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Staying Ahead of the Curve: Navigating Changes and Maintaining Gains in Patient Safety Culture—A Mixed-Methods Study

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Staying Ahead of the Curve: Navigating Changes and Maintaining Gains in Patient Safety Culture—A Mixed-Methods Study

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ABSTRACT

Objectives: This study examines how the results of the Hospital Survey on Patient Safety Culture changed between 2012 and 2019 and identifies organizational factors affecting these changes.

Design: The study combined the use of quantitative surveys of staff and qualitative interviews with hospital leadership. Secondary data analysis was performed for previous surveys.

Setting: This is study was conducted in a tertiary care teaching multi-site hospital in Riyadh, Saudi Arabia.

Participants: One thousand hospital staff participated in the survey. Thirty-one executive board members and directors and four focus groups of frontliners were qualitatively interviewed.

Primary and Secondary Outcome Measures: Twelve safety culture dimensions were assessed to study the patient safety culture as perceived by the healthcare professionals. An additional semi-structured interview was conducted to identify organizational factors, changes, and barriers affecting the patient safety culture. Furthermore, suggestions to improve patient safety were proposed.

Results: Comparing the results revealed a general positive trend in scores from 2012 to those from 2019. The areas of strength included teamwork within and across units, organizational

learning, managerial support, overall perception of safety, and feedback and communication about error. Non-punitive response to error, staffing, and communication and openness consistently remain the lowest-scoring composites. Interview results revealed that organizational changes may have influenced the answers of the participants on some survey composites.

Conclusions: Patient safety is a moving target with areas for improvement that are continuously identified. Effective quality improvement initiatives can lead to visible changes in the patient safety culture in a hospital, and consistent leadership commitment and support can maintain these improvements.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This is the first study to explore the results of a survey on patient safety culture in four consecutive rounds in Saudi Arabia.

- This study covered almost all categories of healthcare workers, including managers and care providers.

- A mixed-methods design was used to overcome the methodological limitations of the lack of a single tool that could capture the complexities of a safety culture.

- The lower response rate of the 2019 assessment round was observed and compared to previous years; therefore, the results of this study should be interpreted with caution.

- To minimize the occurrence of spurious correlations due to common-method variance in the survey instrument, we have utilized a mixed-methods design rather than simply applying the survey method alone.

INTRODUCTION

Despite considerable investments in quality healthcare and patient safety over the past decades, patients continue to experience preventable harm, and the current status of patient safety around the world remains alarming.[1] Recent studies have identified adverse events as a serious global issue affecting patient safety. Therefore, identifying and preventing potential harm is a top priority of healthcare organizations, thus enhancing patient outcomes. Evidence suggests that a strong culture of patient safety in a hospital is associated with fewer adverse events and improved patient outcomes.[2 3]

It is increasingly recognized that healthcare organizations around the world, regardless of economic status, are closely focusing on measuring and enhancing their Patient Safety Culture(PSC).[4-6] PSC is assessed to provide information to managers and healthcare policymakers; in addition, it can help organizations understand the present state of their PSC and analyze the PSC trends over time. Measuring PSC is important for identifying areas of strength and areas needing prioritization for interventions, evaluating the impact of patient safety initiatives or programs, and tracking changes over time. Furthermore, it improves staff perceptions, develops a better understanding of patient safety, fulfills accreditation or regulatory requirements, and conducts internal and external benchmarking.[2 7 8]

Measuring PSC is still considered relatively difficult and is well documented in the literature.[9 10] No single tool can sufficiently assess all major components of PSC and provide leaders with clear guidance on how PSC can be effectively improved.[11 12] To explore the complex concept of PSC in healthcare, the mixed-methods approach, by collecting and analyzing both quantitative and qualitative data, can be viewed as the most appropriate approach to increase the robustness

of the results and gain a deeper understanding of PSC while offsetting the intrinsic weaknesses associated with each approach when used on its own.[5][13]

Given the clear need for continuous monitoring of PSC and better understanding of how organizational culture changes after multiple interventions and milestones, we used the mixed-methods approach to assess PSC progressively over a period of eight years. To our knowledge, assessing PSC has not yet been performed at this scale, and this study can provide us insight on the key areas to improve regarding PSC in healthcare organizations and persistent challenges in PSC that are difficult to change rapidly with simple interventions. This study reports on the organizational survey results of 2019 and compares these results to those of three previous assessments at the same multi-site facility (2012,[14] 2015,[4] and 2017).

Objectives

The overall objective of this study is to examine how the results of the HSOPSC survey changed between 2012 and 2019 and identify organizational factors affecting these changes. Specifically, this study provides an overview of the results of multiple assessments of PSC surveys at a large multi-site healthcare facility in Riyadh, Kingdom of Saudi Arabia.

METHODS

Design

In this study, a mixed-methods research design was used to achieve the most comprehensive understanding possible of the research problem. The study combined the use of quantitative surveys and qualitative interviews with hospital staff of different levels to achieve the study objectives. Additionally, we conducted a cross-validation of the results with those of the previous surveys conducted at the same site in 2012[14], 2015[4], and 2017.

Setting

This study was conducted in a tertiary care teaching multi-site hospital having a capacity of 1,160 beds and approximately 9,000 employees. It receives referral patients from all over the country. The hospital has three sites, varying in size and location; site A has 1,060 beds and offers free medical services with a wide range of specialties, and site B has 100 beds and offers complementary services to those of site A. Site C offers inpatient and outpatient dental services.

Quantitative component

The tool (questionnaire)

The tool used was adapted from the HSOPSC developed by the AHRQ.[7] The survey is available in English and Arabic. The internal consistency and reliability of the original English version were tested using Cronbach's alpha that ranged between 0.62 and 0.85.[15][16] However, the Arabic version was adapted and used in similar studies in Lebanon,[17] Saudi Arabia,[4][14] and Jordan,[18] and its reliability was measured using Cronbach's coefficient that ranged between 0.45 and 0.81.[17] The HSOPSC includes 42 items grouped into 12 composites. In addition to the composites, the survey includes two questions asking respondents to provide an overall grade on patient safety and to indicate the number of reported events over the past 12 months.

Data collection

Data collection for the 2017 and 2019 surveys was performed in two assessment rounds: from September to November in 2017 and from February to April in 2019. Data collection for the 2012 and 2015 surveys was described in studies by El-Jardali et al.[14] and Alswat et al.[4]

The survey was made available in hard copies and the electronic format for all respondents. The hard-copy surveys were provided in sealed envelopes for respondents who could not access the electronic-format surveys. The first page of the survey included the consent form and an explanation of the purpose of the survey. Employees were not asked to sign the consent form or any other page of the survey; they were asked to return the hard copies of the survey in a sealed envelope.

Data analysis

Data were analyzed using Statistical Package for the Social Sciences, version 25.0, (IBM Corp., Armonk, NY, USA); p values of > 0.05 were used to denote significance. In addition to answering the study tool, respondents were asked to provide some background demographic information about themselves (age, gender, marital status, profession, educational level, clinical experience, working hours during the week, working area, and whether they were trained on patient safety). The composite items were measured using a 5-point Likert response scale of agreement, with the scores ranged from "strongly disagree" to "strongly agree" or frequencies that ranged from "never" to "always." Consequently, the HSOPSC comprised the following two single-item measures:

- The patient safety grade, scored with a 5-point Likert scale ranging from "excellent" to "failing"
- The number of adverse events reported by the respondent during the last year, ranging from "no events" to "21 events or more."

The results were presented as percentages of the average positive responses (e.g., strongly agree/agree and most of the time/always) for each survey item; negatively worded items were reversed when computing their percentages. The percent positives for each subscale were

computed as follows: [(number of positive responses/total number of responses on the item) ×

100%]. Missing responses were excluded when displaying the percentages of the responses to

the survey items.[7] Composites that had at least 70% positive responses were considered areas of

strength, whereas those with less scores were considered areas for improvement. Our decision to

consider our cut-off point to be 70% for patient safety areas in need for improvement was based

on the results of our previous two PSC surveys conducted in the same facility. Composite scores

were calculated by summing the item scores and dividing the sum by the number of items within

the composite.

Descriptive statistics such as frequency and percentage were used for data summarization. Given

that the data were not normally distributed for all composites, the independent Kruskal–Wallis H

test was used to determine whether a significant difference exists between survey composites

between the 2012, 2015, 2017, and 2019 datasets. The chi-square test was used to determine

whether a significant difference exists between the 2012 and 2019 datasets for the questions

regarding the number of events and patient safety grade.

Qualitative component

Interview tool

Semi-structured interviews were conducted to probe the topic deeper, make the interviews more

conversational, and make sure all interview participants, including leaders and frontline staff, were

asked the same questions. An interview guide was adapted and modified from previous studies,[19-21]

and an external expert review followed (see online Supplementary 1S).

Participants

We used a purposive sampling technique to recruit interviewees. Thirty-one semi-structured individual interviews were conducted with all executive board members in Medical City, medical directors in each site, directors of the main clinical and supportive services departments, and four focus groups of frontliners. Those identified to participate had received an invitation email including all the information about the voluntary nature of participation and an explanation of the entire study phase and a request to record the interviews, which were conducted in a private place (see online supplementary table 1S).

Data collection

The interviews were scheduled according to the participants' availability. All interviews were conducted in English. Each interview lasted 15–30 minutes and was recorded using a digital voice recorder. A research assistant transcribed the recorded data as soon as each interview was completed. The accuracy of the transcriptions was reviewed (and corrected if necessary) by the researchers. In addition, field notes were taken, and the responses and views of the participants were summarized at the end of each interview to ensure that they reflected their views. Participation was voluntary and the interview tool did not collect any information that could be used to identify the participants. Participant confidentiality was maintained at every stage of the study.

Data analysis

Thematic analysis was conducted for the data collected through the interviews. Coding, which was done by two members of the research team, was initially conducted by breaking responses into similar concepts and ideas. Minimal discrepancies were found after cross-checking the work between the two team members. Disagreements were discussed until a consensus was achieved.

This was followed by axial coding, which comprised the organization of the emerging concepts

into themes and categories.

Patient and public involvement

In this study, no patients were involved.

RESULTS

Survey results

General results

In total, 2,694 questionnaires from the 2017 assessment round and 1,000 from the 2019

assessment round were completed, giving a response rate of 59.8% and 22.2%, respectively.

However, the response rates in the previous two rounds were 85.7%[14] and 57.6% [4] (Table 1).The

discrepancy in the response rate was observed as we stopped the second data collection in 2019

as the organization was preparing for the final survey of dual accreditation by both national and

international accreditation bodies. We were concerned about the potential biases or false positive

responses that might arise during the deep engagement of all of the staff at all levels in these

accreditation activities.

Despite the low response rate in 2019, the study sample size is more than the minimum sample

size recommended by the AHRQ.[7] Moreover, all three previous PSC surveys in 2012, 2015, and

2017 conducted at our institution showed good response rates of >50% (85.7%, 57.6%, and

59.8% respectively). In this study, we reflected and interpreted the four PSC surveys

simultaneously.

Most respondents in all four assessment rounds were nurses (50.1%, 78.3%, 56%, and 61.7%,

respectively). Most respondents were female in the four assessment rounds that could be

explained by the fact that the approximate proportion of our nursing staff is approximately 27%

of the total number of employees including both clinical and non-clinical staff. Moreover, our

nursing staff predominantly comprised females (87%). Approximately half of the respondents

were aged between 30 and 45 years (45.3%, 46.4%, 61.6%, and 65.3% in 2012, 2015, 2017, and

2019, respectively).

Among the study respondents, the majority held a Bachelor's degree (38.9%, 56.2%, 61.4%, and

59.2% in years 2012, 2015, 2017, and 2019, respectively), whereas 43.6% in 2012 and 25.4% in

2017 had diplomas. A large proportion of the respondents in the 2015 and 2017 assessment

rounds had 6–10 years of experience in the hospital (32.3% and 27.5%, respectively), whereas

30.5% and 35.4% had 1–5 years of experience in the hospital in the 2012 and 2019 assessment

rounds, respectively. Additionally, approximately half of the staff reported working in medical

units in all assessment rounds, except in 2012, where 27.1% of the respondents were working in

the hospital administration. Moreover, more than 75% of the personnel had been in direct contact

with patients and working 40–60 hours a week in all four assessment surveys.

Table 1. Sociodemographic and professional characteristics of the respondents along with the number of events reported and patient safety grades.				
Sociodemographic and professional characteristics	2012[14] N (%) Total no. 2,572	2015[4] N (%) Total no. 2,592	2017 N (%) Total no. 2,694	2019 N (%) Total no. 1,000
Work area/unit where respondents spend most of their work time				
Many different hospital units/no specific unit	13 (0.5)	21 (0.8)	36 (1.5)	2 (0.2)
Administrative	697 (27.1)	138 (5.4)	357 (14.6)	50 (5.1)
Medical	536 (20.8)	1332 (51.9)	1193 (48.8)	517 (53.1)
Surgical	503 (19.6)	786 (30.6)	406 (16.6)	267 (27.4)
Diagnostics	277 (10.8)	99 (3.9)	399 (16.3)	101 (10.4)
Other	545 (21.2)	191 (7.4)	54 (2.2)	36 (3.7)
Missing	1	25	249	27

Respondents' positions at the hospital				
Administrator/manager/director/head	92 (3.6)	47 (1.9)	96 (3.7)	21 (2.2)
Physician	158 (6.1)	141 (5.6)	191 (7.4)	91(9.4)
Specialist	80 (3.1)	61 (2.4)	164 (6.4)	57 (5.9)
Coordinator	13 (0.5)	10 (0.4)	55 (2.1)	14 (1.4)
Assistant/aide	62 (2.4)	39 (1.6)	65 (2.5)	18 (1.9)
Pharmacist	56 (2.2)	36 (1.4)	79 (3.1)	4 (0.4)
Therapist	52 (2.0)	1 (0.0)	32 (1.2)	18 (1.9)
Registered nurse	1287 (50.1)	1969 (78.3)	1443 (56.0)	596 (61.7)
Resident/PG/intern	67 (2.6)	64 (2.5)	92 (3.6)	29 (3)
Assistant/clerk/secretary/facilitator	133 (5.2)	28 (1.1)	60 (2.3)	28 (2.9)
Technician	308 (12.0)	52 (2.1)	236 (9.2)	76 (7.9)
Other	264 (10.3)	67 (2.7)	62 (2.4)	14 (1.4)
Missing	0	77	119	34
Experience in current hospital (years)				
Less than 1 year	463 (18.6)	133 (5.3)	553 (21.8)	77 (8)
1–5 years	758 (30.5)	741 (29.6)	640 (25.2)	339 (35.4)
6–10 years	622 (25.0)	809 (32.3)	698 (27.5)	262 (27.4)
11–15 years	290 (11.7)	348 (13.9)	353 (13.9)	151(15.8)
16–20 years	136 (5.5)	222 (8.9)	154 (6.1)	73 (7.6)
21 years or more	217 (8.7)	252 (10.1)	139 (5.5)	55 (5.7)
Missing	86	87	157	43
Experience in current work area (years)				
Less than 1 year	436 (17.3)	313 (12.6)	432 (17.0)	50 (5.2)
1–5 years	986 (39.1)	520 (21.0)	404 (15.9)	233 (24.3)
6–10 years	528 (20.9)	781 (31.5)	827 (32.5)	319 (33.3)
11–15 years	245 (9.7)	358 (14.5)	411 (16.1)	165 (17.2)
16–20 years	159 (6.3)	233 (9.4)	249 (9.8)	106 (11.1)
21 years or more	168 (6.7)	272 (11)	223 (8.8)	85 (8.9)
Missing	50	115	148	42
Hours worked per week				
Less than 20 hours per week	55 (2.3)	25 (1.0)	58 (2.3)	24 (2.5)
20–39 hours per week	203 (8.3)	148 (6.0)	214 (8.6)	87 (9.2)
40–60 hours per week	2180 (89.4)	2280 (92.9)	2206 (89.0)	838 (88.3)
Missing	134	139	216	51
Job involving direct contact with patients				
Yes, I typically have direct interaction or contact with patients.	1956 (76.1)	2229 (90.9)	2045(82.2)	808 (85.7)
No, I typically do not have direct interaction or contact with patients.	615 (23.9)	224 (9.1)	443(17.8)	135 (14.3)
Missing	1	139	206	57
Gender				

Male	728 (28.6)	398 (15.9)	628 (24.6)	234 (24.6)
Female	1820 (71.4)	2103 (84.1)	1925 (75.4)	719 (75.4)
Missing	24	91	141	47
Age (years)				
Below 30 year old	854 (33.7)	925 (37.3)	558 (22.7)	175 (18.2)
Between 30 and 45 years old	1148 (45.3)	1152 (46.4)	1515 (61.6)	628 (65.3)
Between 46 and 55 years old	401(15.8)	253 (10.2)	282 (11.5)	114 (11.9)
Above 55 years old	133 (5.2)	151 (6.1)	103 (4.2)	44 (4.6)
Missing	36	111	236	39
Marital Status				
Single	752 (30.3)	851 (34.2)	807(31.5)	309 (32)
Married	1682 (67.8)	1602 (64.4)	1703 (66.4)	633 (65.6)
Divorced/Separated	25 (1.0)	16 (0.6)	33 (1.3)	13 (1.3)
Widowed	14 (0.6)	13 (0.5)	13 (0.5)	6 (0.6)
Other	8(0.3)	6 (0.2)	7(0.3)	4 (0.4)
Missing	91	104	131	35
Educational level				
Under high school level	14 (0.6)	2 (0.1)	11 (0.4)	3 (0.3)
High school level	62 (2.5)	7 (0.3)	25 (1.0)	4 (0.4)
Diploma level	1082 (43.6)	836 (33.5)	654 (25.4)	267 (27.6)
Bachelor's degree	966 (38.9)	1403 (56.2)	1579 (61.4)	574 (59.2)
Master's degree	124 (5.0)	127 (5.1)	160 (6.2)	61 (6.3)
Doctorate degree	112 (4.5)	102 (4.1)	110 (4.3)	53 (5.5)
Others	122 (4.9)	19 (0.8)	32 (1.2)	7(0.7)
Missing	90	96	123	31

PSC dimensions

PSC dimensions were examined (Table 2). The dimensions with the highest average response

rates, considered areas of strength, were "organizational learning–continuous improvement"

ranging from 79.6% to 83.9% between 2012 and 2019 and "teamwork within units" that scored

more than 75% in all four assessments. Furthermore, the average response rates of the "hospital

management support for patient safety" dimension were 70.4%, 75.3%, 73.3%, and 73.8% in

2012, 2015, 2017, and 2019, respectively.

All surveys had the same areas requiring improvement. There is a general trend toward

improvement in percent positive scores from 2012 to 2019, except for the "frequency of events

reported" composite. Note that "overall perception of patient safety" was found to be an area for

improvement in 2012; however, it was shown to be an area of strength in 2019. The lowest

reported average percentage was below 30% for "non-punitive response to error" throughout the

four assessment rounds. Additionally, staffing and communication openness were the next

lowest-scoring composites across the four assessment rounds (Table 2).

Table 2. Distribution of positive responses in the survey dimensions.				
Patient safety culture dimensions	2012	2015	2017	2019
Teamwork within units	78.5%	84.8%	81.6%	84.5%
Supervisor/manager expectations and actions promoting patient safety	60.6%	60.8%	60.4%	64.0%
Organizational learning–continuous improvement	79.6%	86.3%	82.2%	83.9%
Management support for patient safety	70.4%	75.3%	73.3%	73.8%
Overall perceptions of patient safety	65.3%	59.5%	59.6%	61.7%
Feedback and communication about error	63.3%	71.8%	68.7%	72.0%
Communication openness	42.9%	45.0%	48.5%	49.8%
Frequency of events reported	59.4%	68.8%	64.9%	66.6%
Teamwork across units	61.6%	67.0%	64.1%	65.8%
Staffing	35.1%	33.8%	30.8%	31.9%
Handoffs and transitions	51.5%	55.8%	49.6%	52.2%
Non-punitive response to error	26.8%	24.8%	27.2%	27.2%

Comparing the results from 2012 to those of 2019

The Kruskal–Wallis test was conducted to compare the results from all four surveys (Table 3). As

a result, significant differences lie across the four surveys with the exception to the

"supervisor/manager expectations and actions promoting patient safety" and "non-punitive

response to error" composites. A comparison of the mean scores between 2012 and 2019 showed

a steady increase in composite scores. The statistical significance of these differences varied according to the survey composites; however, it is worth noting that the highest scores were observed in 2015.

"Non-punitive response to error" and "staffing" remained the lowest-scoring composites in all assessment rounds, but the difference is not statistically significant. The highest-ranking composite for all surveys was "organizational learning–continuous improvement."

Table 3. The Kruskal–Wallis test comparing the composite scores in 2012 to those in 2019.										
	2012		**2015**		**2017**		**2019 KAUH**		**Independent sample Kruskal–Wallis test**	
Patient safety culture dimensions	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**P-Value**	**Adjusted significance Bonferroni correction**
Frequency of events reporting	3.64	1.16	4.04	1.54	3.83	1.1	3.82	1.14	<0.001	abce
Overall perceptions of safety	3.43	0.59	3.6	1.56	3.47	0.6	3.51	0.62	<0.001	bce
Supervisor/manager expectations and actions promoting safety	3.46	0.65	3.57	1.34	3.48	0.67	3.54	0.68	0.003	c
Organizational learning–continuous improvement	3.89	0.69	4.16	1.14	4.02	0.61	4.03	0.58	<0.001	abc
Teamwork within hospital units	3.85	0.75	4.04	0.71	4.00	0.67	4.03	0.63	<0.001	abc
Communication openness	3.25	0.85	3.45	1.08	3.43	0.82	3.43	0.89	<0.001	abcde
Feedback and communication about errors	3.73	0.95	4.11	1.1	3.95	0.87	4.04	0.8	<0.001	abcd
Non-punitive response to error	2.68	0.81	2.76	1.26	2.69	0.87	2.68	0.87	0.123	
Staffing	2.84	0.62	3.02	1.19	2.68	0.63	2.73	0.65	<0.001	bce
Hospital management support for patient safety	3.69	0.76	3.85	1.05	3.77	0.67	3.78	0.66	0.030	
Teamwork across hospital units	3.52	0.71	3.76	1.36	3.58	0.67	3.60	0.66	0.002	bc
Hospital handoffs and transitions	3.36	0.79	3.82	2.29	3.27	0.87	3.34	0.82	0.001	bc

Letter indicates a *p*-value <0.05 adjusted significance using the Bonferroni correction for multiple tests.
a   2012–2017
b   2012–2019
c   2012–2015
d   2017–2019
e   2017–2015
f   2019–2015

Patient safety grade and event reporting

The percentage of the respondents who evaluated patient safety in their work area/unit as excellent/very good increased from 69.5% in 2012 to 74.1% in 2019 ($p < 0.001$) (Table 4). Moreover, Table 4 displays the percentages of the number of events reported; the analysis indicated that the percentages of the respondents who reported no events in the last 12 months decreased by almost 7.4% from 2012 to 2019 ($p < 0.001$) and the percentages of reporting more than five event reports increased from 6.4% in 2012 to 8% in 2019.

Table 4: Chi-Square test comparing patient safety grades and the number of events reported between 2012 and 2019.					
Patient safety grade	**2012** N (%)	**2015** N (%)	**2017** N (%)	**2019** N (%)	**Sig**
Poor/failing	119 (4.8%)	57 (2.3%)	67 (2.6%)	18 (1.9%)	$p <0.001$
Acceptable	632 (25.6%)	654 (26.6%)	614 (24.2%)	230 (24%)	
Excellent/very good	1714 (69.5)	1747 (71.1%)	1859 (73.2%)	710 (74.1%)	
Number of events reported					
No event reports	1275 (52.7%)	1364 (55.8%)	1180 (47.3%)	427 (45.3%)	$p <0.001$
1 to 5 event reports	992 (41%)	940 (38.4%)	1092 (43.8%)	440 (46.7%)	
>5 event reports	154 (6.4%)	141 (5.8%)	223 (8.9%)	75 (8%)	

Interview results

Characteristics of the respondents

In total, 91 healthcare professionals were interviewed, among whom 10 were executive leaders (corporate level), 8 were hospital directors, and 13 were departmental chairpersons and directors. The researcher conducted interviews with four focus groups consisting of 60 front-liner staff. Most of the staff in the focus groups comprised physicians, pharmacists, nurses, and allied health technicians. The qualitative data obtained from the interviews were thematically categorized into the following: realizing changes in PSC in the facility/departments, factors influencing the PSC in

healthcare, barriers to establishing PSC and how to overcome them, and suggestions to improve

patient safety (see online supplementary table 2S).

Changes in PSC in the facility

The interviews showed that the respondents believe that the PSC in their department has

changed. Some of the documented observed changes included changes in the overall culture,

more awareness among the staff, improved communication, increased error reporting, improved

understanding and following hospital policies and procedures, improved care processes within

the hospital, provision of guides and manuals, more awareness of the risks and how to avert

them, and addressing staff fears about the punitive culture.

Some factors reported by the respondents that may have contributed to these changes include the

multiple accreditation surveys and the introduction of an electronic event reporting system.

Despite the learning curve associated with both interventions, the respondents reported that it has

allowed them to streamline their operations, enabled them to provide quality care to patients, and

improved the process of error reporting.

The respondents indicated that the main changes they saw in their department was the

amendment of existing policies and procedures, the clarification of job descriptions and roles,

and making the staff less resistant to change. In addition, hospital leadership observed better

communication and teamwork across the hospital and better staff awareness on the topic.

Factors influencing PSC in healthcare

According to the hospital leaders, making patients at the core of the PSC is the first step in the

right direction. This requires support at the leadership and administration levels. Hospital leaders

reported that accreditation was one of the factors that changed the culture within their

organization. It has improved communication between the staff and patients and within and across departments, staff training (including continuing education and training), and teamwork within and across units, particularly regarding handoffs and transitions. These were all considered factors that could support and improve event reporting and eventually lead to performance improvement.

Some of the factors that may influence PSC reported by the respondents included leadership and administrative support, monitoring and evaluation (including feedback) of patient safety indicators, the number of staff available, improvement of the error reporting system, receiving feedback on reported events, clarity and correct implementation of policies and procedures, implementing a system for monitoring patient safety goals, and improving workflow within specific departments.Some respondents reported that all hospital staff is responsible for improving the PSC, whereas other respondents placed the responsibility solely on the leaders and managers.

Barriers to establishing PSC and how to overcome them

Some of the documented barriers to establishing a PSC included poor communication within and across departments, punitive culture, limited staff awareness, staff resistance to change, staff shortages, language barrier, limited cooperation from physicians, and poor training of staff. Other less frequently mentioned barriers included staffing, budget, and space.

Organizational changes since 2012

The slight dip in the composite scores in 2017 could be attributed to several organization-wide factors that occurred during this transition period. Introducing new human resources regulations and workflows during the shift from the traditional civil service to a self-operation system, a

national trend throughout the Kingdom, had a significant impact on recruitment, re-contracting, and staff retention and turnover.

Another factor was the preparation for the dual accreditation (i.e., national and international) final surveys that were scheduled in December 2017 had several positive and negative implications. Overwhelming the staff with changes and escalations of improvement during a short period were among the negative effects.

The outset of 2017 witnessed the separation of the administration of the university hospitals (healthcare) quality from the academic (medical education) quality. Widespread expansions throughout the organization occurred including the opening of a new large eastern building that added to the total bed capacity of the hospital, increasing from 948 in 2014 to 1,160 in 2019. This added bed capacity had an additional burden to all categories of healthcare providers, especially physicians and nurses. The launching of new innovative healthcare services such as oncology, nuclear medicine and radiotherapy, home care, and genetics and metabolic and the addition of the new workflows, dynamics, and policies into the existing setting posed an additional burden to specialized expert healthcare providers.

Other organizational initiatives include conducting regular "Quality Days" to share experiences and recognize and reward distinguished contributions of staff and departments.
Several strategies were initiated to enhance the communication between top management and the frontline staff to identify and discuss facilitators and barriers, including an "Open Day," "Patient Safety Leadership Walk-Rounds," and "Breakfast with the Chief Executive Officer."
An occurrence variance reporting (OVR) system was launched as a paper-based system in 2010, followed by the first round of PSC survey in 2012[14] that inspired the organization to gradually

improve the OVR system through its digitalization in 2013 with multiple functionalities such as anonymous reporting and reporting feedback.[22]

Suggestions to improve patient safety

The respondents believed that increasing staffing; offering rewards to staff demonstrating excellence in performance; providing more training and education to staff, managers, and leaders; and improving communications and teamwork within and across departments will improve patient safety. Implementing a horizontal chain of command, more support from the management and leadership, giving feedback on events reported so that staff can see tangible results from their efforts, and supporting a non-punitive culture are important factors in enhancing the PSC in the organization. Some respondents indicated that some ways that managers can improve patient safety include using an open-door leadership approach, rewarding and empowering staff demonstrating initiative and excellence in patient safety, and using walk-rounds as a way to show the leaders' commitment to engaging with the staff.

In addition, the leaders proposed continuing education and training to staff in addition to regular meetings to discuss quality and patient safety as this would encourage more reporting. Additional ways to improve the PSC in the organization included increasing the space and number of machines available to decrease waiting time and accommodate urgent cases.

Some suggestions proposed by the interviewees for improving patient safety included better management of patient flow to avoid crowding and reduce waiting time, better triage and patient assessment, better implementation of policies and procedures, and improved infrastructure. In addition, supporting departmental initiatives relating to patient safety and disseminating the results of those initiatives, and empowering the staff to obtain their commitment can enhance patient safety.

Other suggestions included brainstorming sessions for the staff, initiating projects spearheaded by the departments to improve patient safety, and hosting a "Quality Day" particularly targeting newly recruited staff, and hosting huddles within departments to identify areas for improvement. In addition, more suggestions included empowering the quality committee, creating ambassadors in the hospital supported by the hospital leadership, and making the work and impact of these ambassadors more visible.

DISCUSSION AND CONCLUSIONS

This is the first study to progressively document results of a survey on PSC in four consecutive rounds, particularly in Saudi Arabia. The findings of this study can inform hospital leaders on the changes in performance as a result of quality improvement plans and accreditation.

The study revealed a general positive trend in scores as we compare results from 2012 to those from 2019. A spike in the scores was observed in 2015, and this was attributed to the accreditation survey conducted that year and the corresponding leadership visibility and support during that time. The introduction of an OVR system further reinforced the organizational shift in culture toward one that was centered on creating system changes valuing patient safety.

At the regional level, many scholars have evaluated PSC in different settings. Similar to our results, their findings showed that the areas of strength were "teamwork within units" and "organizational learning–continuous improvement." Alternatively, the areas for improvement were "promoting non-punitive response to error," "encouraging the openness of communication among healthcare professionals," and "facilitating hospital handoffs and transition process."[4 6 17 18 23-25] At the international level, similar areas for improvement were identified in hospitals.[26-28]

We observed a persistent discrepancy between the results of the outcome measures "frequency of events reported" and "non-punitive response to errors" throughout the four PSC surveys, despite the high reported average percentage of "feedback and communication about errors." This may reflect the residual internal conflict that the hospital staff have between their desire to report errors on one hand and the predominant culture of blame on the other hand.

A further gap was noticed as management support for patient safety had one of the highest proportions of positive responses, but non-punitive response to error had one of the lowest percentages of positive responses. A possible explanation for this would be that the low proportion of positive non-punitive response to error was related to the fact that approximately half the responses indicated that no events had been reported (Table 4). Moreover, communicating about and addressing safety issues between healthcare leaders and frontliners and developing training programs to help them understand their roles in the development of PSC could fill this gap.[29]

Accreditation in itself is a major undertaking for hospitals that subjects the hospital to a learning curve for which the major benefits are gained in the first three years with decreasing perceived challenges after ten years.[30] Hospitals can and should leverage on accreditation as a stepping stone to achieve organization-wide improvement in practice and patient outcomes. As demonstrated in the study results, steady improvements were observed with time, and while results appeared to have stabilized, the gained benefits extended beyond the mere numbers to a wider and more tangible organizational change in culture and staff perceptions.

Clearly, the aforementioned organizational changes led to tangible results in the overall PSC. A culture assessment in itself raises staff awareness, promotes a safe patient environment, and helps the hospital establish a common vocabulary and shared goals.[8] Teamwork within and

across units, organizational learning, managerial support, overall perception of safety, and

feedback and communication about error consistently were areas of strength. This reflects and

reinforces hospital commitment to address areas supporting improvement of the overall culture

of safety.[4] [14]

Despite some improvements, it is of note that non-punitive response to error, staffing, and

communication and openness consistently remain the lowest-scoring composites.[4] [14] Non-

punitive response to error gives hospital staff the confidence to report without fear of punishment

and is critical for the hospital to collect data on system deficiencies.[31] Sub-optimal staffing is

potentially the most critical challenge in ensuring patient safety as overworked staff can suffer

from lapses in performance.[32-35] Poor communication in healthcare can lead to avoidable

outcomes compromising patient care quality.[36] Clearly, the hospital should address challenges on

these composites as they have an undeniable impact on patient care outcomes.[37]

With this in mind, building a stronger culture requires committed and willing hospital leaders

engaged in strategies that strengthen the systems governing the organizational culture.[38] [39] Strong

leaders view adverse errors as opportunities for learning and system improvement,[40] [41] which

would ultimately build a more solid foundation for safety. A shared organizational culture

fostering safety is built around a foundation of shared decision making, leadership commitment,

mutual trust, and opportunities for learning and growth.[42] Collectively, these comprise some

traits making an organization more adaptable and receptive to addressing emerging challenges.[38]

Hospital leaders should collectively address challenges such poor communication, lack of visible

leadership, poor teamwork, lack of reporting systems, inadequate analysis of adverse events, and

inadequate staff knowledge about safety.[24]

A consistent improvement in PSC requires maintaining the improvements achieved so far.

Patient safety is a moving target and failing to consistently address the areas for improvement at

the hospital-wide level will not allow the hospital to maintain the gains achieved to date.

Leadership commitment is more important than ever to consistently and visibly support PSC.

The study results confirm that quality improvement initiatives can lead to visible changes in the

hospital culture and that consistent managerial support can help the hospital in maintaining these

improvements. Hospital leaders and managers can leverage on organizational changes to make

lasting changes to the system and create a spillover effect on the entire healthcare team.

Navigating these changes meticulously will allow hospital leaders to sow the seeds of change

and maintain the gains of the implemented interventions (Box 1).

Box 1. Strategies or interventions to promote improvements in patient safety.

- Leveraging on accreditation as a stepping stone to achieve organization-wide improvement in practice and patient outcomes
- Leadership engagement, support, and commitment governing the organizational culture
- Sharing and viewing adverse errors as opportunities for learning and system improvement and offering regular feedback on reported events
- Shared decision making, mutual trust, and identifying opportunities for learning and growth
- Launching and maintaining quality improvement initiatives
- Improving the human resources regulations, workflows, and staffing
- Empowering the quality management department through having direct liaison and representation in all executive boards and committees
- Investing in the infrastructure of the organization to meet patient safety standards and goals
- Conducting regular quality activities (e.g., "Quality Days") to communicate and exchange experiences and success stories, and recognizing improvement achievements throughout the organization
- Enhancing communication between the top management and frontline staff by conducting regular activities like "Patient Safety Leadership Walk-Rounds," "Open Day with the Executives," and "Breakfast with the Executives"
- Digitalizing the health information system and the incident reporting system
- Providing continuous training and education
- Improving communications and teamwork within and across departments (e.g., multidisciplinary meetings, focus group discussions, and information and communication technology utilization)
- Developing a clear policy, training, and workflow involving all managerial levels to support a just culture
- Enhancing the patient flow process through establishing a unit solely working on patient flow and case management

Strengths and limitations

The strengths of our study include using a mixed method to assess PSC progressively in four consecutive rounds in Saudi Arabia over a period of eight years. It provides us with insight on key areas for improving PSC and persistent challenges in healthcare organizations.

Conducting this study in a tertiary care teaching multi-site hospital, may not fully reflect patient safety culture in Saudi Arabia. Despite the low response rate in 2019, the study sample size is more than the minimum sample size recommended by the AHRQ. Moreover, we used the mixed-methods design to minimize the occurrence of spurious correlations due to the common-method variance that is often inherited in any survey instrument.

Implications for patient safety research

Further patient safety research is needed as there is a shortage in the literature understanding how hospital safety culture impacts patient and worker safety outcomes. Furthermore, the research is moving toward linking the results of measuring safety culture with patient, worker, and health system outcomes.

CONTRIBUTORS

MT contributed to the study design, writing of the first draft of the manuscript and review. MT, MB, BZ, and RA contributed to data collection and review. FA and YA critically reviewed the manuscript for important intellectual content. DJ contributed to data analysis and review. FE contributed to study design, data analysis, manuscript development, and review. All authors read and approved the final version of the manuscript.

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COMPETING INTERESTS

There are no conflicts of interest to declare.

PATIENT CONSENT FOR PUBLICATION

Patient consent for the publication of this study is not required.

ETHICAL APPROVAL

The study protocol and instruments were reviewed and approved (no. E19-4315) by the institutional review board (IRB) of the King Saud University College of Medicine.

PROVENANCE AND PEER REVIEW

The study was not commissioned and externally peer-reviewed.

DATA SHARING STATEMENT

All relevant data were made available as tables and figures in this article and other previously published articles.

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Supplementary 1S. Semi-structured interview questions for qualitative data

1. Have you realized any changes in patient safety culture in your department? Why?

2. What are your suggestions to improve patient safety in your department? Why?

3. In your opinion what are the factors that influence the patient safety culture in healthcare?

    Probing question:

    a) How do you think these factors influence the patient safety culture?

    b) Who do you think are responsible for these factors?

    c) Do you receive feedback and action taken?

    d) Do you feel empowered?

4. Based on the current level of patient safety culture in your hospital what do you think is an important factor to improve patient safety culture?

    Followed by:

    a. Do you think these can be achieved at all hospital`s levels?

    b. How do you think these factors could be incorporated with the hospital`s activities

5. What are the barriers and how to overcome them?

6. Do you have any other comments?

For managerial:

7. Which managerial decisions were taken to help improving patient safety culture?

8. What are the additional areas leadership should support to enhance patient safety?

Supplementary table 1S. Interview schedule.

Position	Date and time	Location (Site A, Site B, or Both)
Chief Executive Officer	Aug-2-2019	Corporate Level
Chief Medical Officer	July-30-2019	Corporate Level
Hospital Medical Director	July-30-2019	Site C
Deputy Medical Director	July-30-2019	Site A, Site B
Nursing Corporate Director	July-25-2019	Corporate Level
Nursing Hospital Director	July-25-2019	Site A, Site B, Site C
Nursing Corporate Deputy Director	July-26-2019	Corporate Level
Chief Operation Officer	Aug-6-2019	Corporate Level
Chief Administrative and Financial Officer	Aug-13-2019	Corporate Level
Chief Academic Officer	Aug-4-2019	Corporate Level
Safety and Security Supervisor	July-21-2019	Site A, Site B
Pharmacy Services Corporate Supervisor	July-14-2019	Corporate Level
Pharmacy Services Hospital Director	July-14-2019	Site A, Site B
Human Resources, Executive director	July-2-2019	Corporate Level
Human Resources, Hospital Director	July-6-2019	Site B
Patient Affairs, Hospital Director	July-10-2019	Site A
Medical Laboratory and Pathology Director	Aug-5-2019	Corporate Level
Radiology and Medical Imaging Department Director	July-23-2019	Site A
Operating Room Department Chairman	Jun-28-2019	Site B
Emergency Medicine Department Chairman	Jun-25-2019	Site A,Site B
Medicine Department Chairman	Jun-29-2019	Site A
Surgery Department Chairman	Jun-20-2019	Site A
Nursing Service Manager	July-19-2019	Site B (2)
Health Education Center	July-19-2019	Site A
Front-liner staff – Two Focus group (15 members per group) multidisciplinary composition.	July-15-2019 July-16-2019	2 focus groups in Sites A and C and 2 in Site B

Supplementary table 2S. Summary of the main themes and subthemes identified during the interviews.

Theme	Subthemes
Changes in PSC in the facility	• Change in overall culture • More awareness among staff regrading patient safety • Improved communication • Increased error reporting • Improved understanding and following hospital policies and procedures • Improved care processes within the hospital • Provision of guides and manuals • More awareness of risks and how to avert them • Addressing staff fears about the punitive culture • Clearer job descriptions, roles, and responsibilities • Making staff less resistant to change • Improved teamwork across the hospital
Factors influencing the PSC in healthcare	• Communication between staff and patients and within and across departments • Staff continued education and training • Teamwork within and across units, particularly when it came to handoffs and transitions • Leadership and administrative support • Monitoring and evaluation including feedback on patient safety indicators • Number of staff available • Robust incident reporting system and receiving feedback on reported events • Clarity and correct implementation of policies and procedures • Implementing a system for monitoring patient safety goals • Improving workflow within specific departments
Barriers to establishing PSC and how to overcome them	• Poor communication within and across departments • Punitive culture • Limited staff awareness • Staff resistance to change • Staff shortage • Language barrier • Limited cooperation from physicians • Poor training of staff • Budget and space constraints
Organizational changes since 2012	• Changes in the human resources regulations and workflows (from the traditional civil service to a self-operation system) • Preparation for dual accreditation (i.e., national and international) • Separation of the hospitals' healthcare quality from the academic medical education quality • Infrastructure expansions throughout the organization • Launching of new healthcare services • Conducting regular "Quality Days" • Strategic initiatives to enhance communication between top management and frontline staff (e.g., "Patient Safety Leadership Walk-Rounds," "Open Day," and "Breakfast with the Chief Executive Officer") • Digitalizing the incident reporting system

Suggestions to improve patient safety	• Increasing staffing • Offering continuous training and education • Improving communications and teamwork within and across departments • Implementing a horizontal chain of command • More support from management and leadership • Offering feedback on events reported • Supporting a non-punitive culture • Using an open-door leadership approach • Rewarding and empowering staff • Using walk-rounds • Regular meetings to discuss quality and patient safety • Increasing the space and number of machines available • Better management of patient flow • Better triage and patient assessment • Better implementation of policies and procedures and improved infrastructure • Supporting departmental patient safety initiatives • Staff empowerment to obtain their commitment • Conducting brainstorming sessions for staff and projects spearheaded by departments to improve patient safety and hosting a "Quality Day" • Empowering the quality committee and creating ambassadors in the hospital supported by hospital leadership

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Staying Ahead of the Curve: Navigating Changes and Maintaining Gains in Patient Safety Culture—A Mixed-Methods Study

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ABSTRACT

Objectives: This study examines how the results of the Hospital Survey on Patient Safety Culture changed between 2012 and 2019 and identifies organizational factors affecting these changes.

Design: The study combined the use of quantitative surveys of staff and qualitative interviews with hospital leadership. Secondary data analysis was performed for previous surveys.

Setting: This is study was conducted in a tertiary care teaching multi-site hospital in Riyadh, Saudi Arabia.

Participants: One thousand hospital staff participated in the survey. Thirty-one executive board members and directors and four focus groups of frontliners were qualitatively interviewed.

Primary and Secondary Outcome Measures: Twelve safety culture dimensions were assessed to study the patient safety culture as perceived by the healthcare professionals. An additional semi-structured interview was conducted to identify organizational factors, changes, and barriers affecting the patient safety culture. Furthermore, suggestions to improve patient safety were proposed.

Results: Comparing the results revealed a general positive trend in scores from 2012 to those from 2019. The areas of strength included teamwork within and across units, organizational

learning, managerial support, overall perception of safety, and feedback and communication about error. Non-punitive response to error, staffing, and communication and openness consistently remain the lowest-scoring composites. Interview results revealed that organizational changes may have influenced the answers of the participants on some survey composites.

Conclusions: Patient safety is a moving target with areas for improvement that are continuously identified. Effective quality improvement initiatives can lead to visible changes in the patient safety culture in a hospital, and consistent leadership commitment and support can maintain these improvements.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This is the first study to explore the results of a survey on patient safety culture in four consecutive rounds in Saudi Arabia.

- This study covered almost all categories of healthcare workers, including managers and care providers.

- A mixed-methods design was used to overcome the methodological limitations of the lack of a single tool that could capture the complexities of patient safety culture.

- A lower response rate was observed for the 2019 assessment and compared to previous years; therefore, the results of this study should be interpreted with caution.

- To minimize the occurrence of spurious correlations due to common-method variance in the survey instrument, we have utilized a mixed-methods design rather than simply applying the survey method alone.

INTRODUCTION

Despite considerable investments in quality healthcare and patient safety over the past decades, patients continue to experience preventable harm, and the current status of patient safety around the world remains alarming.[1] Recent studies have identified adverse events as a serious global issue affecting patient safety. Therefore, identifying and preventing potential harm is a top priority of healthcare organizations, thus enhancing patient outcomes. Evidence suggests that a strong culture of patient safety in a hospital is associated with fewer adverse events and improved patient outcomes.[2 3]

It is increasingly recognized that healthcare organizations around the world, regardless of economic status, are closely focusing on measuring and enhancing their Patient Safety Culture(PSC).[4-6] PSC is assessed to provide information to managers and healthcare policymakers; in addition, it can help organizations understand the present state of their PSC and analyze the PSC trends over time. Measuring PSC is important for identifying areas of strength and areas needing prioritization for interventions, evaluating the impact of patient safety initiatives or programs, and tracking changes over time. Furthermore, it improves staff perceptions, develops a better understanding of patient safety, fulfills accreditation or regulatory requirements, and conducts internal and external benchmarking.[2 7 8]

Measuring PSC is still considered relatively difficult and is well documented in the literature.[9 10] No single tool can sufficiently assess all major components of PSC and provide leaders with clear guidance on how PSC can be effectively improved.[11 12] To explore the complex concept of PSC in healthcare, the mixed-methods approach, by collecting and analyzing both quantitative and qualitative data, can be viewed as the most appropriate approach to increase the robustness

of the results and gain a deeper understanding of PSC while offsetting the intrinsic weaknesses associated with each approach when used on its own.[5] [13]

Given the clear need for continuous monitoring of PSC and better understanding of how organizational culture changes after multiple interventions and milestones, we used the mixed-methods approach to assess PSC progressively over a period of eight years. To our knowledge, assessing PSC has not yet been performed at this scale, and this study can provide us insight on the key areas to improve regarding PSC in healthcare organizations and persistent challenges in PSC that are difficult to change rapidly with simple interventions. This study reports on the organizational survey results of 2019 and compares these results to those of three previous assessments at the same multi-site facility (2012,[14] 2015,[4] and 2017).

Objectives

The overall objective of this study is to examine how the results of the HSOPSC survey changed between 2012 and 2019 and identify organizational factors affecting these changes. Specifically, this study provides an overview of the results of multiple assessments of PSC surveys at a large multi-site healthcare facility in Riyadh, Kingdom of Saudi Arabia.

METHODS

Design

In this study, a mixed-methods research design was used to achieve the most comprehensive understanding possible of the research problem. The study combined the use of quantitative surveys and qualitative interviews with hospital staff of different levels to achieve the study objectives. Additionally, we conducted a cross-validation of the results with those of the previous surveys conducted at the same site in 2012[14], 2015[4], and 2017.

Setting

This study was conducted in a tertiary care teaching multi-site hospital having a capacity of 1,160

beds and approximately 9,000 employees. It receives referral patients from all over the country.

The hospital has three sites, varying in size and location; site A has 1,060 beds and offers free

medical services with a wide range of specialties, and site B has 100 beds and offers

complementary services to those of site A. Site C offers inpatient and outpatient dental services.

Quantitative component

The tool (questionnaire)

The tool used was adapted from the HSOPSC developed by the AHRQ.[7] The survey is available

in English and Arabic. The internal consistency and reliability of the original English version

were tested using Cronbach's alpha that ranged between 0.62 and 0.85.[15][16] However, the Arabic

version was adapted and used in similar studies in Lebanon,[17] Saudi Arabia,[4][14] and Jordan,[18] and

its reliability was measured using Cronbach's coefficient that ranged between 0.45 and 0.81.[17]

The HSOPSC includes 42 items grouped into 12 composites. In addition to the composites, the

survey includes two questions asking respondents to provide an overall grade on patient safety

and to indicate the number of reported events over the past 12 months.

Participants

The survey randomly sampled staff targeting 50% (4500) of clinical and non-clinical employees

similar to the previous two assessment rounds by El-Jardali et al.[14] and Alswat et al.[4]

Data collection

Data collection for the 2017 and 2019 surveys were performed in two assessment rounds: from September to November in 2017 and from February to April in 2019. Data collection for the 2012 and 2015 surveys was described in studies by El-Jardali et al.[14] and Alswat et al.[4]

The survey was made available in hard copies and the electronic format for all respondents. The hard-copy surveys were provided in sealed envelopes for respondents who could not access the electronic-format surveys. The first page of the survey included the consent form and an explanation of the purpose of the survey. Employees were not asked to sign the consent form or any other page of the survey; they were asked to return the hard copies of the survey in a sealed envelope.

Data analysis

Data were analyzed using Statistical Package for the Social Sciences, version 25.0, (IBM Corp., Armonk, NY, USA); p values of > 0.05 were used to denote significance. In addition to answering the study tool, respondents were asked to provide some background demographic information about themselves (age, gender, marital status, profession, educational level, clinical experience, working hours during the week, working area, and whether they were trained on patient safety). The composite items were measured using a 5-point Likert response scale of agreement, with the scores ranged from "strongly disagree" to "strongly agree" or frequencies that ranged from "never" to "always." Consequently, the HSOPSC comprised the following two single-item measures:

- The patient safety grade, scored with a 5-point Likert scale ranging from "excellent" to "failing"

- The number of adverse events reported by the respondent during the last year, ranging from "no events" to "21 events or more."

The results were presented as percentages of the average positive responses (e.g., strongly agree/agree and most of the time/always) for each survey item; negatively worded items were reversed when computing their percentages. The percent positives for each subscale were computed as follows: [(number of positive responses/total number of responses on the item) × 100%]. Missing responses were excluded when displaying the percentages of the responses to the survey items.[7] Composites that had at least 70% positive responses were considered areas of strength, whereas those with less scores were considered areas for improvement. Our decision to consider our cut-off point to be 70% for patient safety areas in need for improvement was based on the results of our previous two PSC surveys conducted in the same facility. Composite scores were calculated by summing the item scores and dividing the sum by the number of items within the composite.

Descriptive statistics such as frequency and percentage were used for data summarization. Given that the data were not normally distributed for all composites, the independent Kruskal–Wallis H test was used to determine whether a significant difference exists between survey composites between the 2012, 2015, 2017, and 2019 datasets. The chi-square test was used to determine whether a significant difference exists between the 2012 and 2019 datasets for the questions regarding the number of events and patient safety grade.

Qualitative component

Interview tool

Semi-structured interviews were conducted to probe the topic deeper, make the interviews more conversational, and make sure all interview participants, including leaders and frontline staff, were asked the same questions. An interview guide was adapted and modified from previous studies,[19-21] and an external expert review followed (see online Supplementary 1S).

Participants

We used a purposive sampling technique to recruit interviewees. Thirty-one semi-structured individual interviews were conducted with all executive board members in Medical City, medical directors in each site, directors of the main clinical and supportive services departments, and four focus groups of frontliners. Those identified to participate had received an invitation email including all the information about the voluntary nature of participation and an explanation of the entire study phase and a request to record the interviews, which were conducted in a private place (see online supplementary table 1S).

Data collection

The interviews were scheduled according to the participants' availability. All interviews were conducted in English. Each interview lasted 15–30 minutes and was recorded using a digital voice recorder. A research assistant transcribed the recorded data as soon as each interview was completed. The accuracy of the transcriptions was reviewed (and corrected if necessary) by the researchers. In addition, field notes were taken, and the responses and views of the participants were summarized at the end of each interview to ensure that they reflected their views.

Participation was voluntary and the interview tool did not collect any information that could be used to identify the participants. Participant confidentiality was maintained at every stage of the study.

Data analysis

Thematic analysis was conducted for the data collected through the interviews. Coding, which was done by two members of the research team, was initially conducted by breaking responses

into similar concepts and ideas. Minimal discrepancies were found after cross-checking the work

between the two team members. Disagreements were discussed until a consensus was achieved.

This was followed by axial coding, which comprised the organization of the emerging concepts

into themes and categories.

Patient and public involvement

No patients were involved in this study.

RESULTS

Survey results

General results

In total, 2,694 questionnaires from the 2017 assessment round and 1,000 from the 2019

assessment round were completed, giving a response rate of 59.8% and 22.2%, respectively.

However, the response rates in the previous two rounds were 85.7%[14] and 57.6% [4] (Table 1).The

discrepancy in the response rate was observed as we stopped the second data collection in 2019

as the organization was preparing for the final survey of dual accreditation by both national and

international accreditation bodies. We were concerned about the potential biases or false positive

responses that might arise during the deep engagement of all of the staff at all levels in these

accreditation activities.

Despite the low response rate in 2019, the study sample size is more than the minimum sample

size recommended by the AHRQ.[7] Moreover, all three previous PSC surveys in 2012, 2015, and

2017 conducted at our institution showed good response rates of >50% (85.7%, 57.6%, and

59.8% respectively). In this study, we reflected and interpreted the four PSC surveys

simultaneously.

Most respondents in all four assessment rounds were nurses (50.1%, 78.3%, 56%, and 61.7%,

respectively). Most respondents were female in the four assessment rounds that could be

explained by the fact that the approximate proportion of our nursing staff is approximately 27%

of the total number of employees including both clinical and non-clinical staff. Moreover, our

nursing staff predominantly comprised females (87%). Approximately half of the respondents

were aged between 30 and 45 years (45.3%, 46.4%, 61.6%, and 65.3% in 2012, 2015, 2017, and

2019, respectively).

Among the study respondents, the majority held a Bachelor's degree (38.9%, 56.2%, 61.4%, and

59.2% in years 2012, 2015, 2017, and 2019, respectively), whereas 43.6% in 2012 and 25.4% in

2017 had diplomas. A large proportion of the respondents in the 2015 and 2017 assessment

rounds had 6–10 years of experience in the hospital (32.3% and 27.5%, respectively), whereas

30.5% and 35.4% had 1–5 years of experience in the hospital in the 2012 and 2019 assessment

rounds, respectively. Additionally, approximately half of the staff reported working in medical

units in all assessment rounds, except in 2012, where 27.1% of the respondents were working in

the hospital administration. Moreover, more than 75% of the personnel had been in direct contact

with patients and working 40–60 hours a week in all four assessment surveys.

Table 1. Sociodemographic and professional characteristics of the respondents along with the number of events reported and patient safety grades.				
Sociodemographic and professional characteristics	2012[14] N (%) Total no. 2,572	2015[4] N (%) Total no. 2,592	2017 N (%) Total no. 2,694	2019 N (%) Total no. 1,000
Work area/unit where respondents spend most of their work time				
Many different hospital units/no specific unit	13 (0.5)	21 (0.8)	36 (1.5)	2 (0.2)
Administrative	697 (27.1)	138 (5.4)	357 (14.6)	50 (5.1)
Medical	536 (20.8)	1332 (51.9)	1193 (48.8)	517 (53.1)

Surgical	503 (19.6)	786 (30.6)	406 (16.6)	267 (27.4)
Diagnostics	277 (10.8)	99 (3.9)	399 (16.3)	101 (10.4)
Other	545 (21.2)	191 (7.4)	54 (2.2)	36 (3.7)
Missing	1	25	249	27
Respondents' positions at the hospital				
Administrator/manager/director/head	92 (3.6)	47 (1.9)	96 (3.7)	21 (2.2)
Physician	158 (6.1)	141 (5.6)	191 (7.4)	91(9.4)
Specialist	80 (3.1)	61 (2.4)	164 (6.4)	57 (5.9)
Coordinator	13 (0.5)	10 (0.4)	55 (2.1)	14 (1.4)
Assistant/aide	62 (2.4)	39 (1.6)	65 (2.5)	18 (1.9)
Pharmacist	56 (2.2)	36 (1.4)	79 (3.1)	4 (0.4)
Therapist	52 (2.0)	1 (0.0)	32 (1.2)	18 (1.9)
Registered nurse	1287 (50.1)	1969 (78.3)	1443 (56.0)	596 (61.7)
Resident/PG/intern	67 (2.6)	64 (2.5)	92 (3.6)	29 (3)
Assistant/clerk/secretary/facilitator	133 (5.2)	28 (1.1)	60 (2.3)	28 (2.9)
Technician	308 (12.0)	52 (2.1)	236 (9.2)	76 (7.9)
Other	264 (10.3)	67 (2.7)	62 (2.4)	14 (1.4)
Missing	0	77	119	34
Experience in current hospital (years)				
Less than 1 year	463 (18.6)	133 (5.3)	553 (21.8)	77 (8)
1–5 years	758 (30.5)	741 (29.6)	640 (25.2)	339 (35.4)
6–10 years	622 (25.0)	809 (32.3)	698 (27.5)	262 (27.4)
11–15 years	290 (11.7)	348 (13.9)	353 (13.9)	151(15.8)
16–20 years	136 (5.5)	222 (8.9)	154 (6.1)	73 (7.6)
21 years or more	217 (8.7)	252 (10.1)	139 (5.5)	55 (5.7)
Missing	86	87	157	43
Experience in current work area (years)				
Less than 1 year	436 (17.3)	313 (12.6)	432 (17.0)	50 (5.2)
1–5 years	986 (39.1)	520 (21.0)	404 (15.9)	233 (24.3)
6–10 years	528 (20.9)	781 (31.5)	827 (32.5)	319 (33.3)
11–15 years	245 (9.7)	358 (14.5)	411 (16.1)	165 (17.2)
16–20 years	159 (6.3)	233 (9.4)	249 (9.8)	106 (11.1)
21 years or more	168 (6.7)	272 (11)	223 (8.8)	85 (8.9)
Missing	50	115	148	42
Hours worked per week				
Less than 20 hours per week	55 (2.3)	25 (1.0)	58 (2.3)	24 (2.5)
20–39 hours per week	203 (8.3)	148 (6.0)	214 (8.6)	87 (9.2)
40–60 hours per week	2180 (89.4)	2280 (92.9)	2206 (89.0)	838 (88.3)
Missing	134	139	216	51
Job involving direct contact with patients				
Yes, I typically have direct interaction or contact with patients.	1956 (76.1)	2229 (90.9)	2045(82.2)	808 (85.7)

No, I typically do not have direct interaction or contact with patients.	615 (23.9)	224 (9.1)	443(17.8)	135 (14.3)
Missing	1	139	206	57
Gender				
Male	728 (28.6)	398 (15.9)	628 (24.6)	234 (24.6)
Female	1820 (71.4)	2103 (84.1)	1925 (75.4)	719 (75.4)
Missing	24	91	141	47
Age (years)				
Below 30 year old	854 (33.7)	925 (37.3)	558 (22.7)	175 (18.2)
Between 30 and 45 years old	1148 (45.3)	1152 (46.4)	1515 (61.6)	628 (65.3)
Between 46 and 55 years old	401(15.8)	253 (10.2)	282 (11.5)	114 (11.9)
Above 55 years old	133 (5.2)	151 (6.1)	103 (4.2)	44 (4.6)
Missing	36	111	236	39
Marital Status				
Single	752 (30.3)	851 (34.2)	807(31.5)	309 (32)
Married	1682 (67.8)	1602 (64.4)	1703 (66.4)	633 (65.6)
Divorced/Separated	25 (1.0)	16 (0.6)	33 (1.3)	13 (1.3)
Widowed	14 (0.6)	13 (0.5)	13 (0.5)	6 (0.6)
Other	8(0.3)	6 (0.2)	7(0.3)	4 (0.4)
Missing	91	104	131	35
Educational level				
Under high school level	14 (0.6)	2 (0.1)	11 (0.4)	3 (0.3)
High school level	62 (2.5)	7 (0.3)	25 (1.0)	4 (0.4)
Diploma level	1082 (43.6)	836 (33.5)	654 (25.4)	267 (27.6)
Bachelor's degree	966 (38.9)	1403 (56.2)	1579 (61.4)	574 (59.2)
Master's degree	124 (5.0)	127 (5.1)	160 (6.2)	61 (6.3)
Doctorate degree	112 (4.5)	102 (4.1)	110 (4.3)	53 (5.5)
Others	122 (4.9)	19 (0.8)	32 (1.2)	7(0.7)
Missing	90	96	123	31

PSC dimensions

PSC dimensions were examined (Table 2). The dimensions with the highest average response

rates, considered areas of strength, were "organizational learning–continuous improvement"

ranging from 79.6% to 83.9% between 2012 and 2019 and "teamwork within units" that scored

more than 75% in all four assessments. Furthermore, the average response rates of the "hospital

management support for patient safety" dimension were 70.4%, 75.3%, 73.3%, and 73.8% in 2012, 2015, 2017, and 2019, respectively.

All surveys had the same areas requiring improvement. There is a general trend toward improvement in percent positive scores from 2012 to 2019, except for the "frequency of events reported" composite. Note that "overall perception of patient safety" was found to be an area for improvement in 2012; however, it was shown to be an area of strength in 2019. The lowest reported average percentage was below 30% for "non-punitive response to error" throughout the four assessment rounds. Additionally, staffing and communication openness were the next lowest-scoring composites across the four assessment rounds (Table 2).

Table 2. Distribution of positive responses in the survey dimensions.				
Patient safety culture dimensions	2012	2015	2017	2019
Teamwork within units	78.5%	84.8%	81.6%	84.5%
Supervisor/manager expectations and actions promoting patient safety	60.6%	60.8%	60.4%	64.0%
Organizational learning–continuous improvement	79.6%	86.3%	82.2%	83.9%
Management support for patient safety	70.4%	75.3%	73.3%	73.8%
Overall perceptions of patient safety	65.3%	59.5%	59.6%	61.7%
Feedback and communication about error	63.3%	71.8%	68.7%	72.0%
Communication openness	42.9%	45.0%	48.5%	49.8%
Frequency of events reported	59.4%	68.8%	64.9%	66.6%
Teamwork across units	61.6%	67.0%	64.1%	65.8%
Staffing	35.1%	33.8%	30.8%	31.9%
Handoffs and transitions	51.5%	55.8%	49.6%	52.2%
Non-punitive response to error	26.8%	24.8%	27.2%	27.2%

Comparing the results from 2012 to those of 2019

The Kruskal–Wallis test was conducted to compare the results from all four surveys (Table 3). As a result, significant differences lie across the four surveys with the exception to the

"supervisor/manager expectations and actions promoting patient safety" and "non-punitive response to error" composites. A comparison of the mean scores between 2012 and 2019 showed a steady increase in composite scores. The statistical significance of these differences varied according to the survey composites; however, it is worth noting that the highest scores were observed in 2015.

"Non-punitive response to error" and "staffing" remained the lowest-scoring composites in all assessment rounds, but the difference is not statistically significant. The highest-ranking composite for all surveys was "organizational learning–continuous improvement."

Table 3. The Kruskal–Wallis test comparing the composite scores in 2012 to those in 2019.										
Patient safety culture dimensions	**2012**		**2015**		**2017**		**2019 KAUH**		**Independent sample Kruskal–Wallis test**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**P-Value**	**Adjusted significance Bonferroni correction**
Frequency of events reporting	3.64	1.16	4.04	1.54	3.83	1.1	3.82	1.14	<0.001	abce
Overall perceptions of safety	3.43	0.59	3.6	1.56	3.47	0.6	3.51	0.62	<0.001	bce
Supervisor/manager expectations and actions promoting safety	3.46	0.65	3.57	1.34	3.48	0.67	3.54	0.68	0.003	c
Organizational learning–continuous improvement	3.89	0.69	4.16	1.14	4.02	0.61	4.03	0.58	<0.001	abc
Teamwork within hospital units	3.85	0.75	4.04	0.71	4.00	0.67	4.03	0.63	<0.001	abc
Communication openness	3.25	0.85	3.45	1.08	3.43	0.82	3.43	0.89	<0.001	abcde
Feedback and communication about errors	3.73	0.95	4.11	1.1	3.95	0.87	4.04	0.8	<0.001	abcd
Non-punitive response to error	2.68	0.81	2.76	1.26	2.69	0.87	2.68	0.87	0.123	
Staffing	2.84	0.62	3.02	1.19	2.68	0.63	2.73	0.65	<0.001	bce
Hospital management support for patient safety	3.69	0.76	3.85	1.05	3.77	0.67	3.78	0.66	0.030	
Teamwork across hospital units	3.52	0.71	3.76	1.36	3.58	0.67	3.60	0.66	0.002	bc
Hospital handoffs and transitions	3.36	0.79	3.82	2.29	3.27	0.87	3.34	0.82	0.001	bc

Letter indicates a *p*-value <0.05 adjusted significance using the Bonferroni correction for multiple tests.

a   2012–2017
b   2012–2019
c   2012–2015
d   2017–2019
e   2017–2015
f   2019–2015

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Patient safety grade and event reporting

The percentage of the respondents who evaluated patient safety in their work area/unit as excellent/very good increased from 69.5% in 2012 to 74.1% in 2019 ($p < 0.001$) (Table 4). Moreover, Table 4 displays the percentages of the number of events reported; the analysis indicated that the percentages of the respondents who reported no events in the last 12 months decreased by almost 7.4% from 2012 to 2019 ($p < 0.001$) and the percentages of reporting more than five event reports increased from 6.4% in 2012 to 8% in 2019.

Table 4: Chi-Square test comparing patient safety grades and the number of events reported between 2012 and 2019.					
Patient safety grade	**2012** N (%)	**2015** N (%)	**2017** N (%)	**2019** N (%)	**Sig**
Poor/failing	119 (4.8%)	57 (2.3%)	67 (2.6%)	18 (1.9%)	p <0.001
Acceptable	632 (25.6%)	654 (26.6%)	614 (24.2%)	230 (24%)	
Excellent/very good	1714 (69.5)	1747 (71.1%)	1859 (73.2%)	710 (74.1%)	
Number of events reported					
No event reports	1275 (52.7%)	1364 (55.8%)	1180 (47.3%)	427 (45.3%)	p <0.001
1 to 5 event reports	992 (41%)	940 (38.4%)	1092 (43.8%)	440 (46.7%)	
>5 event reports	154 (6.4%)	141 (5.8%)	223 (8.9%)	75 (8%)	

Interview results

Characteristics of the respondents

In total, 91 healthcare professionals were interviewed, among whom 10 were executive leaders (corporate level), 8 were hospital directors, and 13 were departmental chairpersons and directors. The researcher conducted interviews with four focus groups consisting of 60 front-liner staff. Most of the staff in the focus groups comprised physicians, pharmacists, nurses, and allied health technicians. The qualitative data obtained from the interviews were thematically categorized into the following: realizing changes in PSC in the facility/departments, factors influencing the PSC in

healthcare, barriers to establishing PSC and how to overcome them, and suggestions to improve patient safety (see online supplementary table 2S).

Changes in PSC in the facility

The interviews showed that the respondents believe that the PSC in their department has changed. Some of the documented observed changes included changes in the overall culture, more awareness among the staff, improved communication, increased error reporting, improved understanding and following hospital policies and procedures, improved care processes within the hospital, provision of guides and manuals, more awareness of the risks and how to avert them, and addressing staff fears about the punitive culture.

Some factors reported by the respondents that may have contributed to these changes include the multiple accreditation surveys and the introduction of an electronic event reporting system. Despite the learning curve associated with both interventions, the respondents reported that it has allowed them to streamline their operations, enabled them to provide quality care to patients, and improved the process of error reporting.

The respondents indicated that the main changes they saw in their department was the amendment of existing policies and procedures, the clarification of job descriptions and roles, and making the staff less resistant to change. In addition, hospital leadership observed better communication and teamwork across the hospital and better staff awareness on the topic.

Factors influencing PSC in healthcare

According to the hospital leaders, making patients at the core of the PSC is the first step in the right direction. This requires support at the leadership and administration levels. Hospital leaders reported that accreditation was one of the factors that changed the culture within their

organization. It has improved communication between the staff and patients and within and across departments, staff training (including continuing education and training), and teamwork within and across units, particularly regarding handoffs and transitions. These were all considered factors that could support and improve event reporting and eventually lead to performance improvement.

Some of the factors that may influence PSC reported by the respondents included leadership and administrative support, monitoring and evaluation (including feedback) of patient safety indicators, the number of staff available, improvement of the error reporting system, receiving feedback on reported events, clarity and correct implementation of policies and procedures, implementing a system for monitoring patient safety goals, and improving workflow within specific departments.Some respondents reported that all hospital staff is responsible for improving the PSC, whereas other respondents placed the responsibility solely on the leaders and managers.

Barriers to establishing PSC and how to overcome them

Some of the documented barriers to establishing a PSC included poor communication within and across departments, punitive culture, limited staff awareness, staff resistance to change, staff shortages, language barrier, limited cooperation from physicians, and poor training of staff. Other less frequently mentioned barriers included staffing, budget, and space.

Organizational changes since 2012

The slight dip in the composite scores in 2017 could be attributed to several organization-wide factors that occurred during this transition period. Introducing new human resources regulations and workflows during the shift from the traditional civil service to a self-operation system, a

national trend throughout the Kingdom, had a significant impact on recruitment, re-contracting, and staff retention and turnover.

Another factor was the preparation for the dual accreditation (i.e., national and international) final surveys that were scheduled in December 2017 had several positive and negative implications. Overwhelming the staff with changes and escalations of improvement during a short period were among the negative effects.

The outset of 2017 witnessed the separation of the administration of the university hospitals (healthcare) quality from the academic (medical education) quality. Widespread expansions throughout the organization occurred including the opening of a new large eastern building that added to the total bed capacity of the hospital, increasing from 948 in 2014 to 1,160 in 2019. This added bed capacity had an additional burden to all categories of healthcare providers, especially physicians and nurses. The launching of new innovative healthcare services such as oncology, nuclear medicine and radiotherapy, home care, and genetics and metabolic and the addition of the new workflows, dynamics, and policies into the existing setting posed an additional burden to specialized expert healthcare providers.

Other organizational initiatives include conducting regular "Quality Days" to share experiences and recognize and reward distinguished contributions of staff and departments.
Several strategies were initiated to enhance the communication between top management and the frontline staff to identify and discuss facilitators and barriers, including an "Open Day," "Patient Safety Leadership Walk-Rounds," and "Breakfast with the Chief Executive Officer."
An occurrence variance reporting (OVR) system was launched as a paper-based system in 2010, followed by the first round of PSC survey in 2012[14] that inspired the organization to gradually

improve the OVR system through its digitalization in 2013 with multiple functionalities such as anonymous reporting and reporting feedback.[22]

Suggestions to improve patient safety

The respondents believed that increasing staffing; offering rewards to staff demonstrating excellence in performance; providing more training and education to staff, managers, and leaders; and improving communications and teamwork within and across departments will improve patient safety. Implementing a horizontal chain of command, more support from the management and leadership, giving feedback on events reported so that staff can see tangible results from their efforts, and supporting a non-punitive culture are important factors in enhancing the PSC in the organization. Some respondents indicated that some ways that managers can improve patient safety include using an open-door leadership approach, rewarding and empowering staff demonstrating initiative and excellence in patient safety, and using walk-rounds as a way to show the leaders' commitment to engaging with the staff.

In addition, the leaders proposed continuing education and training to staff in addition to regular meetings to discuss quality and patient safety as this would encourage more reporting. Additional ways to improve the PSC in the organization included increasing the space and number of machines available to decrease waiting time and accommodate urgent cases.

Some suggestions proposed by the interviewees for improving patient safety included better management of patient flow to avoid crowding and reduce waiting time, better triage and patient assessment, better implementation of policies and procedures, and improved infrastructure. In addition, supporting departmental initiatives relating to patient safety and disseminating the results of those initiatives, and empowering the staff to obtain their commitment can enhance patient safety.

Other suggestions included brainstorming sessions for the staff, initiating projects spearheaded by the departments to improve patient safety, and hosting a "Quality Day" particularly targeting newly recruited staff, and hosting huddles within departments to identify areas for improvement. In addition, more suggestions included empowering the quality committee, creating ambassadors in the hospital supported by the hospital leadership, and making the work and impact of these ambassadors more visible.

DISCUSSION AND CONCLUSIONS

This is the first study to progressively document results of a survey on PSC in four consecutive rounds, particularly in Saudi Arabia. The findings of this study can inform hospital leaders on the changes in performance as a result of quality improvement plans and accreditation.

The study revealed a general positive trend in scores as we compare results from 2012 to those from 2019. A spike in the scores was observed in 2015, and this was attributed to the accreditation survey conducted that year and the corresponding leadership visibility and support during that time. The introduction of an OVR system further reinforced the organizational shift in culture toward one that was centered on creating system changes valuing patient safety.

At the regional level, many scholars have evaluated PSC in different settings. Similar to our results, their findings showed that the areas of strength were "teamwork within units" and "organizational learning–continuous improvement." Alternatively, the areas for improvement were "promoting non-punitive response to error," "encouraging the openness of communication among healthcare professionals," and "facilitating hospital handoffs and transition process."[4 6 17 18 23-25] At the international level, similar areas for improvement were identified in hospitals.[26-28]

We observed a persistent discrepancy between the results of the outcome measures "frequency of events reported" and "non-punitive response to errors" throughout the four PSC surveys, despite the high reported average percentage of "feedback and communication about errors." This may reflect the residual internal conflict that the hospital staff have between their desire to report errors on one hand and the predominant culture of blame on the other hand.

A further gap was noticed as management support for patient safety had one of the highest proportions of positive responses, but non-punitive response to error had one of the lowest percentages of positive responses. A possible explanation for this would be that the low proportion of positive non-punitive response to error was related to the fact that approximately half the responses indicated that no events had been reported (Table 4). Moreover, communicating about and addressing safety issues between healthcare leaders and frontliners and developing training programs to help them understand their roles in the development of PSC could fill this gap.[29]

Accreditation in itself is a major undertaking for hospitals that subjects the hospital to a learning curve for which the major benefits are gained in the first three years with decreasing perceived challenges after ten years.[30] Hospitals can and should leverage on accreditation as a stepping stone to achieve organization-wide improvement in practice and patient outcomes. As demonstrated in the study results, steady improvements were observed with time, and while results appeared to have stabilized, the gained benefits extended beyond the mere numbers to a wider and more tangible organizational change in culture and staff perceptions.

Clearly, the aforementioned organizational changes led to tangible results in the overall PSC. A culture assessment in itself raises staff awareness, promotes a safe patient environment, and helps the hospital establish a common vocabulary and shared goals.[8] Teamwork within and

across units, organizational learning, managerial support, overall perception of safety, and feedback and communication about error consistently were areas of strength. This reflects and reinforces hospital commitment to address areas supporting improvement of the overall culture of safety.[4] [14]

Despite some improvements, it is of note that non-punitive response to error, staffing, and communication and openness consistently remain the lowest-scoring composites.[4] [14] Non-punitive response to error gives hospital staff the confidence to report without fear of punishment and is critical for the hospital to collect data on system deficiencies.[31] Sub-optimal staffing is potentially the most critical challenge in ensuring patient safety as overworked staff can suffer from lapses in performance.[32-35] Poor communication in healthcare can lead to avoidable outcomes compromising patient care quality.[36] Clearly, the hospital should address challenges on these composites as they have an undeniable impact on patient care outcomes.[37]

With this in mind, building a stronger culture requires committed and willing hospital leaders engaged in strategies that strengthen the systems governing the organizational culture.[38] [39] Strong leaders view adverse errors as opportunities for learning and system improvement,[40] [41] which would ultimately build a more solid foundation for safety. A shared organizational culture fostering safety is built around a foundation of shared decision making, leadership commitment, mutual trust, and opportunities for learning and growth.[42] Collectively, these comprise some traits making an organization more adaptable and receptive to addressing emerging challenges.[38] Hospital leaders should collectively address challenges such poor communication, lack of visible leadership, poor teamwork, lack of reporting systems, inadequate analysis of adverse events, and inadequate staff knowledge about safety.[24]

A consistent improvement in PSC requires maintaining the improvements achieved so far.

Patient safety is a moving target and failing to consistently address the areas for improvement at

the hospital-wide level will not allow the hospital to maintain the gains achieved to date.

Leadership commitment is more important than ever to consistently and visibly support PSC.

The study results confirm that quality improvement initiatives can lead to visible changes in the

hospital culture and that consistent managerial support can help the hospital in maintaining these

improvements. Hospital leaders and managers can leverage on organizational changes to make

lasting changes to the system and create a spillover effect on the entire healthcare team.

Navigating these changes meticulously will allow hospital leaders to sow the seeds of change

and maintain the gains of the implemented interventions (Box 1).

Box 1. Strategies or interventions to promote improvements in patient safety.

- Leveraging on accreditation as a stepping stone to achieve organization-wide improvement in practice and patient outcomes
- Leadership engagement, support, and commitment governing the organizational culture
- Sharing and viewing adverse errors as opportunities for learning and system improvement and offering regular feedback on reported events
- Shared decision making, mutual trust, and identifying opportunities for learning and growth
- Launching and maintaining quality improvement initiatives
- Improving the human resources regulations, workflows, and staffing
- Empowering the quality management department through having direct liaison and representation in all executive boards and committees
- Investing in the infrastructure of the organization to meet patient safety standards and goals
- Conducting regular quality activities (e.g., "Quality Days") to communicate and exchange experiences and success stories, and recognizing improvement achievements throughout the organization
- Enhancing communication between the top management and frontline staff by conducting regular activities like "Patient Safety Leadership Walk-Rounds," "Open Day with the Executives," and "Breakfast with the Executives"
- Digitalizing the health information system and the incident reporting system
- Providing continuous training and education
- Improving communications and teamwork within and across departments (e.g., multidisciplinary meetings, focus group discussions, and information and communication technology utilization)
- Developing a clear policy, training, and workflow involving all managerial levels to support a just culture
- Enhancing the patient flow process through establishing a unit solely working on patient flow and case management

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Strengths and limitations

The strengths of our study include using a mixed method to assess PSC progressively in four consecutive rounds in Saudi Arabia over a period of eight years. It provides us with insight on key areas for improving PSC and persistent challenges in healthcare organizations.

Conducting this study in a tertiary care teaching multi-site hospital, may not fully reflect patient safety culture in Saudi Arabia. Despite the low response rate in 2019, the study sample size is more than the minimum sample size recommended by the AHRQ. Moreover, we used the mixed-methods design to minimize the occurrence of spurious correlations due to the common-method variance that is often inherent in any survey instrument.

Implications for patient safety research

Further patient safety research is needed as there is a shortage in the literature understanding how hospital safety culture impacts patient and worker safety outcomes. Repeated assessments of patient safety culture can provide unparalleled insight for hospital leaders into organizational changes resulting from quality improvement initiatives. Future research should link the results of patient safety culture assessments with with patient, worker, and health system outcomes.

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CONTRIBUTORS

MT contributed to the study design, writing of the first draft of the manuscript, and review. MT, MB, BZ, and RA contributed to data collection and review. FA and YA critically reviewed the manuscript for important intellectual content. DJ contributed to data analysis and review. FE contributed to study design, data analysis, manuscript development, and review. All authors read and approved the final version of the manuscript.

COMPETING INTERESTS

There are no conflicts of interest to declare.

PATIENT AND PUBLIC INVOLVEMENT STATEMENT

Patients were not involved in this study and as such their consent was not applicable as the sample involved only hospital staff.

ETHICAL APPROVAL

The study protocol and instruments were reviewed and approved (no. E19-4315) by the institutional review board (IRB) of the King Saud University College of Medicine.

PROVENANCE AND PEER REVIEW

The study was not commissioned and externally peer reviewed.

DATA SHARING STATEMENT

All relevant data were made available as tables and figures in this article and other previously

published articles.

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Supplementary 1S. Semi-structured interview questions for qualitative data

1. Have you realized any changes in patient safety culture in your department? Why?

2. What are your suggestions to improve patient safety in your department? Why?

3. In your opinion what are the factors that influence the patient safety culture in healthcare?

    Probing question:

    a) How do you think these factors influence the patient safety culture?

    b) Who do you think are responsible for these factors?

    c) Do you receive feedback and action taken?

    d) Do you feel empowered?

4. Based on the current level of patient safety culture in your hospital what do you think is an

    important factor to improve patient safety culture?

    Followed by:

    a. Do you think these can be achieved at all hospital`s levels?

    b. How do you think these factors could be incorporated with the hospital`s activities

5. What are the barriers and how to overcome them?

6. Do you have any other comments?

For managerial:

7. Which managerial decisions were taken to help improving patient safety culture?

8. What are the additional areas leadership should support to enhance patient safety?

Supplementary table 1S. Interview schedule.

Position	Date and time	Location (Site A, Site B, or Both)
Chief Executive Officer	Aug-2-2019	Corporate Level
Chief Medical Officer	July-30-2019	Corporate Level
Hospital Medical Director	July-30-2019	Site C
Deputy Medical Director	July-30-2019	Site A, Site B
Nursing Corporate Director	July-25-2019	Corporate Level
Nursing Hospital Director	July-25-2019	Site A, Site B, Site C
Nursing Corporate Deputy Director	July-26-2019	Corporate Level
Chief Operation Officer	Aug-6-2019	Corporate Level
Chief Administrative and Financial Officer	Aug-13-2019	Corporate Level
Chief Academic Officer	Aug-4-2019	Corporate Level
Safety and Security Supervisor	July-21-2019	Site A, Site B
Pharmacy Services Corporate Supervisor	July-14-2019	Corporate Level
Pharmacy Services Hospital Director	July-14-2019	Site A, Site B
Human Resources, Executive director	July-2-2019	Corporate Level
Human Resources, Hospital Director	July-6-2019	Site B
Patient Affairs, Hospital Director	July-10-2019	Site A
Medical Laboratory and Pathology Director	Aug-5-2019	Corporate Level
Radiology and Medical Imaging Department Director	July-23-2019	Site A
Operating Room Department Chairman	Jun-28-2019	Site B
Emergency Medicine Department Chairman	Jun-25-2019	Site A,Site B
Medicine Department Chairman	Jun-29-2019	Site A
Surgery Department Chairman	Jun-20-2019	Site A
Nursing Service Manager	July-19-2019	Site B (2)
Health Education Center	July-19-2019	Site A
Front-liner staff – Two Focus group (15 members per group) multidisciplinary composition.	July-15-2019 July-16-2019	2 focus groups in Sites A and C and 2 in Site B

Supplementary table 2S. Summary of the main themes and subthemes identified during the interviews.

Theme	Subthemes
Changes in PSC in the facility	• Change in overall culture. • More awareness among staff regrading patient safety. • Improved communication • Increased error reporting • Improved understanding and following hospital policies and procedures. • Improved care processes within the hospital • Provision of guides and manuals • More awareness of risks and how to avert them. • Addressing staff fears about the punitive culture. • Clearer job descriptions, roles, and responsibilities • Making staff less resistant to change • Improved teamwork across the hospital
Factors influencing the PSC in healthcare	• Communication between staff and patients and within and across departments • Staff continued education and training. • Teamwork within and across units, particularly when it came to handoffs and transitions. • Leadership and administrative support • Monitoring and evaluation including feedback on patient safety indicators • Number of staff available • Robust incident reporting system and receiving feedback on reported events. • Clarity and correct implementation of policies and procedures • Implementing a system for monitoring patient safety goals • Improving workflow within specific departments
Barriers to establishing PSC and how to overcome them	• Poor communication within and across departments • Punitive culture • Limited staff awareness • Staff resistance to change. • Staff shortage • Language barrier • Limited cooperation from physicians • Poor training of staff • Budget and space constraints
Organizational changes since 2012	• Changes in the human resources regulations and workflows (from the traditional civil service to a self-operation system) • Preparation for dual accreditation (i.e., national and international) • Separation of the hospitals' healthcare quality from the academic medical education quality • Infrastructure expansions throughout the organization • Launching of new healthcare services • Conducting regular "Quality Days" • Strategic initiatives to enhance communication between top management and frontline staff (e.g., "Patient Safety Leadership Walk-Rounds," "Open Day," and "Breakfast with the Chief Executive Officer") • Digitalizing the incident reporting system

Suggestions to improve patient safety	• Increasing staffing • Offering continuous training and education • Improving communications and teamwork within and across departments • Implementing a horizontal chain of command • More support from management and leadership • Offering feedback on events reported • Supporting a non-punitive culture • Using an open-door leadership approach • Rewarding and empowering staff • Using walk-rounds • Regular meetings to discuss quality and patient safety. • Increasing the space and number of machines available • Better management of patient flow • Better triage and patient assessment • Better implementation of policies and procedures and improved infrastructure • Supporting departmental patient safety initiatives • Staff empowerment to obtain their commitment. • Conducting brainstorming sessions for staff and projects spearheaded by departments to improve patient safety and hosting a "Quality Day." • Empowering the quality committee and creating ambassadors in the hospital supported by hospital leadership