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Psychometric properties of the full and short version Nursing Home Survey on Patient Safety Culture (NHSOPSC) instrument: a cross-sectional study assessing patient safety culture in Norwegian homecare services

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ABSTRACT

Objectives Measure patient safety culture in homecare services; test the psychometric properties of the Nursing Home Survey on Patient Safety Culture (NHSOPSC) instrument; and propose a short-version Homecare Services Survey on Patient Safety Culture instrument for use in homecare services.

Design Cross-sectional survey with psychometric testing.

Setting Twenty-seven publicly funded homecare units in eight municipalities (six counties) in Norway.

Participants Five-hundred and forty health personnel working in homecare services.

Interventions Not applicable.

Primary and secondary outcome measures Primary: Patient safety culture assessed using the NHSOPSC instrument. Secondary: Overall perception of service users' safety, service safety and overall care.

Methods Psychometric testing of the NHSOPSC instrument using factor analysis and optimal test assembly with generalised partial credit model to develop a short-version instrument proposal.

Results Most healthcare personnel rated patient safety culture in homecare services positively. A 19-item short-version instrument for assessing patient safety culture had high internal consistency, and was considered to have sufficient concurrent and convergent validity. It explained a greater proportion of variance (59%) than the full version (50%). Short-version factors included safety improvement actions, teamwork, information flow and management support.

Conclusion This study provides a first proposal for a short-version Homecare Services Survey on Patient Safety Culture instrument to assess patient safety culture within homecare services. It needs further improvement, but provides a starting point for developing an improved valid and reliable short-version instrument as part of assessment of patient safety and quality improvement processes.

Strengths and limitations of this study

- ► A strength of this article was that it provided first proposal for a short-version instrument to assess patient safety culture in homecare services, entitled the Homecare Services Survey on Patient Safety Culture.
- ► Another strength was the combined use of a factor analysis, generalised partial credit model and optimal test assembly approach to assess internal consistency, concurrent and convergent validity.
- ► A limitation was the lack of comparison to a 'gold standard' instrument for assessment of convergent validity, although the use of three single-item outcomes compensated somewhat for this.
- ► The largest study assessing patient safety culture in Norwegian homecare services, possibly worldwide.
- ► A limitation was lack of random selection of participants, although variation in contextual settings contributes to strengthen generalisability of results, and a somewhat low response rate, although it was comparable to previous surveys.

INTRODUCTION

A recent systematic review with a meta-analysis, including over 70 studies worldwide with 330 000 patients, found that 1 in 20 experienced preventable health service inflicted harm.[1] Harm could take place in any clinical context, including primary, secondary and tertiary care, involving, for example, infections; diagnostic procedures; and the use of drugs, surgical or other therapeutic interventions. In 12% of patients, harm was severe or fatal. Estimates suggest that in primary and ambulatory care, almost four in ten patients experience safety issues, resulting in increased need for hospitalisation.[2] Patient harm is a major global health burden costing trillions of dollars annually.[3]

Considerable efforts have been made to improve patient safety over the last decades, resulting in some reduction in the prevalence of harm. For example, the mortality rate due to adverse effects of medical treatment decreased by 21% in the USA from 1990 to 2016.[4] However, a significant proportion of patients are still exposed to risk and experience adverse events, some of which are fatal. In Norway, a recent review found that 4.2% of deaths in hospitals could probably have been avoided.[5]

Improving patient safety measures within healthcare services is particularly important for older patients (70+ years) who have 20 times higher mortality rates due to adverse medical effects, compared with younger age groups (15–49 years).[4] Improved patient safety is crucial from a societal perspective as the number of older citizens will increase from 700 million to 1.5 billion worldwide over the next three decades.[6] Most citizens wish to 'age in place', which can be understood as living safely in their own home, regardless of age and ability.[7] A high proportion of older citizens living at home can have significant societal benefits, by reducing the increasing burden to healthcare services and by limiting the need for nursing homes. However, healthcare services must adapt to the demographic shift and attend to the needs of a much larger proportion of older citizens, many of whom have chronic health conditions and will require homecare services.[8]

To advance patient safety, the National Patient Safety Foundation (NPSF) recommended a total systems approach in 2015, where leaders should establish and sustain a safety culture at all levels of patient care, including homecare services.[9] Although the understanding of patient safety culture varies among researchers, Halligan and Zecevic found in their review[10] that the UK Health and Safety Commission's definition[11] was most commonly used: 'The product of individual and group values, attitudes, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety programmes. Organisations with a positive safety culture are characterised by communications founded on mutual trust, by shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures.' NPSF's recommendations are supported by a systematic review, which found that improvements in healthcare services' organisational culture were associated with positive patient outcomes.[12] Although results were similar across clinical settings, most studies took place within the context of hospitals and none within homecare services. A scoping review assessing patient safety culture in care homes for older people found that most studies were carried out in the USA and within nursing homes rather than residential home settings.[13] Since then, three studies have assessed patient safety culture in Norwegian homecare services.[14–16] Two studies found better safety culture scores for homecare nursing compared with other healthcare settings, although there was room for improvement.[14 16] The third identified transformational leadership as important in improving patient safety culture and work engagement in homecare services.[15] These studies contribute to the evidence base to support the WHO's global patient safety action plan 2021–2030 policy to improve patient safety culture in order to eliminate avoidable harm in healthcare.[17]

To assess patient safety culture, validated outcome measures are needed. Several instruments exist, out of which three have been recommended for use in EU member states.[18] Two of these instruments have been further tested and validated, the Safety Attitudes Questionnaire (SAQ),[19] and the Hospital Survey on Patient Safety Culture (HSOPSC).[20] The HSOPSC is completed by healthcare personnel and addresses core components of safety culture, including sharing attitudes, values, perceptions, competencies and behaviours. It was developed in 2004 for hospital contexts and has been found to be an efficient measure of patient safety culture.[21] It has since then been modified and become the most commonly used instrument to assess patient safety culture in primary care,[22] such as the Nursing Home Survey on Patient Safety Culture (NHSOPSC), developed by The Agency for Healthcare Research and Quality.[23]

The NHSOPSC has been translated into Norwegian and was found to be a valid and reliable measure of patient safety culture within the context of nursing homes.[24 25] A slightly modified version has been used in homecare services.[16] There is a need to test the psychometric properties of the instrument in homecare services. Moreover, results of surveys in other fields of research suggest that questionnaire length is negatively associated with response rates.[26 27] It is not unreasonable to assume that the length of the NHSOPSC instrument (41 items) poses increased burden on participants, thereby limiting its usefulness as a measure in clinical practice. A short-version instrument could reduce participant burden and be introduced in routine practice.

The aims of this study were:

1. To measure patient safety culture in Norwegian homecare services.
2. To test the psychometric properties of the NHSOPSC.
3. To propose a short version of the NHSOPSC for use in homecare services and test its psychometric properties.

METHODS

Design

A cross-sectional and psychometric design was used to assess patient safety culture in homecare services in Norway using the NHSOPSC instrument. Health personnel working in 27 publicly funded homecare units in 8 municipalities in 6 counties in Norway were recruited through 2 research projects (further information follows). Data from the two projects were merged and analysed collectively. An optimal test assembly (OTA) approach with psychometric testing was used to develop a proposal for a short-version NHSOPSC instrument.

Clinical context

In Norway, healthcare provision is the responsibility of the government. It provides over 95% of all homecare services, with equal access for citizens regardless of socioeconomic status, ethnicity or area of residence.[28] The aim is for care recipients to stay at home as long as possible, and nursing homes are only used when citizens can no longer live in their home.[29] Although there is variation between homecare services, they primarily consist of nursing at home, and to a smaller extent practical assistance to support a physically and socially active life. Public homecare services are adapted to individuals' care needs, based on assessments of a broad range of areas, including, for example, daily help required for treatment (eg, medication administration), personal hygiene, rehabilitation, wound/palliative care, physical activity, housework, mental health management and social activities.[30] Services may be time-limited or permanent, but must meet acceptable minimum care and safety standards. Management of homecare services is delegated to the 356 municipalities and services are provided by different categories of health personnel (eg, nurses, general practitioners, physiotherapists, untrained healthcare workers).

Participants and setting

Purposeful sampling was used to increase generalisability of results, through inclusion of homecare services in different municipalities over a wide geographical area, due to the country's variation in contextual settings, such as municipality type (urban/rural), municipality size (median 26 000, range 4600–79 000) and distance to hospitals.

Recruitment of homecare services took place through two projects: Digital Solutions for Increased Quality, Improved Patient Safety and Efficient Use of Resources in Municipal Healthcare (DigiPAS) by SINTEF, an independent private multidisciplinary research organisation, in collaboration with the University of South-Eastern Norway; and Improving Quality and Safety in Primary Care—Implementing a Leadership Intervention in Nursing Homes and Homecare (SAFE-LEAD),[31] run by SHARE—Centre for Resilience in Healthcare, at the University of Stavanger. In the SAFE-LEAD project, coresearchers from the Centre for Development of Institutional and Homecare Services (USHT) contacted managers in all homecare units with information about the project, followed by researchers meeting each unit. Homecare service managers provided researcher with email contact lists, which were used to send a link to the online questionnaire by email to employees. Five survey reminders were sent. The response rate was 57% (table 1).

Data collection

Participants completed the survey digitally. Data collection took place from 1 March to 8 April 2018 in the SAFE-LEAD project, and 26 March to 9 May 2019 in the DigiPAS project. Response time was 20 and 14 min, respectively. Responses were automatically transferred to research centres.

Table 1 Response rates according to municipality size

	Invited (n)	Responders (n, %)	Municipality size (n)
Municipality 1	295	160 (54.2)	50–55 000
Municipality 2	230	140 (60.9)	25–30 000
Municipality 3	93	71 (76.3)	60–65 000
Municipality 4	75	65 (86.7)	15–20 000
Municipality 5	116	30 (25.9)	25–30 000
Municipality 6	46	27 (58.7)	<5000
Municipality 7	47	25 (53.2)	5–10 000
Municipality 8	39	22 (56.4)	70–75 000
Total	941	540 (57.4)	

Cumulative per cent for 540 participants, missing values not included (n=28).

Questionnaire and instrument

The questionnaire (online supplemental appendix A) included the validated Norwegian version of the NHSOPSC instrument,[16 24] overall perception of service safety (see Optimal test assembly section), and participant characteristics (age, position/education, years in current workplace, shift type, work hours per week, extent of patient contact).

NHSOPSC originally consisted of 42 items (12 dimensions, Cronbach's alpha 0.71–0.86) (US version),[23] whereas the Norwegian validated version consisted of 41 items (10 dimensions, Cronbach's alpha 0.55–0.90)[24 25]: teamwork staffing, compliance with procedures, training and skills, non-punitive responses to mistakes, handoffs, feedback and communication about incidents, communication openness, supervisor expectations and actions promoting patient safety, and management and organisational learning. Wording was slightly modified to fit the homecare setting, by replacing 'nursing homes' with 'unit' and 'patient' with 'user[15 16]' (online supplemental appendix A). Items were rated on 5-point Likert scales, from 1 (never or totally disagree) to 5 (always or totally agree). The full-scale instrument is presented in online supplemental appendix B, the developed short versions presented in online supplemental appendixs C and D. The average percentage of positive scores was calculated for each individual dimension, in line with previous research, and an average of at least 60% positive responses was considered a good score, as this has been shown to indicate lower risk of adverse events.[23 25 32]

Data analyses

Data were analysed to report on patient safety culture in homecare services, to test the psychometric properties of the NHSOPSC instrument, and to develop a proposal for a short version of NHSOPSC for use in homecare services. NHSOPSC instrument assessment was carried

out by testing internal consistency, factor analysis and a generalised partial credit model (GPCM) approach. Patient safety culture was reported using the best version of the NHSOPSC instrument identified through an OTA approach, and reporting mean item scores and proportion of participants positively scoring instrument items and three single-item outcomes. Data were normally distributed. Alpha was set to 0.05. Statistical analyses were carried out using SPSS (V.25.0) and GPCM analyses using STATA (V.16.1).

Factor analysis

Factor analysis was used to test the full-version 41-item NHSOPSC instrument with data from 540 participants. Only factors with initial eigenvalue of minimum 1 were included. For development of 2 candidate short-version instruments, 2 of the 41 NHSOPSC instrument items were first removed, as they were outcomes rather than instrument items ('the homecare services are safe for service users' and 'service users are well cared for'). In factor analyses for short-version 1 and 2, items with factor loadings (Λ) below 0.4 were excluded, as suggested by Stevens.[33]

Based on previous publications, we expected factors to be correlated with each other. Nevertheless, we carried out initial testing of correlations using oblique rotation (direct oblimin) as suggested by Tabachnick and Fidell.[34] For the full-version instrument, 8 out of 21 factor correlations were above 0.32 (maximum=0.65), suggesting minimum 10% overlap in variance among some factors (online supplemental appendix E). Similarly, significant overlap was found for candidate short-version instruments (short-version 1: 6 of 15 factor correlations; and short-version 2: 6 of 6 factor correlations). We did, therefore, not apply orthogonal rotation, but used oblique rotation.

Kaiser-Meyer-Olkin measure of sampling adequacy test was ideal for the full-version instrument (0.95) and candidate short-version 1 (0.94) and 2 (0.94). Bartlett's test of sphericity for the full-version instrument indicated that 21 correlations significantly differed from zero (χ^2 (820)=11 886, p<0.001), and 15 correlations for candidate short-version 1 (χ^2 (351)=7884, p<0.001) and for 6 for short-version 2 (χ^2 (190)=6758, p<0.001).

Generalised partial credit model (GPCM)

For development of the second candidate short-version instrument, a GPCM was carried out prior to factor analysis.[35] The partial credit helps to evaluate items that may be scored on a scale, instead of dichotomous outcomes. The generalised approach was used to determine measurement quality of items, rather than assuming that items were of equal discrimination. Items with high discrimination parameters are likely to contribute better at obtaining estimates of the latent trait of interest. GPCM was therefore used to assess each individual item's discrimination (precision) and the total instrument's function consists of the sum of the individual polytomous items. Although the use of Likert scales implied that individual items contained ordinal data, the sum scores across instruments can be considered to be interval.[36] The GPCM approach was therefore used, instead of the graded response model. Individual item information function was assessed by boundary and category characteristic curves. Items with low discrimination parameters (coefficients<1) were removed.

Optimal test assembly (OTA)

To determine whether either of the short-version instruments could be recommended to replace the full-version instrument, we applied an OTA approach, partially based on recommendations by Harel and Baron.[35] Our approach differed slightly from their suggestions, as our dataset did not include a second validated instrument for assessment of convergent validity. Instead, we compared correlation between instrument sum scores and three outcomes. Our OTA approach included a four-stage process to determine whether:

1. Candidate short-version instruments maintain 95% of Cronbach's alpha of the full-length instrument (internal consistency).
2. The correlation of short-version instrument summed scores was at least 0.95 of the full-length instrument (concurrent validity).
3. The correlation of candidate short-version instrument factor scores was at least 0.95 of the full-length instrument (concurrent validity).
4. The correlation of candidate short-version instrument summed scores with three outcomes were at least 0.95 of the full-length instrument (convergent validity).

Weaknesses associated with the use of Cronbach's alpha as a measure of internal consistency has been pointed out by others.[37] Therefore, we also calculated the omega coefficient.

The first of the three outcomes was a single-item question ('overall, how do you consider users' safety when using these homecare services'), used as an outcome in previous patient safety culture studies within the context of nursing homes[23 25] and homecare services.[16] The other two outcomes were the two single items removed from the full-version instrument as the first step in developing candidate short-version instruments.

The OTA results, together with results of a factor analysis, were used to consider if any of the NHSOPSC instrument versions could be recommended for assessing patient safety culture within the context of homecare services.

Analysis of patient safety culture

Patient safety culture was assessed using the best version of the NHSOPSC instrument identified through the OTA approach. Results included mean overall and factor scores, and proportion of items indicating participants' perception of a positive patient safety culture (scored as 'agree' or 'entirely agree', or 'often' or 'always'). Multiple regression analysis was used to determine influence of participants' age, education/background, number of

years in current practice, number of hours worked per week, or municipality, on the instrument total score. There were no violations of linearity/undue influence of single cases on the model (Cook's distance=0.002) and no evidence of multicollinearity (tolerance>0.2). The plotted residuals did not suggest homoscedasticity. Standardised residuals were normally distributed, the normal probability plot was sufficiently linear and the scatterplot did not show any specific pattern for standardised residuals. Pearson correlation was calculated to determine the association between the overall NHSOPSC score and each of the three individual outcomes.

Patient and public involvement

Stakeholder involvement was used in all phases of the SAFE-LEAD project, including representatives of patients/users and next of kin, a patient and user ombudsman and managers in nursing homes and homecare services. Coresearchers from the USHT were involved in planning and recruitment of participants in this survey.

RESULTS

A total of 540 health personnel working in homecare services participated (response rate 57%, table 1). Most were healthcare workers with upper secondary school education (45%) or healthcare personnel (minimum Bachelor's degree) (36%) (table 2). The remaining were untrained care assistants (13%), managers (3%), administrative (1%) or other personnel (3%). The majority (93%) worked directly with service users most of the time. Most health personnel were from 30 to 59 years (73%), 1 in 5 was under 30 and 1 in 10 above 60. Almost two out of three had practised for minimum 6 years, 30% had less than 1 year's experience.

We will now present the process of developing a short-version NHSOPSC proposal for use within homecare services. It involves development of two candidate short-version instruments and comparison to the full version. The version fulfilling most criteria is selected as the final short version. We also present the psychometric properties of the full and short versions. Finally, we use the instrument to assess patient safety culture within the context of Norwegian homecare services.

Factors of full and candidate short-version instruments

Analysis of the full-version NHSOPSC instrument resulted in seven factors explaining 50.3% of the variance (Λ range 0.32–0.88). The analysis did not confirm the former 10-factor solution used in nursing homes[24] and homecare services[16] (online supplemental appendix B). Candidate short-version 1 resulted in six factors explaining 54.7% of the variance (Λ range 0.42–0.94). Factors included: (1) safety improvement actions (eight items); (2) teamwork (four items); (3) information flow (five items); (4) management support (four items); (5) compliance with procedures (four items); and (6) managing workload (two items) (online supplemental appendix C). Candidate short-version 2 resulted in four factors explaining 59.2% of the variance (Λ range 0.43–0.96). Factors included: (1) safety improvement actions (eight items); (2) teamwork (four items); (3) information flow (three items); and (4) management support (four items) (online supplemental appendix D).

Table 2 Participants' characteristics

	N (%)
Age group	
20–29 years	103 (19.1)
30–39 years	123 (22.8)
40–49 years	127 (23.5)
50–59 years	138 (25.6)
60+ years	49 (9.1)
Position/education	
Managers (including leaders at first-line level)	17 (3.1)
Healthcare personnel (minimum Bachelor's degree)	194 (35.9)
Healthcare workers (upper secondary school)	242 (44.8)
Care assistants (untrained)	68 (12.6)
Administrative personnel	5 (0.9)
Other	14 (2.6)
Number of years in current workplace	
<1 year	163 (30.2)
1–5 years	38 (7.0)
6–10 years	122 (22.6)
11–15 years	84 (15.6)
16–20 years	81 (15.0)
21+years	52 (9.6)
Amount of work per week	
<15 hours	28 (5.2)
16–24 hours	103 (19.1)
25–35.5 hours	298 (55.2)
>35.5 hours	111 (20.6)

Cumulative per cent for 540 participants, missing values not included (n=28).

Internal consistency

All versions had high internal consistency (Cronbach's alpha 0.93–0.95) (table 3). The omega coefficient was found to be identical to Cronbach's alpha for the full-version and short-version 1 instrument, and marginally higher for short-version 2 (0.93 vs 0.94). Short versions were both within the boundary of the first OTA criterion by maintaining over 95% of Cronbach's alpha compared with the full version (short-version 1: 97.9%, short-version 2: 98.4%).[33]

Table 3 Patient safety culture measured using full and candidate NHSOPSC short-version instruments

	Full version		Short-version 1		Short-version 2	
	Mean (SD)*	α†	Mean (SD)*	α†	Mean (SD)*	α†
Items (n)	41		27		19	
Factors (n)	7		6		4	
Complete	3.8 (0.5)	0.95	3.7 (0.5)	0.93	3.8 (0.6)	0.93
% of full version				97.9%		98.4%
Factor 1: safety improvement actions	3.8 (0.6)	0.92	3.7 (0.6)	0.91	3.7 (0.6)	0.91
Factor 2: teamwork	3.9 (0.6)	0.85	4.1 (0.6)	0.84	4.1 (0.6)	0.84
Factor 3: information flow	3.7 (0.6)	0.84	3.7 (0.6)	0.80	3.7 (0.7)	0.79
Factor 4: management support	3.9 (0.7)	0.87	4.0 (0.7)	0.87	4.0 (0.7)	0.87
Factor 5: compliance with procedures	3.8 (0.6)	0.62	3.7 (0.6)	0.64		
Factor 6: managing workload	3.3 (0.6)	0.47	2.8 (0.8)	0.61		
Factor 7: reporting mistakes	3.7 (0.8)	0.67				

*Mean scores and SD for complete instrument and instrument factors.
†Instrument's internal consistency measured using Cronbach's alpha.

Concurrent validity

Comparison of summed scores for short and full version instruments was above the minimum threshold of 0.95 (table 4). Results therefore fulfilled the criterion of the second OTA rule.[35] Correlation coefficients for factor scores comparing short-version 1 with the full-version instrument ranged from 0.75 to 0.99, with four out of seven below the threshold of 0.95 (table 4). For short-version 2, two out of four factor correlations were below the minimum, although not as low as for short-version 1.

Table 4 Comparison of summed and factor scores for full and candidate NHSOPSC short-version instruments

	Short-version 1		Short-version 2	
Full version	r*	sig.	r*	sig.
Sum†	0.99	0.000	0.96	0.000
Factor 1: safety improvement actions	0.99	0.000	0.99	0.000
Factor 2: teamwork	0.92	0.000	0.92	0.000
Factor 3: information flow	0.96	0.000	0.91	0.000
Factor 4: management support	0.96	0.000	0.96	0.000
Factor 5: compliance with procedures	0.75	0.000		
Factor 6: managing workload	0.93	0.000		
Factor 7: reporting mistakes				

*Pearson correlation.
†Sum: total score of the scale.

Convergent validity

Correlation coefficients for summed scores and short-version 1 outcomes were from 89% to 104% of the full-version instrument (table 5). Similarly, results for short-version 2 were from 89% to 102% of the full version. Hence, results were within the 95% threshold level for OTA criterion for two of the comparisons, and below for one comparison.

Instruments to assess patient safety culture in homecare services

The two candidate short-version instruments fulfilled some, but not all, of the OTA criteria. Both short versions fulfilled the first two criteria (internal consistency, concurrent validity). For the third criterion (second part of concurrent validity), some factors were within the minimum threshold for concurrent validity, others were not. Short-version 2 was however close to the minimum threshold. For the fourth criterion (convergent validity), both short versions were within the minimum threshold for two out of three outcomes, and slightly below for one. Factor analyses suggested short-version 2 explained more of the variance (59.2%) than short-version 1 (54.7%), and both did better than the full version (50.3%).

In summary, it was not possible to draw firm conclusions to determine which of the three versions should be preferred. However, the results favour short-version 2 as it scored well on most tests, explained more of the variance and the individual items fit well with the four factors which include: (1) safety improvement actions; (2) teamwork; (3) information flow; and (4) management support.

Patient safety culture in Norwegian homecare services

Employees' overall perception of a positive patient safety culture was suggested by the mean score of 3.8 (SD 0.6) and 69% of items scored positively in the 19-item short-version 2 NHSOPSC instrument (table 6). Positive results

Table 5 Correlation between instruments' summed scores and outcomes

	Full version	Short-version 1		Short-version 2	
Outcomes	r*	r*	% of full version	r*	% of full version
Overall safety of service users	0.61	0.59	95	0.58	95
The homecare services are safe for service users	0.67	0.59	89	0.60	89
Service users are well cared for	0.63	0.65	104	0.64	102

*Pearson correlation.

were found for all four factors: 'teamwork' (4.1, SD 0.7, 78%), 'management support' (4.0, SD 0.7, 78%), 'safety improvement actions' (3.7, SD 0.6, 63%) and 'information flow' (3.7, SD 0.7, 64%). A linear regression did not suggest significant influence of age, education/background, years in current practice, hours worked per week or municipality (data not shown).

The three single-item outcomes indicated perception of positive patient safety culture: overall perception of service users' safety (4.0, SD 0.7, 75%), service safety (4.1, SD 0.7, 84%) and overall care (4.2, SD 0.7, 86%). Scores positively correlated with short-version 2 NHSOPSC sum scores (p<0.001).

DISCUSSION

Results of this study suggest the majority of healthcare personnel rated patient safety culture positively in Norwegian homecare. This includes positive ratings for information flow, teamwork, management support and patient safety actions. Results indicate that the NHSOPSC instrument could potentially be reduced to half the number of items. Psychometric testing suggested the short-version instrument was comparable to the full version. An arising question is how the instrument compares to previous studies.[24 25] Three dimensions—teamwork, information flow and management—were comparable to previous studies. The safety improvement actions dimension encompassed several items from dimensions included in the original full version (incident feedback/communication; communication openness; supervisor expectations and safety actions; and management/organisational learning). However, the short version did not include staffing; compliance with procedures; training and skills; and non-punitive responses to mistakes.

Out of the other patient safety culture instruments recommended for use in EU member states,[18] the SAQ has been tested and validated, also within the context of Norwegian homecare services.[19] It includes six dimensions, out of which two share considerable resemblance to NHSOPSC dimensions focusing on perceptions of teamwork and management support. SAQ safety climate and working conditions dimensions share some resemblance to items from different NHSOPSC dimensions. For example, items addressing feedback performance and learning from others' mistakes under SAQ's safety climate dimension, would fit under two different NHSOPSC dimensions (management support and safety improvement action). Furthermore, SAQ dimensions of job satisfaction and stress recognition are not covered by the NHSOPSC instrument. We suggest it might be more appropriate to assess job satisfaction as a separate outcome measure that may influence patient safety culture.

A significant advantage of the NHSOPSC instrument, in particular the short version, over the SAQ instrument, is the reduced burden it poses on health personnel in everyday practice (19 vs 62 items).

Differences between our current findings and previous studies using the NHSOPSC or SAQ instruments raise the question of which dimensions are needed to assess patient safety culture. The commonly used patient safety culture definition,[11] emphasises shared perceptions of safety importance and communication within the context of trusting relationships. This is captured by both the full and short version NHSOPSC instrument. However, the definition provides a very general and overarching description of patient safety culture. Moreover, there is disagreement as to how patient safety culture should be defined.[10] Lack of clarity in definitions and discrepancies between dimensions in the full-version NHSOPSC instrument and previous research,[16 24 25] raises questions about the instrument's validity and reliability, at least in Norwegian homecare service settings. Lack of consistency warrants further studies to develop agreement on the definition of patient safety culture and instruments to assess clinical practice and research.

Among original NHSOPSC dimensions not included in the short version, we suggest items should cover staffing and non-punitive responses to mistakes. These dimensions seem to be of significant importance to patient safety culture. First, in previous research, these had the highest need for improvement.[38] Second, staffing has been found to have strong predictive value on health personnel's perception of patient safety[38–40] and patient safety outcomes[41–43] in different settings and countries. Thirdly, we consider non-punitive responses to mistakes important due to considerable variation between countries and clinical settings in blame culture,[16] which may significantly influence patient safety culture.[38 39 44] Healthcare personnel in Norwegian studies score higher on non-punitive responses to mistakes compared with international studies,[16] which might be explained by the non-hierarchical structure in Norway.[45] Exclusion

Table 6 Patient safety culture in Norwegian homecare services (n=540)*

	Mean (SD)	Positive responses (n, %)†
Overall score	3.8 (0.6)	(69.4)
Factor 1: safety improvement actions	3.7 (0.6)	(62.8)
Item 1: management asks staff how the services can improve patient safety (U2)	3.7 (0.9)	341 (61.3)
Item 2: it is easy to make changes to improve service users' safety (U3)	3.6 (0.8)	321 (57.7)
Item 3: the service is always doing something to improve service users' safety (U4)	3.7 (0.7)	366 (65.8)
Item 4: a good job is done to keep service users safe (U5)	3.9 (0.7)	422 (75.9)
Item 5: management listens to staff ideas and suggestions to improve safety (U6)	3.9 (0.8)	423 (76.1)
Item 6: management regularly stays in touch with service users in order to assess the care (U8)	3.2 (1.0)	214 (38.5)
Item 7: changes to improve service users' safety are evaluated (U9)	3.5 (0.8)	293 (52.7)
Item 8: within this unit, we discuss ways to keep service users safe from harm (C8)	3.9 (0.8)	424 (74.6)
Factor 2: teamwork	4.1 (0.7)	(78.0)
Item 1: staff in our unit treat each other with respect (W1)	4.2 (0.8)	449 (79.0)
Item 2: staff within our unit support each other (W2)	4.2 (0.8)	459 (80.8)
Item 3: staff feel like they are part of a team (W5)	4.0 (0.8)	444 (78.1)
Item 4: when someone gets really busy, other staff help out (W9)	4.0 (0.8)	421 (74.1)
Factor 3: information flow	3.7 (0.7)	(63.8)
Item 1: staff are told what they need to know before taking care of a service user for the first time (C1)	3.8 (0.8)	377 (66.4)
Item 2: staff are told right away when there is a change in a service user's care plan (C2)	3.4 (0.9)	268 (47.2)
Item 3: staff are given all the information they need to care for service users (C10)	3.9 (0.7)	442 (77.8)
Factor 4: management support	4.0 (0.7)	(77.8)
Item 1: my supervisor listens to staff ideas and suggestions concerning service users' safety (M1)	4.1 (0.8)	447 (79.3)
Item 2: my supervisor says a good word to staff who follow the right procedures (M2)	4.0 (0.9)	428 (75.9)
Item 3: my supervisor pays attention to service users' safety (M3)	4.3 (0.7)	497 (88.1)
Item 4: staff ideas and suggestions are valued (C7)	3.8 (0.8)	387 (68.1)

*Based on the proposed short-version 19-item NHSOPSC Scale.
†'Positive responses' were defined as responding 'agree' or 'entirely agree', or 'often' or 'always' to individual items. Valid per cent, missing data for factor 1 (n=12) and factor 4 (n=4), no missing data for factors 2 and 3.

of these dimensions may limit the instrument's ability to assess important aspects of patient safety culture. However, items covering these two dimensions in the original NHSOPSC are not valid, at least not within the context of Norwegian homecare services. We therefore suggest new items should be developed to cover these dimensions and be tested with the other dimensions in a revised short version. Healthcare personnel with different backgrounds (eg, nurses, general practitioners, physiotherapists, occupational therapists) should be involved in the development process to ensure relevance and face validity. Finally, we also recommend the instrument title reflects the contextual setting of homecare services, and therefore propose renaming it the Homecare Services Survey on Patient Safety Culture.

Strengths and limitations of this study

This was the second and largest study assessing patient safety culture in homecare services in Norway. To the best of our knowledge, it was the largest study assessing patient safety culture in homecare worldwide. Overall response rate was not ideal, but not far off from our previous survey,[24] and comparable to research involving nurses.[46] Although participants were not randomly selected, variation in contextual settings (eg, geographical, distance to hospitals, urban/rural areas) was used to increase generalisability of results, and should be representative for Norwegian homecare services. Another limitation was variability in response rates between municipalities. Caution should be made when generalising findings to other countries with different structures and organisation of services, and to other healthcare settings.

This was the first study developing a proposal for a short-version instrument to assess patient safety culture within homecare services. The factor analysis and OTA approach was a strength of this study. It provides assessment of internal consistency, concurrent and convergent validity. Others found that inclusion of factors with initial eigenvalue of minimum 1 may overestimate or underestimate the number of components.[47] However, Velicer's minimum average partial (MAP) test also resulted in a four-factor model for the recommended short-version instrument (data not shown).

In lack of a 'gold standard' instrument to assess convergent validity, we used single-item outcomes previously

used.[16 24 25 48 49] The use of single items might not capture variability and the use of an additional instrument such as the SAQ[19] is recommended to assess convergent validity in future studies. In the current study, we did however find comparable results using all three single-item outcomes. The GPCM approach helped to determine whether items were discriminable. In future studies, variance-based structural equation modelling could be used as an addition to the OTA approach, to assess discriminant validity.[50]

CONCLUSION

The ageing population worldwide, with increased risk of adverse events within the context of citizens' homes, requires strengthened focus on patient safety within homecare services. The results of this study showed that the majority of home healthcare personnel rated patient safety culture positively. Patient safety culture is central for assessing and improving patient safety. Valid and reliable instruments are needed. The NHSOPSC is the most commonly used instrument, but its length carries significant burden on personnel who struggle to carry out daily tasks. This article proposes the first short version of the NHSOPSC instrument, which could serve as a starting point for an improved short-version Homecare Services Survey on Patient Safety Culture instrument for assessing patient safety culture within homecare services. Psychometric tests indicated that the short-version instrument was comparable to the full version, and both had high internal consistency. Nevertheless, there is a need to further develop a validated short-version instrument to ensure relevance and validity. A short-version instrument would be less time-consuming and reduce burden on personnel. It is more likely to be used in routine practice, and to give higher response rates in research projects. Results could potentially be transferred to other clinical contexts.

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Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

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