


# BMJ Open Quality Measuring the patient safety culture at a tertiary care hospital in Pakistan using the Hospital Survey on Patient Safety Culture (HSOPSC)

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## ABSTRACT

**Background** Patient safety is a top priority for many healthcare organisations worldwide. However, most of the initiatives aimed at the measurement and improvement of patient safety culture have been undertaken in developed countries. The purpose of this study was to measure the patient safety culture at a tertiary care hospital in Pakistan using the Hospital Survey on Patient Safety Culture (HSOPSC).

**Methods** The HSOPSC was used to measure the patient safety culture across 12 dimensions at Aga Khan University Hospital, Karachi. 2,959 individuals, who had been working at the hospital, were administered the HSOPSC in paper form between June and September 2019.

**Results** The response rate of the survey was 50%. In the past 12 months, 979 respondents (33.1%) had submitted at least one event report. Results showed that the personnel viewed the patient safety culture at their hospital favourably. Overall, respondents scored highest in the following dimensions: 'feedback and communication on error' (91%), 'organisational learning and continuous improvement' (85%), 'teamwork within units' (83%), 'teamwork across units' (76%). The dimensions with the lowest positive per cent scores included 'staffing' (40%) and 'non-punitive response to error' (41%). Only the reliability of the 'handoffs and transitions', 'frequency of events reported', 'organisational learning' and 'teamwork within units' was higher than Cronbach's alpha of 0.7. Upon regression analysis of positive responses, physicians and nurses were found to have responded less favourably than the remaining professional groups for most dimensions.

**Conclusion** The measurement of safety culture is both feasible and informative in developing countries and could be broadly implemented to inform patient safety efforts. Current data suggest that it compares favourably with benchmarks from hospitals in the USA. Like the USA, high staff workload is a significant safety concern among staff. This study lays the foundation for further context-specific research on patient safety culture in developing countries.

## INTRODUCTION

Over the past decade, the need to improve patient safety has been widely recognised. Multiple studies from developed and developing countries have demonstrated

### WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Adequate patient safety culture is known to reduce preventable harm as exemplified in several high-income countries.

### WHAT THIS STUDY ADDS

⇒ This study provides insight into the baseline safety culture at a tertiary care hospital in Pakistan. High staff workload and staffing are areas for targeted intervention to improve safety culture.

### HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The study lays findings for context-specific research in similar under-resourced settings. Moreover, findings from this study highlight opportunities for targeted interventions to improve safety culture in other developing countries.

significant amounts of preventable patient harm.<sup>1–5</sup> Although the progress aimed at improving patient safety has been slow,<sup>6,7</sup> several initiatives to promote patient safety have been successfully launched in the USA, helping create a paradigm shift. Among them was the effort to create a patient safety culture: a culture that requires embracing teamwork, enhancing leadership support and shifting the focus of blame from individual practitioners to systemic flaws.<sup>8</sup> All other high-risk industries recognise the importance of culture in improving safety.<sup>9,10</sup> Healthcare now also recognises the importance of safety culture. According to the Agency for Healthcare Research and Quality (AHRQ), 'the safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management'.<sup>11</sup> Culture shift is ultimately the impetus that steers an organisation toward



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change, which in turn, can have an important impact on safety.<sup>12</sup> The ongoing pandemic due to the emergence of COVID-19 has put an additional strain on existing measures leading to reduced incident reporting as documented in one study from the UK.<sup>13</sup> Thus, the need for fostering an effective patient safety culture has escalated.

Safety culture is important, being linked to several important clinical outcomes and patient satisfaction.<sup>14 15</sup> It is measurable using valid and reliable tools such as surveys.<sup>14 16–20</sup> On the one hand, these tools have enabled researchers to measure norms and behaviours in healthcare settings and understand the workforce's attitudes and perceptions; on the other hand, they have enabled healthcare leadership to identify and rectify the identified vulnerabilities in system design, organisation and operation, ultimately culminating in the improvement of the overall patient safety culture. Findings from such surveys can also be used to reinforce positive aspects of safety culture.<sup>21</sup>

Research has shown that safety culture is responsive to interventions. Safety programmes such as the comprehensive unit-based safety programme were associated with substantial improvements in patient safety culture. However, most of the efforts to measure and improve patient safety culture have been undertaken in developed countries. Tens of millions of patients worldwide continue to suffer disabling injuries or deaths due to medical errors annually.<sup>22</sup> While there are some data on the patient safety culture in several developing countries,<sup>23–26</sup> it is still plagued by the lack of financial resources, medical expertise and advanced information technology.<sup>27</sup> Moreover, the discrepancy in the data from one study between the USA and Taiwan<sup>24</sup> suggests that the distinctiveness of culture in each setting should be taken into consideration whenever safety tools are applied in different settings. An appreciation of such similarities and differences is instrumental in tailoring appropriate, region-specific interventions and capacity-building initiatives to improve patient safety culture. Hospital Survey on Patient Safety Culture (HSOPSC) is a survey that was pilot tested in 2003 in 21 hospitals across 6 states in the USA.<sup>28</sup> The dimensions of the HSOPSC have been shown to have reasonable psychometric properties.<sup>28–31</sup> It has been used as a tool to measure patient safety culture in a variety of regions across the world, including the UK,<sup>16</sup> Lebanon,<sup>32</sup> Belgium, Denmark, Norway, the Netherlands,<sup>14</sup> Turkey<sup>33</sup> and Taiwan<sup>24</sup>; and has been translated and validated in several of these settings. The aim of this study was to measure the baseline patient safety culture at a tertiary care hospital in Karachi, Pakistan by using the HSOPSC to subsequently tailor strategies for quality improvement and patient safety in this region.

## METHODS

### Setting

Aga Khan University Hospital (AKUH), Karachi, is a not-for-profit teaching tertiary care hospital in Karachi,

Pakistan. This 710-bed hospital provides healthcare services to more than 50,303 inpatients and 941,826 outpatients annually from all over Pakistan.<sup>34</sup>

### Hospital Survey on Patient Safety Culture

The HSOPSC V.1.0 comprises 42 items that assess patient safety culture across 12 basic dimensions, including 2 outcome dimensions and 10 safety culture dimensions. This survey has been validated by the AHRQ.<sup>35</sup> The HSOPSC includes both positively and negatively worded items. Participants can respond to most of the items in the questionnaire using a 5-point Likert response scale of agreement ranging across a spectrum from strongly disagree to strongly agree. A few items also require a response across a 5-point Likert frequency scale ranging from never to always.<sup>28</sup> Respondents also answered two outcome questions in the survey by giving an overall grade on patient safety for their specific work area (on a five-option scale ranging from excellent to failing) and by rating the frequency of event reports filled out and submitted by them in the past 12 months (on a five-option scale ranging from no events to 21 events or more). The HSOPSC also gathers basic work-related information of the respondents, such as current staff position, unit/area of work in the hospital, duration of work at that unit/area, number of work hours per week at the hospital and whether they typically have direct interaction with patients.<sup>28</sup> The administered survey included 41 items out of the total 42 items in the original survey as the subject hospital does not employ temporary staff/agency.

### Administration of survey

The survey was conducted among the employees at AKUH between June and September 2019. Personnel of both morning and evening shifts were included in the survey; however, the precise distribution of respondents between the two shifts was not documented.

### Patient and public involvement

Patients and the public were not involved in conducting this research.

### Data analysis

Descriptive statistics were used to compute the work-related background variables of the participants. For the 41 items included in 12 dimensions of patient safety culture, responses were dichotomised as follows:

1. The 5-point response scale of agreement was dichotomised to 'agree' (including strongly agree/agree) and 'disagree' (neither/disagree/strongly disagree).
2. The 5-point frequency scale was dichotomised to 'frequently' (including always/most of the time/sometimes) and 'never' (including rarely/never).

We calculated the average percentage of positive responses for each of the 41 items. We also calculated composite-level percentage of positive responses for each dimension of patient safety culture. The composite scores were computed by averaging the per cent positive response for all of the items within a composite or dimension.<sup>36</sup>

Positive responses in positively worded items were 'agree' (strongly agree/agree) and 'frequently' (always/most of the time/sometimes). Positive responses in negatively worded items were 'disagree' (strongly disagree/disagree/neither) and 'never' (never/rarely). Negatively worded items were, thus, reverse coded for the analysis of per cent positive response rates. Strong dimensions were those for which 75% of the respondents answered affirmatively; dimensions that required improvement were identified as those with a composite percentage <50%.<sup>35</sup> A comparison of the data from AKUH with AHRQ benchmarks for the overall hospital data in the 2018 database was also done. Data were managed and analysed with STATA V.16 (STATA Corp, College Station, Texas, USA).

Furthermore, multivariable logistic regression was used to compute factors associated with average positive responses for each dimension. This model was adjusted for professional role, employment duration in the hospital, and average weekly work hours. The internal reliability of the questionnaire and its dimensions was assessed using Cronbach's alpha, with alpha of 0.7 as the threshold for reliability.

## RESULTS

A total of 2959 patients were included in this analysis. The response rate of the HSOPSC was 50%. Respondents included 886 (29.9%) nurses and midwives, 145 (4.66%) postgraduate medical trainees (residents, fellows and medical interns), 469 (15.85%) technologists, 140 (5.50%) attending physicians, 658 (22.24%) hospital aides, 250 (8.45%) administration or management personnel and 411 (13.9%) other healthcare professionals. The postgraduate medical trainees and attending

physicians were condensed into one category titled 'Physicians' for further analysis.

In the 12 months prior to the survey, 979 respondents (33.01%) had filled out and submitted an adverse event report. Out of these 979 respondents, 652 (66.6%) submitted one to two reports, 167 (17.1%) submitted three to five reports, while 160 (16.3%) submitted six or more reports. Distribution of other work-related parameters among the respondents is shown in [table 1](#) 455 (15.57%) individuals were working ≥60 hours per week; approximately half of those were resident physicians. 2,433 (84.2%) respondents had been at AKUH for more than 1 year, and 2,227 (76.6%) respondents had been at their current unit/work area for more than 1 year. Overall, 1,523 (52.3%) respondents deemed their work area/unit to have an 'excellent' grade of patient safety, 1,020 (35.0%) considered it very good, 334 (11.5%) thought it was acceptable and 34 (1.2%) thought it was poor. The distribution of patient safety grades among different healthcare personnel is displayed in [table 2](#).

Cronbach's alpha was calculated for evaluation of internal consistency of the questionnaire. Cronbach's alpha for all 41 items was 0.896. The internal consistency of individual dimensions was also calculated using the same method. Only the reliability of the 'handoffs and transitions', 'frequency of events reported', 'organisational learning' and 'teamwork within units' was higher than 0.7. The results are displayed in [table 3](#).

The distribution of the positive responses for each of the 41 items included in the 12 patient culture dimensions of HSOPSC among the different healthcare personnel is shown in online supplemental table 2. Nurses reported higher patient safety culture than

**Table 1** Distribution of work-related parameters among healthcare professionals at AKUH

| Parameter                                  | Nurses and midwives (n=886) | Physicians (n=285) | Technologists (n=469) | Hospital aides (n=658) | Management (n=250) | Others (n=411) |
|--|-----------------------------|--------------------|-----------------------|------------------------|--------------------|----------------|
| Average number of hours/week*              |                             |                    |                       |                        |                    |                |
| <60  | 746 (84.2)                  | 157 (55.1)         | 395 (84.2)            | 596 (90.6)             | 219 (87.6)         | 355 (86.4)     |
| ≥60  | 133 (15.0)                  | 127 (44.6)         | 71 (15.1)             | 58 (8.8)               | 31 (12.4)          | 35 (8.5)       |
| Event reports submitted in last 12 months* |                             |                    |                       |                        |                    |                |
| 0  | 603 (68.1)                  | 170 (59.6)         | 333 (71.0)            | 510 (77.5)             | 91 (36.4)          | 273 (66.4)     |
| 1–2  | 210 (23.7)                  | 77 (27.0)          | 87 (18.6)             | 118 (17.9)             | 76 (30.4)          | 84 (20.4)      |
| >2   | 65 (7.3)                    | 32 (11.2)          | 36 (7.7)              | 22 (3.3)               | 78 (31.2)          | 32 (7.8)       |
| Time in current hospital*                  |                             |                    |                       |                        |                    |                |
| <1 year                                    | 168 (19.0)                  | 48 (16.8)          | 102 (20.2)            | 81 (12.3)              | 9 (3.6)            | 50 (12.4)      |
| ≥1 year                                    | 707 (79.8)                  | 232 (81.4)         | 360 (76.8)            | 563 (85.6)             | 240 (90.6)         | 331 (80.5)     |
| Time in current unit/work area*            |                             |                    |                       |                        |                    |                |
| <1 year                                    | 240 (27.1)                  | 66 (23.2)          | 147 (31.3)            | 137 (20.8)             | 34 (13.6)          | 57 (13.9)      |
| ≥1 year                                    | 643 (72.6)                  | 216 (75.8)         | 315 (67.2)            | 514 (78.1)             | 214 (85.6)         | 325 (79.1)     |

\*X<sup>2</sup> test: p<0.001.  
AKUH, Aga Khan University Hospital.

**Table 2** Patient safety grades

| Patient safety grade | Nurses and midwives (%) | Physicians | Technologists | Hospital aides | Management | Others     | Overall | AHRQ 2018 benchmarks |
|----------------------|-------------------------|------------|---------------|----------------|------------|------------|---------|----------------------|
| Excellent            | 466 (53.1)              | 67 (23.9)  | 275 (59.1)    | 412 (63.3)     | 99 (40.6)  | 204 (51.8) | 52.3    | 35                   |
| Very good            | 316 (36.0)              | 142 (50.7) | 139 (29.9)    | 188 (28.9)     | 108 (44.3) | 127 (32.2) | 35      | 43                   |
| Acceptable           | 84 (9.6)                | 67 (23.9)  | 45 (9.7)      | 45 (6.9)       | 32 (13.1)  | 61 (15.5)  | 11.5    | 18                   |
| Poor                 | 11 (1.3)                | 4 (1.4)    | 6 (1.30)      | 6 (0.9)        | 5 (2.1)    | 2 (0.5)    | 1.2     | 4                    |

AHRQ, Agency for Healthcare Research and Quality.

other healthcare professionals in 2 out of 12 dimensions including communication openness and the frequency of events reported. Physicians fared best in the supervisor/manager's expectations and actions promoting patient safety. Technologists performed higher in the domain on overall perception of patient safety, while hospital aides reported highest safety culture in dimensions on teamwork within and across units, organisational learning and continuous improvement, management support for patient safety and communication openness. Managerial employees reported higher positive responses than other professionals in the dimensions on non-punitive response to error, staffing, management support for patient safety, and feedback and communication on error.

The overall distribution of the positive responses for each of the 41 items included in the 12 patient culture dimensions of HSOPSC is shown in online supplemental tables 1 and 2. Safety culture dimensions with the highest positive score included 'feedback and communication on error' (91%), 'organisational learning and continuous improvement' (85%), 'teamwork within units' (83%), 'teamwork across units' (76%); whereas the dimensions

with the lowest positive scores included 'staffing' (40%) and 'non-punitive response to error' (41%).

**Table 4** displays results of logistic regression according to composites of each dimension. Hospital aides had significantly higher level of positive responses for organisational learning and continuous improvement (OR: 2.48, 95% CI: 1.4–3.8) and management support for patient safety (OR: 1.9 95% CI: 1.11–3.26), while technologists fared significantly better in overall perceptions of patient safety (OR: 2.31, 95% CI: 1.01–5.28) when compared with the remaining professional roles. On the other hand, physicians had significantly lower positive responses in staffing (OR: 0.4, 95% CI: 0.25–0.65), handoffs and transitions (OR: 0.64, 95% CI: 0.41–0.99) and teamwork across units (OR: 0.24, 95% CI: 0.12–0.48), whereas nurses did so in non-punitive response to error (OR: 0.24, 95% CI: 0.12–0.48). In contrast to their response pattern for other dimensions, hospital aides scored significantly lower for positive responses on non-punitive response to error (OR: 0.66, 95% CI: 0.47–0.92). More employees whose average weekly work hours ranged between 40 and 60 responded positively for teamwork within units (OR: 2.89, 95% CI: 1.72–4.85), organisational learning–continuous improvement (OR: 2.15, 95% CI: 1.45–3.18), management support for patient safety (OR: 2.21, 95% CI: 1.5–3.25), and feedback and communication on error (OR: 1.72, 95% CI: 1.06–2.81) but significantly less for non-punitive response to error (OR: 1.72, 95% CI: 1.06–2.81). Similarly, those who had worked at the hospital between 1 and 10 years (OR: 0.48, 95% CI: 0.27–0.84) and 10 years or more (OR: 0.4, 95% CI 0.22–0.74) had significantly lower positive responses for teamwork across units, whereas those who worked for 10 years or more also did so in handoffs and transitions (OR: 0.68, 95% CI: 0.49–0.93).

**Table 3** Internal consistency of the HSOPSC questionnaire

| Dimensions   | Cronbach's alpha |
|--|------------------|
| Teamwork within units  | 0.74             |
| Supervisor/manager expectations and actions promoting patient safety | 0.59             |
| Organisational learning–continuous improvement                       | 0.74             |
| Management support for patient safety                                | 0.41             |
| Overall perceptions of patient safety                                | 0.49             |
| Feedback and communication about error                               | 0.66             |
| Communication openness   | 0.25             |
| Frequency of events reported   | 0.8              |
| Teamwork across units  | 0.17             |
| Staffing   | 0.37             |
| Handoffs and transitions   | 0.8              |
| Non-punitive response to errors                                      | 0.62             |
| Overall  | 0.896            |

## DISCUSSION

To our knowledge, this study is one of the very few studies to explore the culture of patient safety in Pakistan and the first to investigate it across different professional roles.<sup>37 38</sup>

We used the HSOPSC to gauge perceptions, perspectives and practices among 2,959 personnel at AKUH, Karachi. AKUH is a nationally and internationally reputed health-care institution. In 2006, it became the first hospital in Pakistan to receive the Joint Commission International



**Table 4** Factors associated with positive responses in each dimension

| Dimension  |             | Professional role |                     | Duration in the hospital |                   |                         |                   |         | Average work hours per week |                   |           |                   |                   |
|--|-------------|-------------------|---------------------|--------------------------|-------------------|-------------------------|-------------------|---------|-----------------------------|-------------------|-----------|-------------------|-------------------|
|  |             | Management        | Nurses and midwives | Physicians               | Technologists     | Hospital aides          | Others            | <1 year | 1–10 years                  | >10 years         | <40 hours | 40–60 hours       | >60 hours         |
| Teamwork within units  | OR (95% CI) | *                 | 0.55 (0.26, 1.14)   | 1.05 (0.44, 2.5)         | 1.18 (0.51, 2.71) | 2.37 (0.96, 5.84)       | 2.15 (0.81, 5.7)  | *       | 1.49 (0.96, 2.31)           | 1.63 (0.9, 2.92)  | *         | 2.89 (1.72, 4.85) | 1.28 (0.72, 2.28) |
|  | P value     |                   | 0.106               | 0.911                    | 0.7               | 0.062                   | 0.124             |         | 0.079                       | 0.104             |           | <0.001            | 0.397             |
| Supervisor/manager expectations and actions promoting patient safety | OR (95% CI) |                   | 1.39 (0.77, 2.51)   | 1.23 (0.6, 2.51)         | 1.5 (0.77, 2.94)  | 1.45 (0.78, 2.7)        | 1.44 (0.73, 2.82) |         | 0.44 (0.25, 0.8)            | 0.64 (0.33, 1.26) |           | 1.52 (0.86, 2.69) | 1.16 (0.61, 2.22) |
|  | P value     |                   | 0.271               | 0.578                    | 0.233             | 0.237                   | 0.293             |         | 0.007                       | 0.196             |           | 0.152             | 0.657             |
| Organisational learning–continuous improvement                       | OR (95% CI) |                   | 0.86 (0.53, 1.4)    | 0.65 (0.38, 1.13)        | 1.29 (0.75, 2.22) | 2.48 (1.4, 4.38)        | 1.17 (0.67, 2.03) |         | 1.03 (0.73, 1.45)           | 1.38 (0.9, 2.1)   |           | 2.15 (1.45, 3.18) | 1.57 (1, 2.46)    |
|  | P value     |                   | 0.552               | 0.129                    | 0.362             | 0.002                   | 0.58              |         | 0.868                       | 0.136             |           | <0.001            | 0.051             |
| Management support for patient safety                                | OR (95% CI) |                   | 0.85 (0.53, 1.37)   | 0.65 (0.38, 1.11)        | 1.25 (0.73, 2.12) | 1.9 (1.11, 3.26)        | 1.48 (0.84, 2.59) |         | 1.05 (0.75, 1.46)           | 1.21 (0.81, 1.82) |           | 2.21 (1.5, 3.25)  | 1.35 (0.87, 2.09) |
|  | P value     |                   | 0.517               | 0.113                    | 0.418             | 0.019                   | 0.174             |         | 0.794                       | 0.357             |           | <0.001            | 0.1728            |
| Overall perceptions of patient safety                                | OR (95% CI) |                   | 1.5 (0.77, 2.92)    | 0.55 (0.27, 1.12)        | 2.31 (1.01, 5.28) | 1.34 (0.67, 2.67)       | 0.94 (0.46, 1.9)  |         | 0.6 (0.34, 1.05)            | 1.02 (0.52, 2)    |           | 1.24 (0.66, 2.35) | 0.85 (0.42, 1.69) |
|  | P value     |                   | 0.232               | 0.101                    | 0.048             | 0.411                   | 0.855             |         | 0.074                       | 0.956             |           | 0.504             | 0.634             |
| Feedback and communication about error                               | OR (95% CI) |                   | 0.55 (0.27, 1.09)   | 0.65 (0.29, 1.43)        | 0.79 (0.37, 1.68) | 0.84 (0.4, 1.74)        | 0.88 (0.4, 1.93)  |         | 1.32 (0.9, 1.95)            | 1.52 (0.93, 2.48) |           | 1.72 (1.06, 2.81) | 1.24 (0.7, 2.17)  |
|  | P value     |                   | 0.087               | 0.282                    | 0.539             | 0.633                   | 0.752             |         | 0.161                       | 0.092             |           | 0.029             | 0.46              |
| Communication openness   | OR (95% CI) |                   | 0.87 (0.57, 1.34)   | 0.79 (0.48, 1.31)        | 0.78 (0.49, 1.23) | 0.93 (0.59, 1.44)       | 0.85 (0.53, 1.37) |         | 0.92 (0.68, 1.24)           | 0.92 (0.65, 1.29) |           | 1.43 (0.99, 2.08) | 1.02 (0.67, 1.55) |
|  | P value     |                   | 0.539               | 0.362                    | 0.29              | 0.731                   | 0.515             |         | 0.57                        | 0.621             |           | 0.056             | 0.921             |
| Frequency of events reported   | OR (95% CI) |                   | 1.17 (0.8, 1.72)    | 1.14 (0.71, 1.81)        | 1.13 (0.75, 1.72) | 0.88 (0.6, 1.3)         | 1.02 (0.67, 1.55) |         | 1.14 (0.88, 1.49)           | 1.31 (0.96, 1.8)  |           | 1.3 (0.91, 1.85)  | 1.08 (0.72, 1.62) |
|  | P value     |                   | 0.412               | 0.591                    | 0.557             | 0.524                   | 0.937             |         | 0.327                       | 0.09              |           | 0.146             | 0.711             |
| Teamwork across units  | OR (95% CI) |                   | 0.64 (0.33, 1.26)   | 0.24 (0.12, 0.48)        | 0.93 (0.44, 1.97) | 1.4 (0.66, 2.98)        | 0.87 (0.41, 1.86) |         | 0.48 (0.27, 0.84)           | 0.4 (0.22, 0.74)  |           | 1.41 (0.83, 2.4)  | 1.27 (0.7, 2.32)  |
|  | P value     |                   | 0.201               | <0.001                   | 0.841             | 0.384                   | 0.723             |         | 0.01                        | 0.004             |           | 0.207             | 0.428             |
| Staffing   | OR (95% CI) |                   | 0.83 (0.55, 1.27)   | 0.4 (0.25, 0.65)         | 0.74 (0.47, 1.16) | 1.0095 (0.6489, 1.5704) |                   |         | 0.75 (0.56, 1)              | 1.18 (0.83, 1.67) |           | 1.04 (0.71, 1.52) | 0.7 (0.46, 1.07)  |
|  | P value     |                   | 0.399               | <0.001                   | 0.189             | 0.967                   | 0.179             |         | 0.051                       | 0.363             |           | 0.843             | 0.103             |
| Handoffs and transitions   | OR (95% CI) |                   | 0.84 (0.58, 1.22)   | 0.64 (0.41, 0.99)        | 0.87 (0.58, 1.3)  | 1.17 (0.79, 1.73)       | 1.76 (1.13, 2.74) |         | 0.76 (0.58, 1.01)           | 0.68 (0.49, 0.93) |           | 1.25 (0.88, 1.77) | 1.29 (0.86, 1.92) |
|  | P value     |                   | 0.359               | 0.043                    | 0.506             | 0.426                   | 0.013             |         | 0.062                       | 0.018             |           | 0.205             | 0.213             |
| Non-punitive response to error                                       | OR (95% CI) |                   | 0.68 (0.49, 0.94)   | 0.78 (0.53, 1.16)        | 0.75 (0.53, 1.07) | 0.66 (0.47, 0.92)       | 0.74 (0.52, 1.05) |         | 0.86 (0.68, 1.09)           | 0.85 (0.65, 1.12) |           | 0.66 (0.48, 0.9)  | 0.71 (0.5, 1.01)  |
|  | P value     |                   | 0.018               | 0.221                    | 0.111             | 0.014                   | 0.094             |         | 0.213                       | 0.253             |           | 0.008             | 0.055             |

Bolded p-values indicates statistically significant findings (P<0.05).

\*Reference category.

(JCI) accreditation.<sup>39</sup> AKUH respondents performed well in most of the domains of patient safety culture when compared with the benchmarks of the AHRQ 2018 database as well as other developing countries such as Lebanon and Turkey.

Our results demonstrate lower internal consistency for several dimensions than acceptable thresholds. This variability may be attributable to influence of national and professional subcultures at the region of administration. For instance, Wagner *et al* found clear differences in responses between the Netherlands, the USA and Taiwan for several HSOPSC dimensions (eg, communication openness and non-punitive response to error).<sup>40</sup> The interpretation of many items may vary not just by the geographical region but also by professional groups.<sup>41</sup> Furthermore, most items in staffing and teamwork across units, the domains with lowest reliability, are negatively worded, potentially causing confusion among the respondents while interpreting them. Moreover, several local adaptations of HSOPSC have underperformed when compared with the original tool.<sup>42–46</sup> This might be due to the difference in context, health systems, staff groups and culture from the region of administration of the original tool.<sup>47–49</sup> Therefore, comparisons of the patient safety culture data from AKUH with the AHRQ 2018 database must be made with knowledge of the wide variations in the findings within the AHRQ database.<sup>50</sup>

The response rate of this study was 50%. This is lower than the overall response rate of 54% obtained for the HSOPSC in the AHRQ 2018 database.<sup>50</sup> The latter is comparable with the response rate reported in studies conducted in other regions of the world; for instance, 56% in Lebanon,<sup>32</sup> 37% in the UK<sup>16</sup> and 51%–91% in Turkey.<sup>33</sup> Response rate for HSOPSC has been reported to vary with the type of healthcare professional (being highest for registered nurses (91%) and lowest for doctors (51%)) and type of institution (being highest for teaching hospitals (86%) and lowest for university hospitals (56%)).<sup>33</sup>

The workforce at AKUH generally felt positively about the patient safety culture in their work area/unit. More than 87% of the respondents felt that the patient safety culture in their unit was either excellent or very good. This percentage is comparable with that found in the AHRQ 2018 database, where 74% of respondents gave their work area/unit a grade of excellent or very good on patient safety.<sup>36</sup> Reported values for different regions of the world included 73% in China,<sup>45</sup> 70% in Lebanon<sup>32</sup> and 40% in Turkey.<sup>33</sup>

Approximately 31% of the respondents had filled out and submitted at least one event report in the previous 12 months. This number is lower than that in the AHRQ 2018 database, where on average, 45% of respondents had reported at least one event in the past 12 months.<sup>36</sup> Previously, another study assessing perception of safety culture among nurses in public hospitals in Pakistan reported low levels of incident reporting due to the punitive response to error reporting.<sup>37</sup> However, our results still report a considerably higher percentage than in

Turkey, where 84% of the healthcare personnel never reported a medical error related to patient safety.<sup>33</sup> The frequency of event reporting at AKUH shows that, in general, personnel are able to comfortably report errors and bring associated patient safety issues to the attention of the appropriate authorities.

The dimension with the lowest positive scores was staffing (40%). The score for this domain is below the 10th percentile of the AHRQ 2018 benchmarks.<sup>36</sup> This is consistent with existing literature where in multiple studies, staffing scored lowest of the total dimensions.<sup>44 45 51 52</sup> An estimate of the magnitude of the problem of understaffing and high workload in Pakistan can be made from the following figures. The doctor-to-population ratio in Pakistan is estimated to be 1:1000.<sup>53</sup> This ratio is even higher in the case of specialists (1:7216).<sup>54</sup> In 2018, the nurses and midwives-to-population ratio in Pakistan was 0.7:1000.<sup>55</sup> In contrast, the doctor-to-population ratio in the USA was 2.6/1000 in 2017,<sup>56</sup> and the nurse-to-population ratio is estimated at 14.5:1000 in 2017.<sup>57</sup> There is a shortage in the area of human resources for health in Pakistan.<sup>58</sup> Such a shortage is likely to affect the current workforce in terms of increased workload and/or longer working hours. In a study on postgraduate trainees from Pakistan, individuals under stress were more likely to report longer working hours; they were also more likely to have used negative coping mechanisms to deal with the stress.<sup>59</sup> Such individuals can be expected to be less efficient, more prone to the commission of medical errors and ultimately counterproductive towards a patient safety culture. High workload can also adversely affect error reporting rates because personnel cannot expend time in submission of lengthy reporting forms.<sup>33</sup> Thus, improvement in working conditions and staffing can, therefore, be an important strategy for improving the patient safety culture<sup>32</sup> in a developing country such as Pakistan.

The composite scores of respondents in this survey were higher for teamwork within units (83%) as compared with teamwork across units (76%) and hospital handoffs and transitions (66%). This area merits further exploration in future studies, as interdepartmental friction is often a barrier to the delivery of optimum patient care. Similar results have been seen in studies from Lebanon and Turkey.<sup>32 33</sup> According to Jafree *et al*, nursing instructors and supervisors were the only one among nurses to feel comfortable communicating openly in public hospitals within Pakistan.<sup>37</sup> Cooperation and open communication form the core of quality care in a multidisciplinary healthcare organisation where a patient is often treated by several specialists<sup>32</sup> and should be practised across all units.

The hospital aides and technologists have consistently responded more positively for most domains when compared with nurses and physicians. Schwartz *et al* report work–life balance to be associated with better safety culture norms and report poor work–life balance among physicians and nurses when compared with technologists and aides.<sup>60</sup> Similarly, those who worked between 40 and

60 hours per week have responded more positively than the ones who worked more for most domains. This may explain our finding of more positive perceptions of patient safety among technologists and aides. Furthermore, these findings underscore the importance of work–life balance in establishing safety culture. The results also highlight the importance of varying needs of different professionals, which is consistent with findings from a German study.<sup>49</sup> For instance, our results reflect poor perception of patient safety culture among physicians if the handoffs and transitions are not smooth, if there is poor teamwork across units and if staff is short. On the other hand, nurses perceive patient safety culture to be poorer if they are penalised for errors. This merits designing and implementation of strategies tailored according to the needs of each professional group focusing on error-proof systems rather than individuals.

## LIMITATIONS

We acknowledge certain key limitations of this descriptive study. The sample was obtained from only one tertiary care hospital in Pakistan. This may limit the external validity of the study. AKUH, being a high-end private institution, would be expected to cater to a population with a higher average socioeconomic status than the general population of Pakistan. Moreover, AKUH is an organisation with a history of focus on patient safety, as is evidenced by the self-imposition of oversight by JCI.<sup>39</sup> Hence, we acknowledge the possibility that the patient safety culture in private and public hospitals in Pakistan may differ considerably from each other. This hypothesis should be explored in future studies.

The HSOPSC has not yet been validated in the Pakistani setting; a larger sample size will allow assessment of the psychometric properties of the questionnaire. This study has shown that the conduct of a patient safety culture assessment tool such as the HSOPSC is feasible in a developing country like Pakistan.

The inherent weaknesses of self-reporting instruments include possible tedium of respondents because of their length, bias of individuals regarding their own behaviour, and possible concealment of true attitudes and perspectives. AKUH respondents performed well in most of the domains of patient safety culture when compared with the benchmarks of the AHRQ 2018 database. Although it may indeed be reflective of a better patient safety culture, it can also be attributed to the cultural differences and unwillingness of personnel to express negative opinions about their workplaces.<sup>33 45</sup>

The disadvantages of using the Likert-type scale items have also been broached in literature. Individuals may simply choose to mark the options at the two extremes of the scale throughout the questionnaire; consequently, the true spectrum of opinions may not have been captured. For negatively worded items, the HSOPSC uses reverse scoring. However, respondents may continue to mark the agree end of the scale, leading to lower scoring for such

items. Nevertheless, inclusion of negatively worded items is important for the holistic exploration of the perceptual dimensions of a concept.<sup>20</sup>

## CONCLUSIONS

Patient safety is emerging as a premier priority for healthcare systems globally. Assessment tools allow an understanding of the workforce's attitudes and perceptions toward patient safety.<sup>24</sup> Comprehensive data on patient safety culture in the developed countries are available as a result of a battery of well-coordinated efforts over the past decade. However, developing countries need to channel resources toward the assessment of patient safety culture at their healthcare institutions.<sup>32</sup> Measurement of patient safety culture in Pakistan is currently at an embryonic stage. This study is one of the very few to report the safety culture from a tertiary care hospital in Pakistan.<sup>37</sup> Therefore, the results of this study can be used as a baseline for future interventions. It highlights the feasibility of conducting such a survey in a developing country. It also lays the foundation for further context-specific work on factors such as instrument validity and reliability in Pakistan. We look forward to broadly measuring and improving safety culture in developing countries.

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## REFERENCES

- Pronovost P, Needham D, Berenholtz S, *et al.* An intervention to decrease catheter-related bloodstream infections in the ICU. *N Engl J Med* 2006;355:2725–32.
- Lipitz-Snyderman A, Steinwachs D, Needham DM, *et al.* Impact of a statewide intensive care unit quality improvement initiative on hospital mortality and length of stay: retrospective comparative analysis. *BMJ* 2011;342:d219.
- DePalo VA, McNicoll L, Cornell M, *et al.* The Rhode island ICU collaborative: a model for reducing central line-associated bloodstream infection and ventilator-associated pneumonia statewide. *Qual Saf Health Care* 2010;19:555–61.
- Rosenthal VD, Maki DG, Salomao R, *et al.* Device-associated nosocomial infections in 55 intensive care units of 8 developing countries. *Ann Intern Med* 2006;145:582–91.
- Rosenthal VD, Maki DG, Jamulitrat S, *et al.* International nosocomial infection control Consortium (INICC) report, data summary for 2003–2008, issued June 2009. *Am J Infect Control* 2010;38:95–104.
- Connolly W, Li B, Conroy R, *et al.* National and institutional trends in adverse events over time: a systematic review and meta-analysis of longitudinal retrospective patient record review studies. *J Patient Saf* 2021;17:141–8.
- Landrigan CP, Parry GJ, Bones CB, *et al.* Temporal trends in rates of patient harm resulting from medical care. *N Engl J Med* 2010;363:2124–34.
- Jha AK, Prasopa-Plaizier N, Larizgoitia I, *et al.* Patient safety research: an overview of the global evidence. *Qual Saf Health Care* 2010;19:42–7.
- Pronovost PJ, Berenholtz SM, Goeschel CA, *et al.* Creating high reliability in health care organizations. *Health Serv Res* 2006;41:1599–617.
- Ilan R, Fowler R. Brief history of patient safety culture and science. *J Crit Care* 2005;20:2–5.
- Agency for Healthcare Research and Quality. Quality and patient safety resources. Available: [www.ahrq.gov/patient-safety/resources/index.html](http://www.ahrq.gov/patient-safety/resources/index.html) [Accessed 2 Apr 2021].
- Pronovost PJ, King J, Holzmueller CG, *et al.* A web-based tool for the comprehensive unit-based safety program (cusp). *Jt Comm J Qual Patient Saf* 2006;32:119–29.
- Denning M, Goh ET, Scott A, *et al.* What has been the impact of covid-19 on safety culture? A case study from a large metropolitan healthcare trust. *Int J Environ Res Public Health* 2020;17:7034.
- Smits M, Christiaans-Dingelhoff I, Wagner C, *et al.* The psychometric properties of the “Hospital survey on patient safety culture” in Dutch hospitals. *BMC Health Serv Res* 2008;8:230.
- Meterko M, Mohr DC, Young GJ. Teamwork culture and patient satisfaction in hospitals. *Med Care* 2004;42:492–8.
- Waterson P, Griffiths P, Stride C, *et al.* Psychometric properties of the hospital survey on patient safety culture: findings from the UK. *Qual Saf Health Care* 2010;19:e2.
- Sexton JB, Helmreich RL, Neilands TB, *et al.* The safety attitudes questionnaire: psychometric properties, benchmarking data, and emerging research. *BMC Health Serv Res* 2006;6:44.
- Deilkås ET, Hofoss D. Psychometric properties of the Norwegian version of the safety attitudes questionnaire (SAQ), generic version (short form 2006). *BMC Health Serv Res* 2008;8:191.
- Smits M, Wagner C, Spreeuwenberg P, *et al.* Measuring patient safety culture: an assessment of the clustering of responses at unit level and hospital level. *Qual Saf Health Care* 2009;18:292–6.
- Blegen MA, Gearhart S, O'Brien R, *et al.* AHRQ's Hospital survey on patient safety culture: psychometric analyses. *J Patient Saf* 2009;5:139–44.
- Pringle J, Weber RJ, Rice K, *et al.* Examination of how a survey can spur culture changes using a quality improvement approach: a region-wide approach to determining a patient safety culture. *Am J Med Qual* 2009;24:374–84.
- Organization WH, Group WA for PSRPSW. Summary of the evidence on patient safety: implications for research. 2008. Available: <https://apps.who.int/iris/handle/10665/43874>
- Kiaei MZ, Ziaee A, Mohebbifar R, *et al.* Patient safety culture in teaching hospitals in Iran: assessment by the hospital survey on patient safety culture (HSOPSC). *J Health Manag Inf Sci* 2016;3:51–6.
- Chen I-C, Li H-H. Measuring patient safety culture in Taiwan using the hospital survey on patient safety culture (HSOPSC). *BMC Health Serv Res* 2010;10:152.
- Abdelhai R, Abdelaziz S, Ghanem N. Assessing patient safety culture and factors affecting it among health care providers at Cairo university hospitals. Available: 2012./paper/Assessing-Patient-Safety-Culture-and-Factors-It-at-Abdelhai-Abdelaziz/10b42a94dfa551ba919f238a51549b839673aa6a [Accessed 2 Apr 2021].
- Aboul-Fotouh AM, Ismail NA, Ez Elarab HS, *et al.* Assessment of patient safety culture among healthcare providers at a teaching hospital in Cairo, Egypt. *East Mediterr Health J* 2012;18:372–7.
- Elmontsri M, Banarsee R, Majeed A. Improving patient safety in developing countries - moving towards an integrated approach. *JRSM Open* 2018;9:2054270418786112.
- Sorra JS, Dyer N. Multilevel psychometric properties of the AHRQ Hospital survey on patient safety culture. *BMC Health Serv Res* 2010;10:199.
- Colla JB, Bracken AC, Kinney LM, *et al.* Measuring patient safety climate: a review of surveys. *Qual Saf Health Care* 2005;14:364–6.
- Flin R, Burns C, Mearns K, *et al.* Measuring safety climate in health care. *Qual Saf Health Care* 2006;15:109–15.
- Hospital survey on patient safety culture user's.pdf. Available: [www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/patientsafetyculture/hospital/userguide/hospcult.pdf](http://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/patientsafetyculture/hospital/userguide/hospcult.pdf) [Accessed 5 Apr 2021].
- El-Jardali F, Jaafar M, Dimassi H, *et al.* The current state of patient safety culture in Lebanese hospitals: a study at baseline. *Int J Qual Health Care* 2010;22:386–95.
- Bodur S, Filiz E. Validity and reliability of Turkish version of “Hospital survey on patient safety culture” and perception of patient safety in public hospitals in Turkey. *BMC Health Serv Res* 2010;10:28.
- Aga Khan Development Network. University hospitals network. Available: [www.akdn.org/our-agencies/aga-khan-university/university-hospitals-network](http://www.akdn.org/our-agencies/aga-khan-university/university-hospitals-network) [Accessed 29 Sep 2021].
- Hospital survey on patient safety culture: user's guide. n.d.: 51.
- Hospital survey on patient safety culture: 2010 user comparative database report. Available: <https://psnet.ahrq.gov/issue/hospital-survey-patient-safety-culture-2010-user-comparative-database-report> [Accessed 5 Apr 2021].
- Jafree SR, Zakar R, Zakar MZ, *et al.* Assessing the patient safety culture and ward error reporting in public sector hospitals of Pakistan. *Saf Health* 2017;3:10.
- Rizwan G, Rizwan Z, Bhatti UA, *et al.* Hospital survey on patient safety culture in dental hospitals in the Twin cities, Pakistan. Available: <https://pjmhsnline.com/published-issues/2021/october/103185> [Accessed 19 Jan 2023].
- University TAK. AKUH and AKU outreach health network, Pakistan receive JCI reaccreditation. Available: <https://hospitals.aku.edu/pakistan/AboutUs/News/Pages/akuu-receives-joint-commission-international-accreditation.aspx> [Accessed 25 Oct 2021].
- Wagner C, Smits M, Sorra J, *et al.* Assessing patient safety culture in hospitals across countries. *Int J Qual Health Care* 2013;25:213–21.
- Waterson P, Carman E-M, Manser T, *et al.* Hospital survey on patient safety culture (HSPSC): a systematic review of the psychometric properties of 62 international studies. *BMJ Open* 2019;9:e026896.
- Al Salem G, Bowie P, Morrison J. Hospital survey on patient safety culture: psychometric evaluation in Kuwaiti public healthcare settings. *BMJ Open* 2019;9:e028666.
- Perneger TV, Staines A, Kundig F. Internal consistency, factor structure and construct validity of the French version of the hospital survey on patient safety culture. *BMJ Qual Saf* 2014;23:389–97.



- 44 Zhu J. Measurement equivalence of patient safety climate in Chinese hospitals: can we compare across physicians and nurses? *Int J Qual Health Care* 2019;31:411–8.
- 45 Nie Y, Mao X, Cui H, *et al.* Hospital survey on patient safety culture in China. *BMC Health Serv Res* 2013;13:228.
- 46 Haugen AS, Sjøteland E, Eide GE, *et al.* Patient safety in surgical environments: cross-countries comparison of psychometric properties and results of the Norwegian version of the hospital survey on patient safety. *BMC Health Serv Res* 2010;10:279.
- 47 Ginsburg L, Gillin D, Tregunno D, *et al.* Advancing measurement of patient safety culture. *Health Serv Res* 2009;44:205–24.
- 48 Coyle IR, Sleeman SD, Adams N. Safety climate. *Journal of Safety Research* 1995;26:247–54.
- 49 Pfeiffer Y, Manser T. Development of the German version of the hospital survey on patient safety culture: dimensionality and psychometric properties. *Safety Science* 2010;48:1452–62.
- 50 SOPS hospital database. Available: [www.ahrq.gov/sops/databases/hospital/index.html](http://www.ahrq.gov/sops/databases/hospital/index.html) [Accessed 25 Nov 2021].
- 51 Okuyama JHH, Galvao TF, Silva MT. Healthcare professional's perception of patient safety measured by the hospital survey on patient safety culture: a systematic review and meta-analysis. *ScientificWorldJournal* 2018;2018:9156301.
- 52 Hellings J, Schrooten W, Klazinga N, *et al.* Challenging patient safety culture: survey results. *Int J Health Care Qual Assur* 2007;20:620–32.
- 53 Physicians (per 1,000 people) - pakistan | data. Available: <https://data.worldbank.org/indicator/SH.MED.PHYS.ZS?locations=PK> [Accessed 2 Apr 2021].
- 54 PAK\_ImmigrationReport.pdf. Available: [www.who.int/workforcealliance/knowledge/resources/PAK\\_ImmigrationReport.pdf](http://www.who.int/workforcealliance/knowledge/resources/PAK_ImmigrationReport.pdf) [Accessed 2 Apr 2021].
- 55 Nurses and midwives (per 1,000 people) - pakistan | data. Available: <https://data.worldbank.org/indicator/SH.MED.NUMW.P3?locations=PK> [Accessed 2 Apr 2021].
- 56 Physicians (per 1,000 people) | data. Available: <https://data.worldbank.org/indicator/SH.MED.PHYS.ZS> [Accessed 6 Apr 2021].
- 57 Nurses and midwives (per 1,000 people) | data. Available: <https://data.worldbank.org/indicator/SH.MED.NUMW.P3> [Accessed 6 Apr 2021].
- 58 WHO EMRO. Pakistan human resources for health assessment, 2009 | volume 16, supplement | EMHJ volume 16. 2009. Available: [www.emro.who.int/emhj-volume-16-2010/volume-16-supplement/article-18.html](http://www.emro.who.int/emhj-volume-16-2010/volume-16-supplement/article-18.html) [Accessed 5 Apr 2021].
- 59 Kasi PM, Khawar T, Khan FH, *et al.* Studying the association between postgraduate trainees' work hours, stress and the use of maladaptive coping strategies. *J Ayub Med Coll Abbottabad* 2007;19:37–41.
- 60 Schwartz SP, Adair KC, Bae J, *et al.* Work-Life balance behaviours cluster in work settings and relate to burnout and safety culture: a cross-sectional survey analysis. *BMJ Qual Saf* 2019;28:142–50.