Patient safety culture: partitioning the variance by organization level

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ABSTRACT

Aim: To document 1) that patient safety culture scores vary not only by individual responder, but also, and to a large degree, by ward and department, and 2) that more of the variation is across wards than across departments.

Setting: 500-bed Norwegian university hospital September-December 2006.

Methods: Data collected from 1400 staff by (the Norwegian version of) the generic version of the Safety Attitudes Questionnaire (SAQ Short Form 2006). Multilevel analysis by MLwiN version 1.10.

Results: Considerable parts of the score variations were at ward and department level. More organization level variation was at ward level than at department level.

Conclusions: 1) Patient safety culture should be studied as close to the patient as possible. There may be such a thing as “hospital safety culture”, and the variance across hospital departments indicates the existence of department safety cultures. But neglecting the study of patient safety culture at ward level will mask important local variations. 2) Patient safety culture improvement efforts should include interventions at ward level, aimed at low-score wards, not just department or all-hospital interventions. 3) Safety culture research and improvement should not stop at the lowest formal level of the hospital (wards, out-patient clinics, ERs), but proceed to collect and analyze data on the micro-units within them.
**Background**

This study reports how the variance in patient safety culture is distributed by wards and departments. The hypothesis to be tested is that patient safety culture is a local phenomenon, i.e. varies more across wards than across departments.

The article analyzes patient safety attitudes data on 1306 Akershus University Hospital clinical staff. The survey was carried out at the hospital’s somatic clinical areas during October-December 2006.

Akershus University Hospital is located just outside Oslo, the capital of Norway. It has 500 somatic and 200 psychiatric beds, 4200 employees, and an annual budget of 2,500,000,000 NOK (approximately 450 million USD). It serves a population of 280,000 inhabitants of north-east Oslo and the Oslo-surrounding county of Akershus. In 2006 it treated 53,000 in-patients and had 150,000 out-patient consultations. 85% of the in-patients were unscheduled emergency cases.

Compared to the two other Scandinavian countries, Norway is a latecomer to patient safety. Sweden and – particularly – Denmark has much more to show for themselves in terms of making patient safety an explicit national health care priority. This does not mean that patient safety is not high on Norwegian clinicians’ list of priorities – it certainly is. But “patient safety” has only recently been made a national health policy issue, e.g. with the 2007 establishment by the Directorate of Health of a National unit for patient safety.
Methods

Data

Responses of staff to a patient safety attitudes questionnaire were collected October-December 2006. The study was approved by the Norwegian Data Inspectorate.

All somatic frontline personnel were asked to fill in (the Norwegian version of) the generic version of the Safety Attitudes Questionnaire Short Form 2006, whose original American version is documented by Sexton JB, Helmreich RL, Neilands TB et al (1). The psychometric properties of the Norwegian version of the SAQ have been tested and found acceptable (2).

The questionnaire was distributed to a total of 1911 clinical staff (physicians, registered nurses, auxiliary nurses, radiographers, laboratory technicians, midwives, and clerical workers). 1306 of the 1911 completed and returned the questionnaire (68 %). Respondents worked at 45 somatic care giving units – 27 wards, 14 outpatient service units, and four laboratories – of 10 clinical departments: emergency admissions, anesthesiology, surgery, operations, orthopedics, gynecology & obstetrics, pediatrics, internal medicine, neurology and ear-nose-throat.

Score calculation

Scores were calculated for each responder for each of the seven patient safety culture factors according to the instruction given by the SAQ-developers (3).
Multilevel analysis

The seven patient safety culture factor scores were analyzed by MLwiN, a multilevel analysis program developed by the University of London’s Institute of Education (4). Multilevel analysis makes it possible to partition the variance in the data by level. Analyzing “the empty model” (5) – a model which contains only the intercept (the data set’s average patient safety attitudes score) and no explanatory variables – we split the total variance in patient safety attitudes scores into variance across individual respondents (individual level variance), across wards (ward level variance) and across departments (department level variance.)

The ratio of the variance at the organizational level to the total variance in the data is the intraclass correlation coefficient (ICC). Multiplied by 100, the ICC can be interpreted as the percentage of the total variance in the data set, which belongs to the organizational level, that is, the percentage of the variance which is not score differences across individual responders, but across the organizational units.

The statistical significance of the variance at organization levels was judged by the change in the goodness of fit of the model to the data, as measured by the change in the model’s log likelihood ratio produced by eliminating that level from the model. Judging significance by the ratio of the parameter estimate to its standard error works quite well for fixed parameters, that is, parameters estimated under the assumption of having the same value in all subunits of the data set. For random parameters, however, the distribution of this ratio may depart considerably from normality, and a better test for random parameters is to use the likelihood ratio statistic (6). In our case, the “large sample” distribution of the -2LL-value under the null hypothesis (H₀ = the two-level model is adequate) is a χ²-distribution with k₂-k₁ degrees of
freedom – that is: d.f. = 3-2= 1. The critical value for $p < ,05$ for the change in -2LL is 3.84, for $p < ,01$ it is 5.99. As suggested by Pinheiro & Bates (7) this test can be conservative, producing from the $\chi^2_{k2-k1}$ distribution a p-value which is greater than it should be.

**Results**

As shown in Table 1, Akershus University Hospital average factor scores (0-100) varied from a high of 79 for Job Satisfaction to a low of 50 for Perception of Hospital Management. All Akershus University Hospital average scores were equal to or higher than the inpatient benchmark scores published by Sexton, Helmreich, Neilands et al (1).

(Table 1 approximately here)
Table 1. Akershus University Hospital patient safety average factor scores and US inpatient institution benchmark averages

<table>
<thead>
<tr>
<th></th>
<th>Teamwork Climate</th>
<th>Safety Climate</th>
<th>Job Satisfaction</th>
<th>Stress Recognition</th>
<th>Work Conditions</th>
<th>Perceptions of Unit Management</th>
<th>Perceptions of Hospital Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akershus University</td>
<td>73,0</td>
<td>61,0</td>
<td>79,3</td>
<td>75,4</td>
<td>57,5</td>
<td>62,3</td>
<td>49,9</td>
</tr>
<tr>
<td>Hospital averages</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benchmarking data</td>
<td>64,3</td>
<td>60,5</td>
<td>59,6</td>
<td>74,4</td>
<td>49,2</td>
<td>38,3</td>
<td></td>
</tr>
<tr>
<td>(US inpatients)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 2 five of the seven patient safety factor scores showed considerable variance at organizational level. Except for factors Stress Recognition (ICC = .02) and Perception of Hospital Management (ICC = .07) all factors had ICCs of 14 % or higher. The highest ICC-value was for factors Perception of Unit Management (21 %) and Teamwork Climate (19 %). For the factor Work Conditions clustering was more pronounced at department level than at ward level. For the factors Teamwork Climate, Safety Climate and Perception of Unit Management clustering was more pronounced at ward level.

(Table 2 approximately here)
Table 2. Organization level variance by patient safety attitudes factor

<table>
<thead>
<tr>
<th>Factor (all factors scaled 0-100)</th>
<th>Total variance</th>
<th>Variance at individual level (% of total variance)</th>
<th>Variance at ward level (% of total variance)</th>
<th>Variance at department level (% of total variance)</th>
<th>ICC (ratio of organizational level variance to total variance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teamwork Climate (valid n: 1090)</td>
<td>285,365</td>
<td>231,298 (81,1 %)</td>
<td>39,245 (13,8 %)</td>
<td>14,822 (5,2 %)</td>
<td>0,19</td>
</tr>
<tr>
<td>Safety Climate (valid n: 984)</td>
<td>240,638</td>
<td>206,303 (85,7 %)</td>
<td>21,733 (9,0 %)</td>
<td>12,602 (5,2 %)</td>
<td>0,14</td>
</tr>
<tr>
<td>Job Satisfaction (valid n: 1036)</td>
<td>365,350</td>
<td>309,274 (84,7 %)</td>
<td>28,081 (7,7 %)</td>
<td>27,995 (7,7 %)</td>
<td>0,15</td>
</tr>
<tr>
<td>Stress Recognition (valid n: 1024)</td>
<td>491,506</td>
<td>483,168 (98,3 %)</td>
<td>1,140 (0,2 %)</td>
<td>7,198 (1,5 %)</td>
<td>0,02</td>
</tr>
<tr>
<td>Work Conditions (valid n: 843)</td>
<td>411,830</td>
<td>352,886 (85,7 %)</td>
<td>20,704 (5,0 %)</td>
<td>38,240 (9,3 %)</td>
<td>0,14</td>
</tr>
<tr>
<td>Perception of Unit Management (valid n: 949)</td>
<td>519,785</td>
<td>412,491 (79,4 %)</td>
<td>68,706 (13,2 %)</td>
<td>38,588 (7,4 %)</td>
<td>0,21</td>
</tr>
<tr>
<td>Perception of Hospital Management (valid n: 904)</td>
<td>373,291</td>
<td>347,452 (93,1 %)</td>
<td>12,430 (3,3 %)</td>
<td>13,409 (3,6 %)</td>
<td>0,07</td>
</tr>
</tbody>
</table>

As shown in Table 3, for four of the seven factors – Teamwork Climate, Stress Recognition, Perception of Unit Management and Perception of Hospital Management – the elimination of the department level from the model did not reduce the model’s goodness-of-fit significantly, as measured by the change in the -2LL. For the remaining three factors – Safety Climate, Job Satisfaction, and Work Conditions – the exclusion of the department level from the model did worsen the model’s goodness of fit.
Table 3. Organization level variance by patient safety attitudes factor

<table>
<thead>
<tr>
<th>Factor</th>
<th>-2LL of three-level Model</th>
<th>-2LL of two-level model (individuals &amp; wards)</th>
<th>Change in -2LL when department level was removed from model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teamwork Climate</td>
<td>9,103,317</td>
<td>9,103,477</td>
<td>0.163 (n.s.: p &gt; .05)</td>
</tr>
<tr>
<td>Safety Climate</td>
<td>8,095,995</td>
<td>8,101,995</td>
<td>5.532 (p &lt; .05)</td>
</tr>
<tr>
<td>Job Satisfaction</td>
<td>8,940,755</td>
<td>8,946,288</td>
<td>5.533 (p &lt; .05)</td>
</tr>
<tr>
<td>Stress Recognition</td>
<td>9,245,302</td>
<td>9,248,427</td>
<td>3.125 (n.s.: p &gt; .05)</td>
</tr>
<tr>
<td>Work Conditions</td>
<td>7,283,521</td>
<td>7,289,960</td>
<td>6.439 (p &lt; .01)</td>
</tr>
<tr>
<td>Perception of Unit Management</td>
<td>8,482,990</td>
<td>8,484,253</td>
<td>1.263 (n.s.: p &gt; .05)</td>
</tr>
<tr>
<td>Perception of Hospital Management</td>
<td>7,887,215</td>
<td>7,890,124</td>
<td>2.809 (n.s.: p &gt; .05)</td>
</tr>
</tbody>
</table>

Discussion

Compared with the US inpatient benchmarking data (1), the Akershus University Hospital average factor scores are high, indicating that many aspects of patient safety culture are in place. International benchmarking comparisons must, however, be interpreted with caution. Items and factors may not have the same meaning across national cultures.

However good the Akershus University Hospital scores may be, there is still considerable room for improvement, especially in the case of staff perceptions of hospital management. Our interpretation is that a clinical culture of patient safety may precede not only an explicit national patient safety policy, but also a visible hospital top management commitment to patient safety. Most hospital CEOs have appointed economic controllers to collect at short intervals reports from the hospital’s leading clinicians on the financial situation of their clinical units. They might also have required to be equally well updated on patient safety and
adverse events. One must keep in mind, though, that the task of making patient safety a focal point for hospital planning and business is not just a question of having hospital top management taking more interest in it. The problem is almost certainly not an inability to see the importance of patient safety. Rather, it may be top management’s limited financial opportunity to act more strongly on the matter. Of course, many hospital top executive could – and probably should – give patient safety a more prominent place on their hospital’s agenda, and the agenda of their hospital board. But to be effective, increased attention must be budget-backed – and that is a problem with the current government emphasis that cost containment is hospital CEOs’ job number one.

Given that hospital top management wish to intervene to improve patient safety culture, where should they intervene? Obviously, patient safety culture scores depend on staff interest, attention and engagement. The major part of the variance in patient safety attitudes was across individual employees, so efforts to promote a patient safety culture must continue targeting individual staff members. But we also found marked clustering of patient safety culture scores at the organizational levels, and much of the organization level variance was across wards. On some patient safety culture factors departments averages differ. But on other factors wards vary more strongly than departments. Therefore interventions to improve patient safety should aim not only at individual employees, but also at organizational units, in particular those at the sharpest end of the health services: the wards.

Having data on one hospital only, we have not been able to check empirically the amount of clustering of safety attitudes at hospital level, but, as indicated by Sexton, Helmreich, Neilands et al (1) there probably are hospital-specific patient safety cultures. But as shown by
Pronovost & Sexton (8) variability in SAQ measurements has been shown to be greater across working groups than across hospitals.

As we have documented significant clustering of three patient safety attitude factors at department level (Safety Climate, Job satisfaction, and Work Conditions) it should not be doubted that there may be differences in patient safety culture across departments. But for four of the seven factors, there was no evidence of variation across departments, only across wards.

Patient safety culture improvement efforts should therefore include interventions at ward level, and not just department or all-hospital interventions. Zohar et al (9) has reported how information on safety climate has been used to guide prevention efforts towards selected units. Selection must, however, be done with discretion in order to avoid stigmatizing working units as “low-score”. And one must not focus solely on the low scorers: high-scoring units may also be interesting; lessons may be learnt from their successes.

Possibly, even probably, one should aim at studying even lower-level units, the “micro-systems” that do not appear in organizational blueprints but in which so much of the actual clinical work is carried out (10-12). The importance of studying such lower-level units is obvious enough in medical departments. One may easily see patient safety as a function of the safety culture of nurse groups or nurse-doctor groups within a ward. And the point is particularly obvious in surgical departments, where the wards are the bed units where patients are prepared for surgery and nursed after having had surgery, but the work that gives the department its name – and is vital to surgical patients’ safety – takes place in the theaters of the department’s operating section. Studying surgical department patient safety at the ward
level, although bedside, one might easily miss important information. A data collection problem is that micro-systems like operating teams are fluid bodies which do not have permanently designated staff. But this may differ between organizations: at our hospital operation teams are temporary, in other organizations they may be permanent. The inclusion of the micro-unit level into multi-level analyses of patient safety attitudes – and other aspects of patient safety – is an important task for future patient safety research.

Conclusions

1) Patient safety culture should be studied in care-giving units as close to the patient as possible. There may be such a thing as “hospital safety culture”, and there are differences across hospital departments. But neglecting the study of patient safety culture at ward level will mask important local variations.

2) Patient safety culture improvement efforts should include interventions at ward level, not just department or all-hospital interventions.

3) Future research should not stop at the level of hospital wards, out-patient clinics, and ERs, but collect and analyze data on the micro-systems within them: nurse teams, doctor-nurse teams, operating teams etc.
Funding

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References


2) Deilkas E, Hofoss D. Psychometric properties of the Norwegian version of the Safety Attitudes Questionnaire (SAQ), Generic version (Short Form 2006). BMC Health Serv Res 2008; 8 (1): 191

3) http://www.uth.tmc.edu/schools/med/imed/patient_safety/Scale%20Computes.doc


