Psychometric Properties of the Norwegian translation of the Safety Attitudes Questionnaire (SAQ), Generic version (Short Form 2006)

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Abstract

Background

How to protect patients from harm is a question of universal interest. Measuring and improving safety culture in care giving units is an important strategy for promoting a safe environment for patients. The Safety Attitudes Questionnaire (SAQ) is the only instrument that measures safety culture in a way which correlates with patient outcome. We have translated the SAQ to Norwegian and validated the translated version. The psychometric properties of the translated questionnaire is presented in this article.

Methods

The questionnaire was translated with the back translation technique and tested in 47 clinical units in a Norwegian university hospital. SAQ’s were distributed to 1911 frontline staff. 762 were distributed during unit meetings and 1149 through the postal system. Cronbach alphas, item-to-own correlations, and test-retest correlations were calculated, and response distribution analysis and confirmatory factor analysis were performed, as well as embryonic validity tests.

Results

1306 staff members completed and returned the questionnaire: a response rate of 68 %. Questionnaire acceptability was good. The reliability measures were acceptable. The factor structure of the responses was tested by confirmatory factor analysis. 36 items were ascribed
to seven underlying dimensions: Teamwork Climate, Safety Climate, Stress Recognition, Perceptions of Hospital Management, Perceptions of Unit Management, Working conditions, and Job satisfaction. Goodness-of-Fit Indices showed reasonable, but not indisputable, model fit. External validity indicators – recognizability of results, correlations with “trigger tool”-identified adverse events, with patient satisfaction with hospitalization, patient reports of possible maltreatment, and patient evaluation of organization of hospital work – provided preliminary validation.

Conclusion

The SAQ in its Norwegian translation showed satisfactory psychometric properties. Further validation by patient outcomes should be performed.
**Background**

How to create a culture that supports patient safety is a question of considerable interest. The Safety Attitudes questionnaire (SAQ) is the most widely used instrument for measuring patient safety culture and it may be used to guide intervention. Including our Norwegian translation the SAQ has been translated into seven languages, and has now been administered in over 1300 hospitals in the USA, United Kingdom, Switzerland, Germany, Norway, Sweden, Spain, Portugal, Italy, Turkey, and New Zealand (written communication, C. Fullwood, Oct 2007). It is the instrument whose psychometric properties are best documented [1], [2].

The SAQ aggregates the attitudes and perceptions of personnel and gives a snapshot of the patient safety culture at the level of care giving units [3]. It maintains continuity with its predecessor, the FMAQ, which is a traditional human factors survey with a 20-year history in aviation. It has been adapted for use in ICUs, operating rooms, inpatient wards, ambulatory clinics, emergency departments, maternity wards, and pharmacies. It exists now in a generic version which takes only 10-15 minutes to complete.

The SAQ measures six dimensions of patient safety culture: teamwork climate, safety climate, job satisfaction, stress recognition, perceptions of management and working conditions. Benchmark scores from 203 clinical areas in USA, UK and New Zealand have been published with an overall response rate of 67 %, ranging from 66 % to 72 % across administrations [2]. The SAQ is also the only questionnaire which shows links to patient outcome: a well-developed patient safety culture, as measured by the SAQ, has been shown to correlate with
fewer medication errors, lower ventilator associated pneumonia rates, fewer blood-stream infections, and shorter ICU lengths of stay [1,4,5].

The purpose of this article is to present the psychometric properties of the generic version of the SAQ on Norwegian data.

Methods

Setting

The survey was carried out in the somatic clinical areas of Akershus University Hospital October-December 2006. The hospital has 500 somatic (and 200 psychiatric) beds, 4200 employees, and an annual budget of 2,500,000,000 NOK (approximately 450 million US$). It serves a population of 280,000 people, treats 53,000 in-patients and provides 150,000 out-patient consultations annually. Most in-patients (85 %) are unscheduled emergency admissions. The safety culture survey was part of a patient safety strategy which the hospital has adopted, which follows guidelines developed by the Institute of Healthcare Improvement [6]. The heads of the clinical departments were informed about the survey in a meeting and in a letter from the CEO.

Translation

Linguistic validation of our translation was performed with the back-translation technique [7]. The questionnaire was first translated from English into Norwegian by one translator and then translated back into the source language by an independent translator (an American nurse and
researcher who has worked for many years in Norway and is fluid in both languages), who
was blinded to the original questionnaire. We (ED and DH) compared independently the
instrument in its original English version and the version translated back to English, and
discussed the retranslation with one of the authors of the American questionnaire, resulting in
minor reformulations of the translation of a small number of items before the Norwegian
version of the questionnaire was tried out at the Akershus University Hospital.

Data collection

Data were collected during regular staff meetings in the somatic care-giving units in
agreement with the unit leaders, nurses by wards, physicians, physiotherapists and
radiographers by department or section. Completing the questionnaire was voluntary. To
alleviate fears of small-group responder identification, we promised that results would not be
analysed across professions at unit level. Staff not present at the meetings was sent the
questionnaire by hospital mail, with a preaddressed envelope and a sheet with information
about the survey attached. To keep track of the number of questionnaires administered,
questionnaires were numbered individually. The responders names were not recorded in the
questionnaire and there were no name-and-number lists. Those who completed their
questionnaire during the meeting were crossed out from the list of employees by the unit
leader, who later told us who had not attended the meeting and should get their questionnaire
by mail. Those who received it by mail crossed out their names on their local unit’s list when
they had returned the questionnaire. To reduce the number of non-responders, a designated
person in the care-giving unit was asked to provide one reminder to persons who hadn’t
crossed out their name from the local list.
Physicians and physiotherapists often serve more than one care-giving unit. In order not to reduce their contribution to assessing the hospital’s safety culture, physicians and physiotherapists were given the opportunity to fill out one questionnaire for each of (up to) three care-giving units. To keep account of the response rate the three questionnaires filled out by physicians and physiotherapists had the same number, but were supplied with an additional a, b, and c. Physicians and physiotherapists were asked to identify the care-giving unit and department they were reporting on by filling out empty boxes for this information in the questionnaire, for other responders these boxes were filled out by us in advance. The information sheet contained a list of care-giving units participating in the study.

Questionnaires were distributed to a total of 1911 frontline personnel in 47 somatic care giving units of 14 ambulatory clinics, 27 wards, four labs, one operation unit, and one anaesthetic department. 762 staff were given the SAQ in staff meetings and 1149 received it through the hospital’s postal system.

Test-retest examination

The test-retest examination was performed in the hospital’s radiology lab, which with its 97 employees is one of the largest clinical units in the hospital. Its questionnaires were, in addition to the serial number, marked to show if the questionnaire was from the first measurement or the second. The time interval between the two measurements was three weeks.
Data processing

Questionnaires were scanned by the optical reading program Snap Survey. In cases where different postal responders had used different names for the same care-giving unit (for example “S5” and “Big children ward”), we harmonized the names into a complete and mutually excluding list of unit names. The factor structure of the responses were analysed using AMOS. SPSS was used to estimate Cronbach alphas, item-to-own correlations, intercorrelations of factors, test-retest correlations and all item-descriptive statistics.

Results

Response rates

1306 of the 1911 persons invited to participate completed and returned the questionnaire (68 %). Including the additional questionnaires returned by physiotherapists and physicians who served more than one ward, a total of 1460 completed questionnaires were returned. The response rate was much higher for questionnaires distributed in meetings (96 %) than for those distributed through the mailing system (50 %). The response rate was markedly lower for physicians (52 %) than for non-physicians. The response rate varied across units from 44 % to 100 %.

Hypothesized factor structure

Technical reports from the SAQ developers at the University of Texas at Austin and the Johns Hopkins University [3] specifies the six factors as described in Table 1 (See additional file table1.xls: Table 1. The six SAQ factors of the non-generic SAQ versions (ICU version).)
No report on the factor structure of the generic short version of the SAQ has been published. As this version of the questionnaire introduced a split of the questions on perceptions of management into two sets, one on hospital (top) management and one on local (unit) management, we were obliged to reformulate slightly the questionnaire’s hypothesized factor structure by imagining two management perception factors instead of one, each containing its set of the five split questions on perceptions of management, as shown in Table 2 (See additional file table2.xls: Table 2. SAQ 2006 Short form, original formulations, Norwegian translations). Because the SAQ Short Form item #29 (“The levels of staffing in this clinical area are sufficient to handle the number of patients”) were not included in the items split on unit and top management, we concluded it was not considered a part of the two perceptions of management factors. We hypothesized it to be part of the working conditions factor. In our hypothesized seven factor structure, factors Teamwork climate, Safety climate, Stress recognition, and Job satisfaction are identical with the ones defined by the developers of the non-generic SAQ-versions (except that “this clinical area” was substituted for “this ICU”). The three other factors were hypothesized as in Table 3 (See additional file table3.xls: Table 3. Re-hypotesizing three SAQ factors for the generic SAQ version).

Cronbach’s alphas
The Cronbach’s alphas (.68 to .85) of our seven factors are shown in Table 4 (See additional file table4.xls: Table 4. Cronbach’s alphas by factor). For no factor the exclusion of any variable would noticeably increase the $\alpha$-value.

Item-to-own-factor correlations
All items correlated more highly with its own factor than with any other factor.
Confirmatory factor analysis

We tested the factor structure by confirmatory factor analysis. Our factor structure model in presented in Figure 1 (See additional file figure1.doc: Figure 1. Factor structure model). Goodness-of-fit indices for the model are shown in Table 5 (See additional file table5.xls: Table 5. Goodness-of-fit indices for factor structure model).

Intercorrelation of factors

The intercorrelations of the extracted factors are presented in Table 6 (See additional file table6.xls: Table 6. Intercorrelation of factors (n = 696)). Except for the factor Stress recognition, factors were relatively strongly intercorrelated (.39 < r < .70).

Test-retest reliability

Test-retest correlations were considerably higher for (additive) factor scores (reversed items were re-reversed before summing) than for single items (table not shown). As shown in Table 7 (See additional file table7.xls: Table 7. Test-retest correlations (by factor and profession)), test-retest correlations exceeded 0.7 for five of the seven factors (the exceptions were Stress recognition and Perceptions of hospital management). Correlations were considerably higher among physicians than among other staff, both for single items and for (additive) factors – for physicians, all test-retest correlations were above 0.7.
Item discriminatory ability

Item responses were clearly skewed towards the positive, but showed considerable variation (See additional file table8.xls: Table 8. Item and index variation). For all items, all categories were ticked.

There was also considerable variation across professions, departments, and – particularly – wards, as exemplified by Figures 2-4 (See additional files figure2.doc: Figure 2. Variation in Safety climate factor average across professions, figure3.doc: Figure 3. Variation in average score on item “Disagreements in this clinical area are _ resolved appropriately (not who is right, but what is best for the patient”, across hospital departments, and figure4.doc: Figure 4. Variation in Safety climate factor average across wards/outpatient clinics).

Embryonic external validation

Four indications provide embryonic external validation of the translation used at the Akershus University Hospital.

First, when we fed the results back to the surveyed hospital units, their general reaction was “Yes. This may well be us”.

Second, the hospital’s Quality Department reported recognizing the picture that had been painted by the questionnaire’s results (“Yes, these are the units which may well benefit from focussing more on patient safety”).
Third, in January-May 2007 the Akershus University Hospital’s Quality Department checked the records of a random sample of 481 patient journals in four of the hospital’s departments by the Global Trigger Tool Method advocated by the Institute of Healthcare Improvement [8]. The departments’ percentage of patients whose records suggest they experienced an adverse event during hospitalization correlated strongly (except for the factor Stress recognition) with the departments’ average staff SAQ-factor scores, as shown in Table 9 (See additional files table9.xls: Table 9. Correlation of average department staff SAQ-scores with department fraction of patient records suggesting an adverse event took place during hospitalization (N = 6)) – of course, due to the very low number of departments studied, only one of the correlation coefficients was significant at the .05-level.

Finally, as shown in Table 10 (See additional files table9.xls : Table 10. Correlation of average department staff SAQ-scores to average department patient scores on (response scale 1-5) variables “Maltreatment suspicion”*, “Hospital work organization”*, and “General satisfaction with hospitalization”* (N = 6)), the average SAQ-scores of staff of six departments at the Akershus University Hospital correlated with the average scores of 178 patients on questions on possible maltreatment, perceived clumsiness of hospital work and general satisfaction with hospitalization, collected (by the Norwegian Knowledge Center for the Health Services, which has provided the department average patient scores used to produce this table) at the same period of time at the same departments.

**Discussion**
Acceptability of questionnaire and feasibility of data collection

Because we personally visited all hospital units to collect the data, we could observe that the questionnaire was generally met with interest (but generally with less enthusiasm from physicians than from others). The questionnaire was not regarded as threatening. Only two units of the 47 approached declined the invitation to participate, and only one of them because it did not want to go on record at this moment, the other was a laboratory unit which just found the generic patient safety questionnaire irrelevant to their tasks. The response rate was relatively high (68 % (among physicians, however, only 52 %)), and, as shown in Table 6 above, very few items produced a significant number of missing responses. The outstanding exception was “I experience good collaboration with pharmacists in this clinical area”, which had a missing rate of 20 %. In our hospital, pharmacists do not participate in daily procedures in care-giving areas; their cooperation with the units is limited to more or less annual inspections. The reason why many have not responded to this item is probably that they found it irrelevant.

A number of respondents asked how to understand the item “Fatigue impairs my performance during emergency situations (e.g. emergency resuscitation, seizure)”. Their comments have convinced us that the translation into Norwegian of this item should be reformulated and should not read “Slitenhet reduserer måten jeg opptrer på i krisesituasjoner (som resuscitering, anfall o.l.)” but “Jeg arbeider dårligere i krisesituasjoner (som resuscitering, anfall o.l.) når jeg er sliten”.
The questionnaire was not very time-consuming. Most respondents completed the questionnaire within the 10-15 minutes suggested by the SAQ technical reports [3], and all respondents finished within 20-25 minutes.

A data collection challenge was to ensure that all those who participated in patient care at the care-giving units were invited to participate in the data collection. The problem was that many physicians and physiotherapists were not employed by any specific unit and therefore did not attend unit staff meetings. These caregivers had to be reached in their own professions’ group meetings.

Reliability of questionnaire

The reliability of the Norwegian version of the generic SAQ Short Form 2006 was acceptable. The relatively high response rate, low number of missing data and the relatively short completion time testify to the acceptability of the SAQ in the Norwegian setting. One item, however, stood out as a candidate for removal, since not many Norwegian clinical workers cooperate directly with pharmacists – in fact, one may wonder why not many more than 20 % of the responders left the question of the quality of their cooperation with pharmacists unanswered.

Responses were, for most (but not all) items skewed towards the positive end of the scale. But the response distributions did not suggest that any particular item or set of items should be removed for failing to reflect variation.
The relatively high Cronbach alphas for all hypothesized factors demonstrates the internal consistency of the factors: all alphas were between .71 and .85 – except for the factor Teamwork climate, but its alpha of .68 was not much below the recommended limit of .70 (Nunnally JC, Bernstein 1994). Also, all items were, as they should be, more strongly correlated with their own factor than with any of the others.

The factors were not constructed to be uncorrelated, but the intercorrelations (.39 < r < .70), were not high enough to make one worry that two or more factors measure the same underlying construct.

The stability of the questionnaire also proved acceptable: the test-retest factor correlations were relatively high – except for factors Stress recognition (.55) and Perceptions of hospital management (.44). A possible interpretation is that in the average clinical worker’s eyes, the hospital’s top management is so distant that it is difficult to maintain a stable perception of its qualities. The fact that the test-retest correlation for Perceptions of hospital management was practically zero for non-physicians, but quite high (.83) for physicians lends credibility to that interpretation. The relatively low retest stability of the Stress recognition score, too, may be explained by the low correlation for non-physicians, for whom feelings of stress and its consequences may be much more variable and beyond control than for physicians. The striking difference in (three-week) test-retest correlations between physicians and others may indeed be seen as suggesting that checking a questionnaire’s reliability by the stability of the responses to it, is more appropriate among staff who are likely to feel reasonably in command of their work. The items made no reference to the length of the period to be taken into consideration when ticking the questionnaire, and for those more easily subject to the variable
demands of those higher in the hospital hierarchy, work must be expected to appear more variable.

Validity of questionnaire

One indicator of the questionnaire’s validity is the construct validity that emerges from the confirmatory factor analysis of the data. The construct validity of the questionnaire, as judged by the goodness-of-fit indicators from the confirmatory factor analysis, can be considered acceptable, but less than perfect. Some of the goodness-of-fit indices speak against the fit of the model to the data, namely the p of less than .001 and the AGFI of .871. But the $\chi^2$ (2.583) is within the limits indicated by Wheaton et al [8] and Carmines and MacIver [9,10], the $p_{close}$ (.893) and the RMSEA (.048) both exceed the criteria suggested by Browne and Cudeck [11], and the Hoelter 05-value of 296 is above the critical value given by Hoelter [12].

The external validity of the results obtained by the questionnaire cannot be regarded as fully validated until more hospitals have been surveyed and the results from similar units can be compared and related to patient outcomes. But the responding units seemed to feel not surprised by the SAQ-scores that were fed back to them, and the hospital Quality department felt the scores might have been reasonably accurate. Department average scores also correlated with the frequency of adverse hospital events (as determined by Global trigger tool revision of patient records) and with department average patient reports on general satisfaction with hospitalization, worries about possible maltreatment, and evaluation of the smoothness of hospital work.
Conclusion

On the basis of the above evidence, we conclude that the Norwegian translation of the generic short-form version of the Safety Attitudes Questionnaire is a reasonably reliable and possibly also valid instrument for the measurement of patient safety culture in hospitals.

From our test experience we would, however, like to suggest two minor adjustments. First, comments from the respondents at Akershus University Hospital showed that our translation into Norwegian of the item “Fatigue impairs my performance during emergency situations (e.g. emergency resuscitation, seizure)” was clumsy and should be reformulated as shown above, and listed in Table 2. Second, the question on cooperation with pharmacists might be considered for removal from the Norwegian version: very few Norwegian clinical workers cooperate directly with pharmacists.

Finally, one should be aware that the genericity of the generic SAQ version is threatened by the word “nurse”, which may alienate radiographers, laboratory technicians, secretaries, physiotherapists etc.

Competing interests
None declared

Author’s contributions
Both authors took part in every phase of the work: the translation of the SAQ into Norwegian, the data collection, the data analysis and the writing of the report.

Acknowledgements

We gratefully acknowledge the contributions of Dr. Helge Svaar, Akershus University Hospital, who provided the department Trigger Tool-average scores and of researcher Øyvind Bjertnes, the Norwegian Knowledge Center for the Health Services, who provided the department patient satisfaction averages which we correlated our safety culture scores with.
Reference List


8. Griffin FA RR. IHI Global Trigger Tool for Measuring Adverse Events. IHI Innovation Series. 2007. Cambridge, Massachusetts, Institute for Healthcare Improvement. Ref Type: Pamphlet


Additional files:

1. table1.xls
   excel
   Table 1. The six SAQ factors of the non-generic SAQ versions (ICU version)

2. table2.xls
   excel
   Table 2. SAQ 2006 Short form, original formulations, Norwegian translations

3. table3.xls
   excel
   Table 3. Re-hypotesizing three SAQ factors for the generic SAQ version

4. table4.xls
   excel
   Table 4. Cronbach’s alphas by factor

5. table5.xls
   excel
   Table 5. Goodness-of-fit indices

6. table6.xls
   excel
   Table 6. Intercorrelation of factors (n = 696)
Table 7. Test-retest correlations (by factor and profession)

Table 8. Item variation by factor

Table 9. Correlation of average department staff SAQ-scores with department fraction of patient records suggesting an adverse event took place during hospitalization (N = 4)

Table 10. Correlation of average department staff SAQ-scores to average department patient scores on (response scale 1-5) variables* “General satisfaction with hospitalization”, “Maltreatment suspicion”, and “Hospital work organization” (N = 6)

Legend to Table 10

*"General satisfaction with hospitalization” = "All things considered, were you generally satisfied with hospital treatment and care?"

"Maltreatment suspicion” = "Do you feel that you were in any way maltreated (as far as you are able to judge)?"

"Hospital work organization” = An index built from the answers to three questions: "Was it your impression that you were cared for by a permanent group of nursing staff?", "Was it your impression that one doctor were responsible for you?”, and "Was it your impression that hospital work was well organized?"

Figure 1. Factor structure model
12. figure2.ppt
Powerpoint
Figure 2. Variation in Safety climate factor average across professions

13. figure3.ppt
Powerpoint
Figure 3. Variation in average score on item “Disagreements in this clinical area are resolved appropriately (not who is right, but what is best for the patient”, across departments

14. figure4.ppt
Powerpoint
Figure 4. Variation in Safety climate factor average across wards/outpatient clinics
Figure 2: Safety climate score by profession. The graph shows the percentage of each profession reporting a good safety climate. The professions are ranked from the lowest to the highest percentage: Junior physician, Assistant nurse, Other, Consultant, Registered nurse, and Nurse in charge. The highest percentage is for Nurse in charge.
Safety climate across care giving units (wards, outpatient clinics, etc.)
Additional files provided with this submission:

Additional file 1: table 1.xls, 29K
http://www.biomedcentral.com/imedia/809577611885057/supp1.xls
Additional file 2: table 2.xls, 43K
http://www.biomedcentral.com/imedia/1316815446188505/supp2.xls
Additional file 3: table 3.xls, 25K
http://www.biomedcentral.com/imedia/6761139181885057/supp3.xls
Additional file 4: table 4.xls, 29K
http://www.biomedcentral.com/imedia/822870921885057/supp4.xls
Additional file 5: table 5.xls, 31K
http://www.biomedcentral.com/imedia/1661214051188505/supp5.xls
Additional file 6: table 6.xls, 30K
http://www.biomedcentral.com/imedia/3738197041885057/supp6.xls
Additional file 7: table 7.xls, 29K
http://www.biomedcentral.com/imedia/1388271655188505/supp7.xls
Additional file 8: table 8.xls, 46K
http://www.biomedcentral.com/imedia/1316870724188505/supp8.xls
Additional file 9: table 9.xls, 29K
http://www.biomedcentral.com/imedia/1526858089188505/supp9.xls
Additional file 10: table 10.xls, 36K
http://www.biomedcentral.com/imedia/5895172901885057/supp10.xls