases and in the emergency room of the ED. The hospital control group included healthcare professionals working in the renal disease medical ward, the infection medicine ward and one ward of the ED. In the municipality, healthcare professionals in the intervention group were employed in intermediate care wards, at two nursing homes in the municipality. The control group included healthcare professionals from short-term and long-term wards in one nursing home.<sup>17</sup>

### Interorganisational educational intervention programme, the 'Meeting Point'

The interorganisational educational intervention, the 'Meeting Point', was carried out between September 2013 and January 2014. The 'Meeting Point' was conducted as half-day seminars organised by a research team of nine members. The 'Meeting Point' consisted of an educational sessions and a discussion platform including participants from different professions, working across levels (hospital and nursing homes) and units of care (different hospital and nursing home wards). There were also participants from home care services, patient coordination offices in the municipality and administrative personnel in the hospital, to ensure presence from all relevant units involved in care transitions. However, they did not take part in the surveys on patient safety culture.<sup>17</sup> The number of participants at the 'Meeting Point' seminars from the hospital intervention and nursing home wards is displayed in [table 1](#). Three thematic areas related to transitional care were addressed: (1) risk factors, (2) patient perspectives and (3) system perspectives. Each seminar had a 15 min introduction, followed by a 45 min teaching session conducted by the members of the research team. One member of the research team introduced a scenario specific to the thematic area (eg, a text-based case of risk factors in transitional care, a film scenario representing the patient perspective in transitional care and a film illustrating the system perspective) to the participants, followed by group activities facilitated by the members of the research team. The groups were mixed to ensure that they were interprofessional and included participants working in different hospital and nursing home wards. The groups addressed two to three questions related to the scenarios and then identified possible measures to improve transitional care at the ward level. Each 'Meeting Point' seminar ended with the participants taking 5 min to provide their written evaluation. [Table 2](#) outlines the elements, period, contents and purpose of the 'Meeting Point'.

The study protocol 'Quality and safety in the transitional care of the elderly (phase 2)' provides the full details of the intervention programme.<sup>17</sup>

### Outcome measures

Common and widely used measures for patient safety culture are the Hospital Survey on Patient Safety Culture (HSOPSC) and the Nursing Home Survey on Patient Safety Culture (NHSOPSC).<sup>6,19,20</sup> Both measures have been developed by the Human Services Agency for Healthcare Research and Quality, US Department of Health and Human Services, and focus on a range of factors including handoff and transitions, organisational learning, teamwork, communication openness and management support for patient safety. The original 12-factor structure of the HSOPSC has been replicated across two measurements with the same sample of Norwegian healthcare professionals.<sup>21,22</sup> A Cronbach's  $\alpha$  of 0.51 was reported for the factor 'Organisational learning - continuous improvement', while ranging between 0.64 and 0.82 for the remaining factors. The NHSOPSC has been validated in the Norwegian nursing home setting reporting a 10-factor solution.<sup>23</sup> The Cronbach's  $\alpha$  values for the factors 'Staffing' and 'Compliance with procedures' were 0.55 and 0.58, respectively, and the values for the remaining factors ranged from 0.65 to 0.90.

### Statistical methods

The statistical software package SPSS V.23 was used for statistical data analysis. The internal consistency (reliability) for both the HSOPSC and NHSOPSC factors was measured by Cronbach's  $\alpha$  coefficients. Descriptive analyses were performed to illustrate sample characteristics. A Pearson  $\chi^2$  test was used to compare proportions of categorical variables between healthcare professionals in the intervention group and the control group. Negatively worded items were recoded/reversed to ensure that higher scores indicate a better safety culture.<sup>19,20</sup> A mean sum score was calculated for each of the factors in the HSOPSC and the NHSOPSC across the three measurements. In addition, mean score differences between premeasurements and postmeasurements were calculated and tested with a Mann-Whitney U test.

A multiple regression analysis using hierarchical mixed linear models (MLM)<sup>24</sup> is used to describe the effects of the 'Meeting point' on the safety culture factors. An unstructured correlation matrix is assumed because of the unequal distances between the repeated responses. MLM assumptions are checked prior to the analyses, for example, normality in the residuals using Q-Q plots. The study uses a similar analytical approach as Haugen *et al.*<sup>25</sup> Non-responders can be a problem when conducting studies with repeated measurements. The MLM is beneficial as it includes participants responding only to one or two of the measurements in the analyses. Each of the patient safety culture factors was included



**Table 2** The elements, period, contents and purpose of the ‘Meeting Point’ based on Storm *et al*<sup>17</sup>

Elements	Approximate time (min)	Contents	Purpose
Introduction by members of the research team	15	Seminar 1: project presentation ‘Quality and safety in transitional care of the elderly’ Seminars 2 and 3: welcome and summary of previous seminar, participant evaluations and identified measures	Introduce the participants to the research project, its main purpose and status Keep focus during the intervention and track of recent activities at the <i>Meeting Point</i> and in the wards
Teaching sessions held by one or several of the research team members	45	Three thematic areas: Risk factors Patient perspective System perspective	Increase competencies of quality and safety in transitional care of elderly Introduce evidence and tools to improve quality in transitional care
Scenarios developed by the research team and the regional health authority	15	Text-based patient case of risks factors Film illustrating the patient and system perspective	Focus attention to the three thematic areas to stimulate individual reflection and group activity
Group activity in mixed groups across professions, wards, and across hospitals and nursing homes	60	Focus on 2–3 questions developed by the research theme in relation to the scenarios Identify measures to improve transitional care at the ward level	To stimulate cross-unit and interorganisational learning and knowledge exchange between the participants
Plenary discussion led by members of the research team	45	Group presentations of improvement measures identified and agreed on	Discussion and agreement of measures for implementation at the wards
Evaluation	5	Five-item questionnaire: if the ‘Meeting Point’ had fulfilled expectations, been beneficial to own clinical work, if patient cases were relevant and if anything should be revised	Written feedback from participants on the key components of the educational programme and experiences with interorganisational staff meetings
Follow-up meeting with healthcare professionals at the hospital and nursing home wards	30–60	Group interview with 4–5 key questions to assess if and how improvement measures have been implemented at the wards	Identification of drivers and barriers to implementation of measures to improve quality in transitional care

as dependent variable and associated with the independent variables: group (control or intervention); survey (T1, T2 or T3); and an interaction term between group and survey. The variable group measures the population average difference of safety factors between intervention and control groups, whereas the variable survey reflects the effect of measurement time with pretest survey measurement T1 as the reference group.<sup>i</sup> The

<sup>i</sup>The hierarchical model can be described by  $Y = \beta_0 + \beta_1 \times \text{Group} + \beta_2 \times \text{Survey}_1 + \beta_3 \times \text{Survey}_2 + \beta_4 \times \text{Group} \times \text{Survey}_1 + \beta_5 \times \text{Group} \times \text{Survey}_2$ .  $\beta_0$  is the intercept (ie, the constant) of the model and  $\beta_1, \dots, \beta_5$  are the regression coefficients. Group is (=0) for the control and (=1) for the intervention group, Survey\_1 is the independent variable at baseline survey T1 (=0) and postintervention T2 (=1), Survey\_2 is the independent variable at baseline survey T1 (=0) and postintervention T3 (=1) and interactions Group×Survey\_1, Group×Survey\_2. The estimated patient safety factors for the control (CG) and intervention group (IG) are  $\beta_0$  (CG) and  $\beta_0 + \beta_1$  (IG) at T1,  $\beta_0 + \beta_2$  (CG) and  $\beta_0 + \beta_1 + \beta_2 + \beta_4$  (IG) at T2, and  $\beta_0 + \beta_3$  (CG) and  $\beta_0 + \beta_1 + \beta_3 + \beta_5$  (IG) at T3. Thus, the change between T1 and T2 is estimated by  $\beta_2$  for the control group and  $\beta_2 + \beta_4$  for the intervention group.

analyses were repeated including additional covariates like profession, patient contact and work experience.

### Qualitative data collection

Qualitative data collection took place after the ‘Meeting Point’ at follow-up meetings between the second (T2) and third survey measurement (T3) to identify measures that had been initiated at the wards related to transitional care and to collect information about ongoing organisational changes (new routines, information technology systems, information exchange and others). In the control group, follow-up meetings with ward leaders and/or nurses were conducted to gain knowledge about the contextual setting and to obtain an overview of potential and ongoing transitional care activities.<sup>17</sup>

Eight follow-up meetings (lasting from 0.5 to 1 hour) were conducted, including 36 participants from the hospital and nursing home intervention and control groups. The follow-up meetings with the intervention group included ward nurses, nurses and auxiliary nurses who had attended the ‘Meeting Point’ seminars. The

meeting was organised in connection with lunch hours in the hospital medical ward, as a meeting with the ward nurse and two ED nurses, and in connection with the regular staff meeting in the nursing homes to ensure that staff were able to participate. For the control group, the participants were ward nurses from the hospital wards and one-ward nurse assistants. For the nursing home control group, the nursing home facility manager and four ward nurses took part. The number of participants at the follow-up meetings from the hospital and nursing home wards is displayed in [table 1](#).

Two researchers conducted the data collection: one was responsible for asking questions, while the other took notes and asked follow-up questions. The follow-up meetings were audio-recorded and transcribed verbatim. In the follow-up meetings with the intervention group, a summary of the 'Meeting Point' seminars was given to the participants, and questions related to initiated measures based on the 'Meeting Point' participation, other measures and possible changes at the ward guided the meeting discussion. In the control group meetings, similar questions were raised, except for the reference to the 'Meeting Point'. The analysis of the qualitative data followed a directed content analysis approach to describe the ongoing transitional care activities in the intervention and control groups, specific measures that had been initiated and the organisational context of relevance.<sup>26</sup>

### Ethics

Participation was voluntary and based on informed, verbal and written consent. The leaders of the hospital and nursing home wards received a formal request with information about the study. A meeting between the leader and members of the research team followed this request to inform about the pre-test and post-test measurements and the intervention programme. Staff were informed about the survey measurements and the 'Meeting Point' at personnel meetings held at their respective wards. Recruitment to the control group was conducted in a similar manner, but without introduction of the 'Meeting Point' seminars. All study participants received written information about the project and the measurements together with the safety culture questionnaire.

## RESULTS

### Responses to questionnaire surveys

Three hundred and forty healthcare professionals (217 at the hospital and 123 in nursing homes) were included and received the survey questionnaire. The respondents were given an identification number to ensure they were matched across the three measurements. At T1, there were 229 responses (response rate 67%); at T2, 193 responses (response rate 54%); and at T3, 146 responses (response rate 44%). At T3, the ward leaders were contacted to provide an overview of professionals not able to respond to the questionnaire. Based on this feedback, 60 professionals were not able to respond to the questionnaire at

T3, as they were not working on the ward anymore, being on sick or maternity leave.

Additional analysis on non-responders in the hospital intervention and control groups revealed a lower proportion of non-responders at T1 in the control group ( $P=0.005$ ) and no difference at T2 and T3. For the nursing homes, there was a lower proportion of non-responders at T1 ( $P=0.036$ ) in the intervention group compared with the control group but no significant difference at T2 and T3.

The Pearson  $\chi^2$  test in [table 2](#) revealed that there was significant difference in proportion for the categorical variables 'profession' ( $P<0.001$ ) and 'patient contact' ( $P=0.042$ ) for the hospital intervention and control groups. For the nursing home intervention and control groups, there was a significant difference in proportion for the variables 'profession' ( $P=0.028$ ) and 'number of years in this nursing home' ( $P<0.001$ ). [Table 3](#) presents the characteristics of healthcare professionals responding at T1.

### Reliability of measurement scales

Reliability was assessed at T1 and T2 for both the Norwegian HSOPSC and NHSOPSC. For the Norwegian 'HSOPSC' ( $n=147$ ), the lowest Cronbach's  $\alpha$  value was 0.46 ('Communication openness') at T1 but improved to 0.70 at T2. For the remaining factors the Cronbach's  $\alpha$  ranged from 0.62 ('Teamwork across units') to 0.83 ('Teamwork within units'), which is acceptable according to Hair *et al.*<sup>27</sup> For the NHSOPSC ( $n=82$ ), the lowest Cronbach's  $\alpha$  values at T1 were 0.50 ('Communication openness'), 0.46 ('Compliance with procedures') and 0.50 ('Nonpunitive response to mistakes'). At T2 Cronbach's  $\alpha$  remained low at 0.48 ('Nonpunitive response to mistakes') and 0.50 ('Compliance with procedure'), and decreased to 0.41 for 'Staffing', while improved to 0.66 for 'Communication openness'. [Table 4](#) displays the factors, number of items, factor definition and Cronbach's  $\alpha$  at T1 and T2 for the Norwegian versions of HSOPSC and NHSOPSC.

### Descriptive statistics and multivariate analyses

Descriptive statistics analyses (means, SE and 95% CI) are presented separately for the hospital intervention and control groups at the three measurements in [table 5](#), and for the nursing home intervention and control groups in [table 6](#).

We calculated the differences between the scores of the premeasurement T1 to postmeasurement T2 (diff T1-T2) and premeasurement T1 to postmeasurement T3 (diff T1-T3) for the hospital and nursing home intervention and control groups. The Mann-Whitney U test shows a significant difference for the hospital patient safety factors: 'Handoff and transitions' (diff T1-T2) ( $P<0.05$ ) and 'Organisational learning - continuous improvement' (diff T1-T3) ( $P<0.05$ ). For the three factors 'Overall perceptions of patient safety' and 'Staffing', and the outcome item 'Patient safety grad', significant differences

**Table 3** Characteristics of the healthcare professionals responding to the survey questionnaire at T1, 2013

	2013 n (%) Intervention	2013 n (%) Control	Total n	P value
<b>City based university hospital</b>	39	106	145	<0.001
Profession				<0.001
Nurse leader/nurse/specialised nurse	25 (17.2)	74 (51.0)	99	
Auxiliary nurse	5 (3.4)	24 (16.6)	29	
Physician/training doctor	2 (1.4)	8 (5.5)	10	
Administrative staff/other	7 (4.8)	–	7	
Direct patient contact				0.022
Yes	34 (23.6)	104 (72.2)	138	
No	4 (2.8)	2 (1.4)	6	
Number of years worked in this hospital				0.370
<1	7 (4.8)	13 (9.0)	20	
1–5	19 (13.1)	41 (28.3)	60	
6–10	6 (4.1)	20 (13.8)	26	
11 or more	7 (4.8)	32 (22.1)	39	
Work hours per week				0.340
<20	–	3 (2.1)	3	
20–37	28 (19.4)	84 (58.3)	112	
>37	10 (6.9)	19 (13.2)	29	
<b>Nursing homes</b>	32	50	82	0.004
Position				0.028
Healthcare professional with a bachelor's degree, including leader	22 (28.8)	22 (26.8)	44	
Skilled healthcare professional/other	10 (12.2)	28 (34.1)	38	
Direct patient contact				0.982
Yes	30 (36.6)	47 (57.3)	77	
No	2 (2.4)	3 (3.7)	5	
Number of years in this nursing home				0.001
<1	8 (9.8)	1 (1.2)	9	
1–5	12 (14.6)	12 (14.6)	24	
6–10	5 (6.1)	11 (13.4)	16	
11 or more	7 (8.5)	26 (31.7)	33	
Work hours per week				0.408
16–24	4 (4.9)	16 (19.8)	20	
25–35.5	21 (25.9)	19 (23.5)	40	
>35.5	14 (17.3)	7 (25.9)	21	

were identified for both time periods, T1–T2 and T1–T3 ( $P<0.05$ ). For the nursing home patient safety factors, there was a significant difference for ‘Staffing’ (diff T1–T3) ( $P<0.05$ ) and for the overall rating item ‘I would tell a friend that this is a safe nursing home for their family’ (diff T1–T2) ( $P<0.05$ ).

The multivariate analyses with a mixed-model approach (MLM) were conducted for each of the factors in the

HSOPSC and NHSOPSC. All model assumptions were met. [Table 7](#) presents the multivariate analysis with a linear mixed model approach for each of the factors in the HSOPSC. For the hospital intervention and control groups, the MLM reveals a significant intervention effect described by the regression coefficients for interactions between intervention and survey time compared with the control.

**Table 4** The factors and the number of items included in the HSOPSC and NHSOPSC

	<b>Definition: The extent to which...</b>	<b>Cronbach's <math>\alpha</math> (T1)</b>	<b>Cronbach's <math>\alpha</math> (T2)</b>
Norwegian version of HSOPSC 12 factors, 42 items and 2 outcome items			
Teamwork within units, 4 items	Staff support each other, treat each other with respect and work together as a team.	0.83	0.84
Teamwork across units, 4 items	Hospital units cooperate and coordinate with one another to provide the best care for patients.	0.62	0.71
Staffing, 4 items	There are enough staff to handle the workload and work hours are appropriate to provide the best care for patients.	0.63	0.61
Non-punitive response to errors, 3 items	Staff feel that their mistakes and event reports are not held against them and that mistakes are not kept in their personnel file.	0.73	0.62
Handoff and transition, 4 items	Important patient care information is transferred across hospital units and during shift changes.	0.69	0.71
Feedback and communication about error, 3 items	Staff are informed about errors that happen, are given feedback about changes implemented and discuss ways to prevent errors.	0.63	0.79
Communication openness, 3 items	Staff freely speak up if they see something that may negatively affect a patient and feel free to question those with more authority.	0.46	0.7
Supervisor/manager expectations and actions promoting patient safety, 4 items	Supervisors/managers consider staff suggestions for improving patient safety, praise staff for following patient safety procedures and do not overlook patient safety problems.	0.79	0.74
Overall perception of patient safety, 4 items	Procedures and systems are good at preventing errors and there is a lack of patient safety problems.	0.68	0.74
Management support for patient safety, 3 items	Hospital management provides a work climate that promotes patient safety and shows that patient safety is a top priority.	0.74	0.84
Organisational learning - continuous improvement, 3 items	Mistakes have led to positive changes and changes are evaluated for effectiveness.	0.67	0.72
Frequency of events reported, 3 items	Mistakes of the following types are reported: (1) mistakes caught and corrected before affecting the patient, (2) mistakes with no potential to harm the patient and (3) mistakes that could harm the patient but do not.	0.7	0.69
Patient safety grade, 1 item			
Number of events reported, 1 item			
Norwegian version of NHSOPSC 10 factors, 41 items and 2 outcome items			
Teamwork, 4 items	Staff treat each other with respect, support one another and feel like they are part of a team.	0.78	0.71
Staffing, 4 items	There are enough staff to handle the workload, meet residents' needs during shift changes and keep residents safe because there is not much staff turnover.	0.62	0.41
Non-punitive response to mistakes, 4 items	Staff are not blamed when a resident is harmed, are treated fairly when they make mistakes and feel safe reporting their mistakes.	0.5	0.49
Handoffs, 3 items*	Staff are told what they need to know before taking care of a resident or when a resident's care plan changes, and have all the information they need when residents are transferred from the hospital.	0.76	0.72

Continued



Table 4 Continued

	Definition: The extent to which...	Cronbach's $\alpha$ (T1)	Cronbach's $\alpha$ (T2)
Feedback and communication about incidents, 4 items	Staff discuss ways to keep residents safe, tell someone if they see something that might harm a resident and talk about ways to keep incidents from happening again.	0.74	0.56
Communication openness, 3 items	Staff speak up about problems, and their ideas and suggestions are valued.	0.45	0.66
Supervisor expectations and actions promoting patient safety, 3 items	Supervisors listen to staff ideas and suggestions about resident safety, praise staff who follow the right procedures and pay attention to safety problems.	0.84	0.85
Management and organisational learning, 10 items†	Nursing home management provides a work climate that promotes resident safety and shows that resident safety is a top priority. There is a learning culture that facilitates making changes to improve resident safety and evaluates changes for effectiveness. Residents are well cared for and safe.	0.9	0.89
Compliance with procedures, 3 items	Staff follow standard procedures to care for residents and do not use short cuts to get their work done faster.	0.46	0.52
Training and skills, 3 items	Staff get the training they need, have enough training on how to handle difficult residents and understand the training they get in the nursing home.	0.71	0.68
Overall patient safety grade, 1 item			
Overall safe nursing home, 1 item			

\*This study uses three 'Handoff' items (originally four) based on the psychometric testing of the Norwegian translated version of the NHSOPSC.

†The three dimensions 'overall perceptions of patient safety' (three items), 'management support for patient safety' (three items) and 'organizational learning' (four items) from the original NHSOPSC have in the Norwegian version been merged to one dimension called 'Management and organizational learning'.<sup>23</sup>

HSOPSC, Hospital Survey on Patient Safety Culture; NHSOPSC, Nursing Home Survey on Patient Safety Culture.

For T1–T2, a significantly different progression in the intervention group is reported on the five patient safety factors 'Handoff and transitions', 0.25 (95% CI 0.01 to 0.49) ( $P<0.05$ ); 'Organisational learning - continuous improvement', 0.29 (95% CI  $-0.00$  to 0.58) ( $P<0.05$ ); 'Overall Perceptions of patient safety', 0.30 (95% CI 0.03 to 0.57) ( $P<0.05$ ); 'Staffing', 0.27 (95% CI 0.06 to 0.48) ( $P<0.05$ ); and 'Nonpunitive response to error', 0.24 (95% CI 0.00 to 0.49) ( $P<0.05$ ). For all five factors, a small increase of  $-0.19+0.25=0.06$ ,  $-0.18+0.29=0.11$ ,  $-0.20+0.30=0.10$ ,  $-0.25+0.27=0.02$  and  $-0.09+0.24=0.19$  was identified for T1–T2 in the intervention group, compared with a negative development of  $-0.19$ ,  $-0.18$ ,  $-0.20$ ,  $-0.25$  and  $-0.09$  for the control group.

From T1–T3, there was a significant intervention effect compared with the control group on the patient safety factors 'Organisational learning - continuous Improvement' at 0.41 (95% CI 0.06 to 0.76) ( $P<0.05$ ); 'Overall perceptions of patient safety' at 0.50 (95% CI 0.19 to 0.80) ( $P<0.01$ ); 'Handoff and transitions' at 0.28 (95% CI 0.02 to 0.53) ( $P<0.05$ ); and 'Staffing' at 0.49 (95% CI 0.19 to 0.79) ( $P<0.01$ ). Similar to before, the control group showed a significant decrease in these factors from T1–T3, whereas the intervention group remained stable or gently increased. For instance, for 'Handoffs and Transitions', the safety score remained almost stable

at  $-0.26+0.28=0.02$  in the intervention group compared with a decrease of  $-0.28$  in the control group.

Furthermore, the MLM analyses in table 7 show, for the intervention group, significantly smaller patient safety culture scores at T1 for the following factors: 'Handoff and transitions' ( $-0.43$ ,  $P<0.001$ ); 'Organisational learning - continuous improvement' ( $-0.45$ ,  $P<0.001$ ); 'Supervisor expectations' ( $-0.11$ ,  $P<0.05$ ); 'Overall perceptions of patient safety' ( $-0.53$ ,  $P<0.001$ ); 'Staffing' ( $-0.49$ ,  $P<0.001$ ); 'Nonpunitive response to error' ( $-0.50$ ,  $P<0.001$ ); and 'Patient safety grade' ( $-0.22$ ,  $P<0.05$ ).

In the nursing home wards, the MLM revealed a significant intervention effect for T1–T2 on the item 'I would tell a friend that this nursing home is safe' at 0.20 (95% CI 0.03 to 0.38) ( $P<0.05$ ). For this item, an increase of  $-0.04+0.20=0.16$  was identified for T1–T2 in the intervention group compared with  $-0.04$  in the control group. From T1–T3, there were significant intervention effects for 'Teamwork' at 0.52 (95% CI 0.01 to 1.03) ( $P<0.05$ ); 'Staffing' at 0.64 (95% CI 0.31 to 0.97) ( $P<0.001$ ); and 'Overall rating on patient safety culture' at 0.62 (95% CI 0.07 to 1.17) ( $P<0.05$ ). For example, there was a small increase of  $-0.58+0.64=0.06$  in the intervention group compared with a decrease of  $-0.58$  in the control group. Table 8 presents the multivariate analysis with a

**Table 5** Descriptive statistics for hospital intervention group (interorganisational educational programme) compared with control group for preintervention and postintervention measurements

Safety factors	Hospital intervention group												Hospital control group											
	Measurement T1				Measurement T2				Measurement T3				Measurement T1				Measurement T2				Measurement T3			
	Mean T1	SE	95% CI		Mean T2	SE	95% CI		Mean T3	SE	95% CI		Mean T1	SE	95% CI		Mean T2	SE	95% CI		Mean T3	SE	95% CI	
Handoffs and transitions	3.00	0.11	2.77 to 3.23		3.00	0.10	2.79 to 3.19		3.03	0.12	2.76 to 3.29		3.40	0.05	3.29 to 3.50		3.24	0.08	3.07 to 3.41		3.14	0.08	2.98 to 3.30	
Organisational learning - continuous improvement	3.13	0.13	2.86 to 3.39		3.15	0.17	2.79 to 3.51		3.29	0.16	2.95 to 3.62		3.58	0.05	3.47 to 3.69		3.42	0.09	3.24 to 3.60		3.11	0.11	2.89 to 3.33	
Teamwork within units	3.94	0.09	3.75 to 4.14		3.71	0.11	3.49 to 3.93		3.87	0.13	3.61 to 4.14		4.07	0.06	3.94 to 4.19		3.90	0.09	3.71 to 4.08		3.77	0.07	3.63 to 3.91	
Supervisor expectations	3.94	0.09	3.75 to 4.14		2.89	0.07	2.73 to 3.05		3.71	0.13	3.43 to 3.99		4.08	0.06	3.96 to 4.20		3.05	0.04	2.98 to 3.14		3.74	0.10	3.54 to 3.95	
Management support for patient safety	2.52	0.12	2.27 to 2.77		2.65	0.20	2.22 to 3.08		2.37	0.23	1.88 to 2.87		2.85	0.07	2.71 to 3.00		2.77	0.11	2.55 to 2.98		2.46	0.09	2.27 to 2.65	
Overall perceptions of patient safety	3.00	0.11	2.76 to 3.25		3.15	0.17	2.80 to 3.50		3.12	0.20	2.71 to 3.54		3.56	0.05	3.44 to 3.67		3.37	0.08	3.20 to 3.55		2.94	0.10	2.73 to 3.15	
Feedback and communication about error	3.14	0.11	2.90 to 3.37		3.04	0.17	2.69 to 3.39		3.16	0.21	2.70 to 3.61		3.24	0.07	3.11 to 3.38		3.15	0.10	3.94 to 3.37		3.03	0.12	2.79 to 3.28	
Communication openness	3.50	0.08	3.33 to 3.67		3.56	0.12	3.30 to 3.82		3.35	0.17	2.98 to 3.72		3.76	0.05	3.65 to 3.87		3.80	0.09	3.63 to 3.98		3.66	0.10	3.45 to 3.86	
Frequency of events reported	2.67	0.11	2.45 to 2.89		2.74	0.14	2.45 to 3.03		3.02	0.18	2.63 to 3.41		2.65	0.07	2.51 to 2.80		2.72	0.09	2.53 to 2.91		2.67	0.09	2.47 to 2.86	
Teamwork across units	3.17	0.07	3.01 to 3.33		3.00	0.10	2.79 to 3.21		3.03	0.14	2.72 to 3.34		3.17	0.05	3.07 to 3.27		3.06	0.82	2.89 to 3.22		2.98	0.08	2.82 to 3.15	
Staffing	2.94	0.11	2.71 to 3.71		3.01	0.12	2.78 to 3.75		2.93	0.17	2.58 to 3.28		3.40	0.064	3.28 to 3.54		3.18	0.08	3.02 to 3.35		2.77	0.11	2.53 to 2.99	
Non-punitive response to errors	3.65	0.12	3.39 to 3.90		3.92	0.12	3.67 to 4.17		3.76	0.15	3.44 to 4.08		4.16	0.05	4.06 to 4.27		4.07	0.06	3.95 to 4.19		4.12	0.08	3.95 to 4.30	
Patient safety grade	3.13	0.12	2.88 to 3.38		3.19	0.09	2.99 to 3.37		2.96	0.13	2.69 to 3.23		3.53	0.63	3.41 to 3.66		3.32	0.08	3.16 to 3.49		2.98	0.09	2.79 to 3.17	
Number of events reported	2.00	0.18	1.63 to 2.37		2.35	0.19	1.96 to 2.75		2.82	0.29	2.23 to 3.41		2.11	0.09	1.93 to 2.29		2.33	0.11	2.11 to 2.54		2.56	0.15	2.26 to 2.86	

**Table 6** Descriptive statistics for nursing home intervention and control group for preintervention and postintervention measurements

Safety factors	Nursing home intervention group												Nursing home control group					
	Measurement T1			Measurement T2			Measurement T3			Measurement T1			Measurement T2			Measurement T3		
	Mean T1	SE	95% CI	Mean T2	SE	95% CI	Mean T3	SE	95% CI	Mean T1	SE	95% CI	Mean T2	SE	95% CI	Mean T3	SE	95% CI
Handoffs	4.29	0.08	4.11 to 4.46	4.27	0.13	4.00 to 4.54	4.31	0.23	3.77 to 4.85	4.23	0.06	4.10 to 4.35	4.07	0.08	3.90 to 4.23	4.01	0.11	3.78 to 4.24
Training and skills	3.68	0.12	3.42 to 3.93	3.48	0.13	3.20 to 3.76	3.46	0.17	3.06 to 3.87	3.67	0.09	3.49 to 3.84	3.70	0.08	3.53 to 3.87	3.39	0.09	3.20 to 3.58
Compliance with procedures	4.16	0.08	3.98 to 4.33	3.95	0.13	3.68 to 4.22	3.89	0.17	3.50 to 4.27	3.82	0.09	3.63 to 3.99	3.71	0.08	3.54 to 3.87	3.38	0.11	3.15 to 3.60
Supervisor expectations	4.14	0.10	3.93 to 4.35	4.03	0.19	3.62 to 4.44	4.18	0.27	3.57 to 4.20	4.43	0.07	4.28 to 4.58	4.39	0.08	4.22 to 4.56	4.10	0.11	3.86 to 4.33
Management and organisational learning	3.84	0.09	3.66 to 4.02	3.69	0.12	3.43 to 3.95	3.72	0.24	3.16 to 4.27	4.01	0.08	3.85 to 4.18	3.95	0.08	3.78 to 4.11	3.62	0.11	3.38 to 3.87
Feedback and communication about incidents	4.29	0.09	4.11 to 4.47	4.17	0.11	3.93 to 4.41	4.31	0.19	3.87 to 4.76	4.17	0.07	4.03 to 4.30	4.18	0.07	4.04 to 4.31	4.11	0.11	3.89 to 4.34
Communication openness	4.13	0.09	3.95 to 4.31	3.98	0.13	3.72 to 4.25	3.59	0.10	3.34 to 3.84	4.01	0.06	3.88 to 4.14	3.94	0.08	3.76 to 4.11	3.48	0.13	3.21 to 3.75
Staffing	3.66	0.09	3.48 to 3.84	3.32	0.10	3.12 to 3.53	3.66	0.11	3.40 to 3.91	3.36	0.08	3.19 to 3.53	3.24	0.08	3.07 to 3.41	2.74	0.11	2.52 to 2.96
Teamwork	4.14	0.14	3.86 to 4.43	3.81	0.08	3.64 to 3.98	3.69	0.28	3.04 to 4.34	4.16	0.08	4.00 to 4.33	3.82	0.08	3.66 to 4.43	3.26	0.12	3.01 to 3.51
Non-punitive response error mistakes	3.91	0.09	3.73 to 4.10	3.72	0.11	3.48 to 3.95	3.72	0.15	3.37 to 4.07	3.94	0.06	3.81 to 4.07	3.93	0.07	3.79 to 4.07	3.87	0.10	3.67 to 4.07
I would tell a friend this is a safe nursing home	2.77	0.08	2.60 to 2.93	2.96	0.03	2.90 to 3.02	2.71	0.16	2.36 to 3.07	2.96	0.03	2.90 to 3.02	2.90	0.05	2.79 to 3.00	2.67	0.09	2.49 to 2.86
Overall rating on patient safety	3.97	0.11	3.74 to 4.20	3.68	0.19	3.29 to 4.08	3.86	0.14	3.55 to 4.17	4.35	0.09	4.15 to 4.55	4.20	0.11	3.98 to 4.42	3.60	0.15	3.30 to 3.90

**Table 7** Multivariate analysis with a linear mixed model approach for each of the factors in the Hospital Survey on Patient Safety Culture

Safety factors (scale 1–5)	Items	Constant		Difference for intervention group vs control		Overall change T1 to T2 (preintervention survey T2) to postintervention survey T2)		Overall change T1 to T3 (preintervention survey T1 to postintervention survey T3)		Intervention group effect for group x survey (pre-T1/post-T2) interaction		Intervention group effect for group x survey (pre-T1/post-T3) interaction	
		$\beta_0$	95% CI	$\beta_1$	95% CI	$\beta_2$	95% CI	$\beta_3$	95% CI	$\beta_4$	95% CI	$\beta_5$	95% CI
Handoff and transitions	4	3.40	3.29 to 3.51	-0.43	-0.76 to 0.04***	-0.19	-0.32 to -0.05**	-0.26	0.40 to -0.12**	0.25	0.01 to 0.49*	0.28	0.02 to 0.53*
Organisational learning - continuous improvement	3	3.59	3.46 to 3.71	-0.45	-0.69 to -0.21***	-0.18	-0.34 to -0.25*	-0.45	-0.65 to -0.25***	0.29	-0.00 to 0.58*	0.41	0.06 to 0.76*
Teamwork within units	4	4.10	3.99 to 4.21	-0.12	-0.29 to 0.05	-0.20	-0.31 to -0.09**	-0.26	-0.39 to -0.14***				
Supervisor expectations	4	4.05	3.95 to 4.16	-0.11	-0 to 23 to 0.00*	-1.01	-1.13 to -0.88***	-0.31	-0.46 to -0.17***				
Management support for patient safety	3	2.86	2.72 to 3.00	-0.23	-0.46 to 0.16	0.01	-0.15 to 0.12	-0.31	-0.48 to -0.14***				
Overall perceptions of patient safety	4	3.57	3.45 to 3.69	-0.53	-0.75 to 0.30***	-0.20	-0.35 to -0.05**	-0.53	-0.71 to -0.36***	0.30	0.03 to 0.57*	0.50	0.19 to 0.80**
Feedback and communication about error	3	3.27	3.14 to 3.40	-0.08	-0.30 to 0.14	-0.05	-0.18 to 0.09	-0.08	-0.26 to 0.09				
Communication openness	3	3.76	3.66 to 3.86	-0.26	-0.43 to 0.09**	0.09	-0.04 to 0.22	-0.02	-0.17 to 0.13				
Frequency of events reported	3	2.63	2.50 to 2.76	0.04	-0.15 to 0.24	0.07	-0.07 to 0.22	0.06	-0.10 to 0.23				
Teamwork across units	4	3.17	3.07 to 3.26	0.00	-0.16 to 0.16	-0.14	-0.24 to -0.03**	-0.16	-0.26 to -0.06**				
Staffing	4	3.41	3.29 to 3.53	-0.49	-0.72 to 0.26***	-0.25	-0.37 to -0.14***	-0.67	-0.84 to -0.50***	0.27	0.07 to 0.48*	0.49	0.19 to 0.79**
Non-punitive response to errors	3	4.16	4.05 to 4.27	-0.50	-0.72 to -0.28***	-0.09	-0.22 to 0.04	-0.03	-0.18 to 0.12	0.24	0.00 to 0.49*	0.13	-0.15 to 0.40
Patient safety grade	1	3.50	3.38 to 3.63	-0.22	-0.42 to -0.03*	-0.18	-0.33 to -0.04*	-0.46	-0.63 to -0.30***				
Number of events reported	1	2.11	1.92 to 2.29	-0.02	-0.32 to 0.27	0.11	-0.08 to 0.30	0.57	0.32 to 0.83***				

\*P<0.05, \*\*P<0.01, \*\*\*P<0.001.

**Table 8** Multivariate analysis with a linear mixed model approach for each of the factors in the Nursing Home Survey on Patient Safety Culture

Safety factors (scale 1-5)	Items	Constant			Difference for nursing home intervention group vs control			Overall change T1 to T2 (preintervention survey T2) postintervention survey T2)			Overall change T1 to T3 (preintervention survey T1 to postintervention survey T3) postintervention survey T3)			Nursing home intervention group effect for group x survey (pre-T1/post-T2) interaction			Nursing home intervention group effect for group x survey (pre-T1/post-T3) interaction		
		$\beta_0$	95% CI		$\beta_1$	95% CI		$\beta_2$	95% CI		$\beta_3$	95% CI		$\beta_4$	95% CI		$\beta_5$	95% CI	
Handoffs	3	4.16	4.04 to 4.29		0.15	-0.04 to 0.33		-0.21	-0.35 to -0.06**		-0.21	-0.34 to -0.08**							
Training and skills	3	3.65	3.49 to 3.81		0.00	-0.20 to 0.21		-0.00	-0.16 to 0.15		-0.27	-0.43 to -0.13***							
Compliance with procedures	3	3.74	3.59 to 3.89		0.46	0.25 to 0.67***		-0.15	-0.32 to 0.02		-0.38	-0.56 to -0.20***							
Non-punitive response or error	4	3.95	3.84 to 4.07		-0.07	-0.23 to 0.09		-0.03	-0.16 to 0.11		-0.08	-0.21 to 0.06							
Supervisor expectations	3	4.40	4.26 to 4.54		-0.23	-0.43 to -0.02*		-0.07	-0.21 to 0.08		-0.23	-0.42 to -0.04*							
Management support for patient safety	10	3.98	3.85 to 4.12		-0.14	-0.34 to 0.07		-0.07	-0.17 to 0.04		-0.36	-0.54 to -0.19***							
Feedback and communication about incidents	4	4.15	4.03 to 4.27		0.09	-0.09 to 0.26		-0.05	-0.16 to 0.06		-0.13	-0.26 to 0.01							
Communication openness	3	4.02	3.90 to 4.14		0.07	-0.11 to 0.24		-0.10	-0.24 to 0.04		-0.55	-0.74 to -0.36***							
Teamwork	4	4.17	3.98 to 4.35		-0.03	-0.32 to 0.27		-0.38	-0.57 to -0.18***		-0.92	-1.21 to -0.64***		-0.16	-0.16 to 0.49	0.52	0.01 to 1.03*		
Staffing	4	3.31	3.15 to 3.47		0.35	0.09 to 0.60**		-0.08	-0.25 to 0.08		-0.58	-0.75 to -0.41***		-0.16	-0.45 to 0.11	0.64	0.31 to 0.97***		
I would tell friends that this nursing home is safe (scale 1-3)	1	2.95	2.87 to 3.04		-0.19	-0.33 to -0.04**		-0.04	-0.14 to 0.07		-0.27	-0.47 to -0.07**		0.20	0.03 to 0.38*	0.17	-0.20 to 0.54		
Overall rating on patient safety	1	4.34	4.16 to 4.52		-0.39	-0.69 to -0.09*		-0.11	-0.35 to 0.13		-0.70	-0.99 to -0.42***		-0.04	-0.47 to 0.38	0.62	0.07 to 1.17*		

\*P<0.05, \*\*P<0.01, \*\*\*P<0.001.



linear mixed model approach for each of the factors in NHSOPSC.

In addition, [table 8](#) reports significantly higher scores at T1 for the intervention group compared with the control group for 'Compliance with procedures' ( $P<0.001$ ) and 'Staffing' ( $P<0.05$ ), and significantly lower scores for 'Supervisor expectations' ( $P<0.05$ ), and for the two single outcome items 'I would tell friends that this nursing home is safe' ( $P<0.05$ ) and 'Overall rating on patient safety' ( $P<0.05$ ). In the nursing home wards, there was a significant negative development for the control group from T1–T2 for the patient safety factors 'Teamwork' and 'Handoffs'. From T1–T3, there was a significant negative development for most of the patient safety factors.

The MLM analyses adjusted for the additional covariates 'profession', 'work experience' and 'patient contact' resulted in same result patterns.

### Ongoing transitional care measures at the wards

The results from the follow-up meetings are presented separately for the hospital and nursing home intervention and control groups.

#### Hospital

In the emergency room of the ED, several initiatives were introduced to improve transitional care between the second and third measurements (T2, T3). One project focused on the overall patient flow in the hospital to avoid overcrowding and was a project initiated as part of a general focus on patient safety in the hospital. This project involved use of a computer-based system that visualised the patient flow, providing a daily report to the leader with information on patient waiting times for the physician (more than 1 hour, more than 3 hours) and expected patient arrivals. The shift leaders had received training to manage the information system. The number of nursing positions had also been increased on evening and night shifts due to several periods of overcrowding. According to the participants, it was not uncommon to have more than 40 patients, with 28 patient beds. Following the 'Meeting Point', two television (TV) screens to provide information on waiting hours had been installed to inform patients.

The internal medicine ward had, according to the participants, about 6–10 discharges per day. The participants mentioned the usefulness of a computer system for electronic messaging of patient information from hospital to municipality, allowing hospital staff to receive information regarding to which nursing home the patient was being discharged. After the 'Meeting Point' a poster visualising the order of messages to be sent to the municipality relating to hospital discharge of patients had come in place.

In the control group, ongoing activities were conducted as part of the National Patient Safety Campaign, addressing issues such as fall prevention, pressure ulcer, nutritional status, urinary infections and central venous line-related infections. Meetings with the hospital control group did

not reveal specific initiatives addressing transitional care, but the participants pointed at areas in need of improvement (eg, reconciliation of patient medications, monitoring e-messages between hospital and municipality to avoid delays, and informing patients and the public about transitional care). Challenges in the control group were identified as related to vacant positions and having sufficient and experienced staff on all shifts, particularly during weekends.

#### Nursing home

The nursing home intervention group wards were going through organisational changes between survey measurements T2 and T3. The ward leader and nursing staff at the intermediate ward were preparing for the ward to be reorganised into a short-term ward following a decision by the City Council. The number of patient beds was to be reduced, and the leader was establishing new routines for the ward. Similarly, the intermediate nursing home ward had been reorganised, including emergency beds for the municipality health services.

In the nursing home control group, participants referred to a well-established quality system containing procedures and checklists (eg, admissions, fall prevention and so on), including a yearly external quality audit. Another issue of concern was the new budget model for the municipality nursing homes leading to retrenchment measures, such as reduction in level of staffing, cutting the yearly external quality audit and reducing the full-time position of the quality coordinator. In particular, reducing the level of staffing was said to influence the time available for staff learning and competence development. Recent improvement projects focused on medication reconciliation and preventing pressure ulcers. Electronic information exchange with the hospital was said to have improved over the last year.

### DISCUSSION

This mixed methods study reports results from a quasi-experimental intervention study with an intervention and a control group, an interorganisational educational programme called 'The Meeting Point', to improve patient safety in transitional care of the elderly. Qualitative follow-up meetings reported measures to improve transitional care and contextual factors that could influence on professionals' patient safety culture reports.

Study results show small but significant changes in reports of patient safety culture immediately after the intervention (T2) that continued after 12 months. A gentle increase was reported for 'Organisational learning-continuous improvement', 'Overall perceptions of patient safety culture' and a stable development for 'Handoffs and transition' for the hospital intervention group compared with negative development for the control group. No similar development was reported for the nursing home intervention group. For the hospital and nursing home control group, there was a downward development for

several patient safety factors. The organisational learning - continuous improvement factor contains items that ask if staff perceive that they are doing things actively to improve safety. The activities at the 'Meeting Point', with professionals engaging in group work activities and identifying intervention measures to improve patient safety in transitional care in their own wards,<sup>17</sup> can be viewed as a first step in organisational improvement. Hoffmann *et al*<sup>28</sup> used a similar approach to improve patient safety culture in general practice, allowing staff to suggest improvement actions in accordance with their own perceived needs.

The mixed methods data collection was valuable and provided insight into improvement measures taking place between T2 and T3 that could have influenced the reports of patient safety culture. Data from the follow-up meetings show that the emergency room used TV screens to provide information to patients about waiting hours and they implemented a daily patient flow registration system. The medical ward also had put into place a poster visualising the order of messages to be sent to the municipality. TV screens and the poster were improvement measures suggested at the 'Meeting Point', but the concurrent implementation of an electronic patient flow registration system might also have contributed to improvement in some patient safety factors in the hospital intervention group. However, the results do indicate a culture fostering organisational learning - continuous improvement and some improvement in information exchange and support for safety improvement among staff. There was an improvement in reports of staffing in the intervention group compared with the control group, and staffing was not an area addressed at the 'Meeting Point'. Data from the follow-up meetings revealed that the emergency room had increased their staffing, and that challenges related to vacant positions were present in the hospital control group.

In the nursing homes, there was a significant and overall negative development from T1 to T3 for most of the patient safety culture factors. The qualitative data report that unexpected organisational changes had taken place in the nursing home intervention group between measurements that may have impacted the study results. Follow-up meetings with the nursing home intervention group revealed that staff perceived improvements in information exchange with the hospital; however, there was no significant intervention effect for this factor. Staffing is reported as an area of improvement in most nursing homes.<sup>29</sup> Although the MLM revealed a small positive effect for staffing, this change cannot be attributed to the 'Meeting Point' intervention. In the nursing home control group, economic constraints were imposed by a new budget model and a reduction in the number of clinical staff.

A further development of the 'Meeting Point' can include full-scale simulation training emphasising inter-professional and interorganisational team training (eg, clinical assessment, information exchange and communication, patient and next-of-kin involvement) in transitional care situations.<sup>17 30 31</sup> For future evaluation of

the 'Meeting Point', including measures at provider and patient levels and more frequent measurements to assess improvement in clinical performance could be useful.

The research team conducted one follow-up meeting between the two postmeasurements. To continue the learning and improvement processes started at the 'Meeting Point' seminars, more involvement and support from the research team, regular reporting and constructive coaching could have fuelled the improvement processes. A systematic review by Nadeem *et al*<sup>10</sup> identified inperson learning sessions, plan-do-study-act cycles, multidisciplinary quality improvement teams, data collection for quality improvement, follow-up calls/email/web support, organisational/leadership involvement and preplanning groups as important for successful interorganisational learning collaboratives.

### Strengths and limitations

Some threats to causal inference in quasi-experimental designs are tied to the selection of participants, statistical regression, dropout and response bias.<sup>32</sup> The intervention and control groups were selected based on their similarity in terms of number of staff and ward type and were included in the study based on the ward leaders' willingness to participate. To control for potential pre-existing difference between the groups,  $\chi^2$  statistics with demographic variables were computed, and we included profession, patient contact and work experience as covariates in the MLM to adjust for possible difference. We also conducted analysis of proportion of non-responders.

Hair *et al*<sup>27</sup> argue that a Cronbach value between 0.60 and 0.70 is acceptable. Internal consistency was questionable with alpha values of 0.50 and below for the nursing home patient safety factors 'Compliance with procedures' and 'Nonpunitive response to mistakes' across T1 and T2, while improved at T2 for 'Communication openness' and was lower for 'Staffing' at T2. Low internal consistency for 'Compliance with procedures' and 'Staffing' has been reported in earlier studies.<sup>23 33</sup> Low internal consistency can be due to low number of items in the factor, the respondents or aspect relating to construct validity.<sup>34</sup> Zúñiga *et al*<sup>33</sup> suggest reformulating and adding items to this factor to 'Compliance with procedures', for example, to include procedures in areas of medication or pressure ulcers relevant to patient safety in nursing homes. As this is the first study applying the Norwegian version of the NHSOPSC in an intervention study to improve patient safety culture, we decided to include all the factors in the statistical analysis. However, we recommend applying the NHSOPSC with a larger study sample to assess the need for refinement.

Sample size estimates were conducted to measure the effects of the intervention. We aimed for, but did not manage to include, 75 participants in the intervention group and 150 in the control group (Storm *et al*<sup>17</sup>). A particular concern is the low number of participants responding to the surveys at T2 and T3 in the nursing home intervention group. The intervention programme

was conducted over a period of 5 months, with the participants meeting at three half-day seminars in order to minimise the problems of taking staff out of clinical work. Despite these efforts, some study participants did not respond to all the questionnaire surveys or did not attend all three 'Meeting Point' seminars, which is a weakness of the study. The MLM model is beneficial with repeated measurements, as it includes participants responding only to one or two of the measurements.

## CONCLUSION

The results show a stable development over time for the safety culture factor 'Handoff and transitions', and small improvements for 'Overall perceptions of patient safety culture' and 'Organisational learning - continuous improvement' for the hospital intervention group compared with the control group. No similar development was reported in the nursing home intervention and control groups. The qualitative data revealed that the intervention group implemented an electronic patient flow system, which was not connected to the 'Meeting Point', thereby reducing the ability to make strong connections between the intervention and the survey results. We believe that the 'Meeting Point' has the potential to be a useful measure for healthcare professionals when aiming to improve patient safety in transitional care of elderly patients. Further use will require a more robust study design as well as work on the key components of the 'Meeting Point' and measurements. In particular, there seems to be a need to address the impact of educational interventions on patient outcomes.

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