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Research Article

Measuring safety culture among dispensing pharmacists and the effect of an educational intervention: Experience from a state sector teaching hospital of a resource limited country

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ABSTRACT

Background: It is essential to ensure that medication dispensing; a vital step in the treatment process takes place in an environment with a strong safety culture. The objectives of this study were to measure the safety culture and to assess the effectiveness of an educational intervention to improve safety culture, as perceived by dispensing pharmacists of a state sector teaching hospital of a resource limited country.

Methods: An interviewer administered questionnaire, developed in-house based on published literature, was initially administered to all dispensing pharmacists of the study hospital. Two weeks later, participants attended an educational workshop on safety culture. The same questionnaire was administered one month after the workshop to assess the six domains of safety culture. The mean composite scores (MCSs) and average positive response rate (PRR) of each domain were compared before and after the intervention (5% significance level).

Results: Except for the domains of environment factors and documentation, other domains (human factor, communication, supervision along with reactions and responses to mistakes) obtained a PRR of more than 50%. A statistically significant difference ($p>0.05$) between the MCSs or PRRs of any domain was not observed after the intervention. However, results indicated an improvement in the knowledge of safety culture among pharmacists as the total number of "don't know" responses reduced ($p=0.019$) after the intervention.

Conclusion: The present study implies that factors such as documentation and working environment needs to be improved to establish a sound safety culture. Additionally, educational interventions alone may have a limited effect in enhancing a safety culture in the dispensing process.

Key words: Pharmacist, dispensing process, Hospital pharmacy, safety culture, educational intervention, Sri Lanka

INTRODUCTION

The World Health Organization (WHO) launched the third Global Patient Safety Challenge in 2017, themed on improving medication safety. (1) The WHO has cautioned unsafe medication practices and medication errors as the foremost issues that need to be confronted by healthcare systems worldwide. (1) Medication errors can occur at any step of the medication use process. However, errors that occur later in the process are more likely to reach the patient. (2) Therefore, a process such as medication dispensing (being the last step of the medication use process for outpatients) warrants to be safe and error free.

According to experts, medication errors are mostly due to faulty systems rather than the negligence of individuals. (1) Thus, healthcare systems are now focusing on error-proofing systems and promoting a safety culture that supports medication safety. (2, 3) According to the Institute of Medicine (United States), Committee on quality of health care in America, "the biggest challenge to moving towards a safer health system is changing the culture from one of blaming individuals for errors to one in which errors are treated not as personal failures, but as opportunities to improve the system and prevent harm". (4) Blame and shame culture discourages healthcare professionals to report medication errors, and permits the same error to occur again and again. Further, blame and shame promotes self-blame and hinders healthcare professionals from considering medication safety as a team effort. (2, 3)

The term "safety culture" originated after the Chernobyl nuclear power disaster in 1988 and then was taken up by many industries. (5) This concept was adopted to healthcare more recently. Literature reveals that there are no clear definitions and measures on safety culture. (5) The health foundation an organization based in the United Kingdom (6) suggests that safety culture is how safety is considered by employees and the availability of systems to promote safety in an organisation. Andersen (7) defines safety culture as "a set of interconnected beliefs, norms and behavioral dispositions among staff (employees and management) that have an actual or potential impact on the efficiency with which the safety management system supports safety". Therefore, measuring safety culture is important as it is an indicator of the current safety status of an organisation. (6) Various validated tools such as checklists, questionnaires and surveys are available to measure safety culture and organisations should select the best tool match to their context. (6)

Safety culture should be measured in terms of all aspects that affect safety. Andersen (7) introduced eight factors that affect safety culture; willingness to report, safety prioritisation, leadership involvement, risk and human performance limitation perception, feeling of responsibility, trust and fairness, team work atmosphere, and motivation or influence. Leadership, policies, strategies, partnerships, and resources are other factors that are said to have direct and indirect influences on safety culture. (8)

Since there is a complex two-way relationship between safety culture with staff or patient outcomes, there is a special necessity to implement interventions to establish safety culture in healthcare settings and to assess the effectiveness of these interventions. (9) Among the various approaches utilized to improve safety, continuing training and education is a

proposed solution in literature as education improves safety practices and attitudes among healthcare professionals. (9, 10)

An educational intervention had increased the patient safety attitudes of pharmacy undergraduates of University of Sydney such as internalising errors ($p=0.010$), questioning behaviours ($p<0.001$), and open disclosure ($p=0.008$). (10) Another study conducted in the family and community medicine teaching units in Galicia, Spain reported a significant improvement in incident reporting but no difference in patient safety grade (a measurement of patient safety attitude) after a two-hour workshop on patient safety. (9) A study conducted with nurse clinical leaders in Canada demonstrated a significant improvement of safety culture measures ($p< 0.001$) after an educational intervention. (11) During this study two patient safety workshops were conducted over a period of six months. The same study reported a decline in safety culture measures for the control group. (11) A quasi-experimental study conducted among senior nurses of Jordan to assess the effect of an educational intervention on safety culture perceptions and rate of adverse event reporting, observed a significant improvement of positive scores for the domains such as frequency of adverse event reporting and non-punitive response. This study also reported a decrease in the rate of adverse events. (12)

A majority of the published studies on safety culture measurement at pharmacy settings were done at community pharmacies. (13-16) No studies were found on assessing the safety culture among dispensing pharmacists engaged in hospital ambulatory care in the South Asian region in published literature. Hence, the objectives of the present study were to measure the safety culture among pharmacists involved in outpatient medication dispensing in the study setting, and to assess the effectiveness of an educational intervention on improving the level of safety culture.

METHODS

Study design and study setting

The present interventional study was carried out in the pharmacy department of a university-based teaching hospital in Sri Lanka. The pharmacy department functions with four units. The units comprise of the outpatient pharmacy, the inpatient pharmacy, surgical stores and the main medication store.

Study population and sample selection

The department of pharmacy operated with 35 pharmacists and 10 post-intern pharmacists (recently recruited pharmacists after internship training) at the time of study. All eligible pharmacists who were involved in dispensing of medications in their daily routine of work and had more than one year of working experience were included. Pharmacists who did dispense medicines as a part of their daily routine work, and pharmacists not registered with the Sri Lanka medical council (trainees) were excluded.

Data collection tool and method

An interviewer administered questionnaire was used to assess the level of safety culture among pharmacists. Two survey tools titled: “Hospital survey on Patient Safety Culture” (17) and “Community Pharmacy Survey on Patient Safety Culture” (18) from the Agency for Healthcare Research and Quality, Rockville, United States of America were used as basic sources to develop the questionnaire with permission from the agency. All questions from the reference questionnaire (n=40) were included. Some questions were re-worded (n=10), and some

new questions were added to suit the Sri Lankan context (n=2). The questionnaire was first fine-tuned through iterative reading by the research team, and then content validated for appropriateness, clarity, relevance, and suitability, to Sri Lanka by an expert panel consisting of three experts (senior pharmacy academics). The questionnaire was forward translated to Sinhala and Tamil languages (local languages used in Sri Lanka) and back translated to English to ensure accuracy of translation. Face validation was done through a pilot study conducted in a local secondary care hospital (Base hospital - Panadura) where the questionnaire was introduced to 10 pharmacists fulfilling the same inclusion criteria indicated in the original study. A five-point Likert's scale was used for responding and for scoring. A score of '1' was given "Strongly Agree (SA)" ascending to a score of '5' "Strongly Disagree (SD)".

The questionnaire assessed the status of safety culture in terms of six domains: environmental factors, human factors, communication factors, supervisor factors, documentation factors, and responses and reactions to mistakes. The questionnaire was introduced as an interviewer administered questionnaire. The same questionnaire was repeated one month after the educational intervention.

Educational intervention

A half-day workshop was carried out as an educational intervention, delivered by two experienced pharmacy academics involved in medication safety research. The workshop was titled; "Safety culture and improving medication safety in the dispensing process". The topics of discussion at the workshop were safety culture in the dispensing process, medication review and drug related problems, and good pharmacy practices in preparing, dispensing and delivering of medication. An educational poster was to be designed by participants at the end of the workshop as an activity of summarising key medication safety messages learnt during the session, and as a means of collating medication safety aspects perceived as important by the participants. After fine-tuning the poster by the research team, and with expert opinion, it was displayed in relevant dispensing units with institutional approval. A study pack on safety culture (including all aspects of medication safety covered during the workshop) was given to all the participants as reference material.

Data analysis

Responses, "strongly agree" and "agree" were combined to calculate the positive response rate (PRR) of each variable. Average PRR was calculated for each domain. A composite score was calculated for each tested variable. The composite score was calculated by multiplying the score of a response by the number of respondents providing each response. Then a mean composite score (MCS) ranging from 1 to 5 was calculated for each domain as follows.

$$\text{MCS} = \frac{\text{Sum of composite scores for all variables in a domain}}{\text{Number of variables of a domain}}$$

The Wilcoxon signed-rank test was used to statistically compare the MCS of each domain before and after the educational intervention. Statistical significance was considered at 5% significance level. Those who responded as "does not apply" and "don't know" were excluded when calculating the MCS.

Ethical clearance and informed consent

Ethical clearance for the study was obtained from the Ethics Review Committees of the University of Sri Jayewardenepura (reference

number: 64/17) and the Colombo South teaching hospital (CSTH) (application number: 621). Administrative permission was obtained from the Director of the CSTH. The study was also registered in the Sri Lanka Clinical Trials Registry (SLCTR/2018/003). Written informed consent was obtained from participants.

RESULTS

All eligible pharmacists (n=19) in the study hospital participated. Pharmacists not dispensing medicines in their daily routine work (n=16) and trainee pharmacists (n=10) were excluded. Three pharmacists were graduates of pharmacy and others had diploma level qualifications in pharmacy. Their demographics are shown in Table 1.

Table 1. Demographic data of participants (n=19)

Demographic characteristic	Number (%)
Gender	
Male	3 (15.8)
Female	16 (84.2)
Duration of service	
1-3 years	2 (10.5)
3-5 years	7 (36.8)
5-10 years	3 (15.8)
More than 10 years	7 (36.8)
Highest Education Qualification*	
Diploma in Pharmacy	16 (84.2)
BPharm/BSc Pharmacy Degree	3 (15.8)
Degree in other discipline	2 (10.5)

*Percentages may not add up to 100% as participants may have had more than one qualification

Forty-two variables were tested under six domains of safety culture assessment. The PRR (percentage of participants who responded strongly agree/agree) for each variable and the average PRR of each domain before and after the intervention are shown in Table 2. MCS values of each domain and the differences between MCS before and after the intervention are shown in Table 3.

The highest PRR was for the supervisor factors domain (73.7%) before the intervention. Communication factors domain gained the highest PRR of 68.4% after the intervention. Human factors, supervisor factors, communication factors, and response and reactions to mistakes domains had a PRR of more than 50% before and after the intervention. Environmental factors domain and documentation factors domain had the lowest PRR both before and after the intervention. There was no statistically significant difference in PRR or MCS for any domain after the intervention. However, decreased total numbers of "don't know" answers (Table 4) imply an increasing of knowledge on safety culture among some participants after the intervention.

The educational poster (attached as additional material) reflected the safety culture aspects gathered by participants. Important safety culture areas highlighted in the educational poster by the participants were: safety in prescription reviewing, labelling of medications, attention on look-alike sound-alike medicines, and high alert medications (e.g. thyroxin, warfarin), errors in medication assembling, and importance of verbal instructions during dispensing.

Table 2. Positive response rate (PRR) for each variable and average PRR for each domain in the questionnaire

Variables of the questionnaire	Positive Response Rate (PRR) n (%)	
	Before the intervention	**After the intervention**
Environment Domain		
Pharmacy is well organised	7 (36.8)	5 (26.3)
Have enough pharmacists to handle the workload	0 (0)	0 (0)
The physical layout supports good workflow	1 (5.3)	4 (21.1)
Pharmacy is free of clutter	4 (21.1)	4 (21.1)
Pharmacy has minimal interruptions by phone calls, faxes, patients, making it difficult for staff to work accurately	4 (21.1)	5 (26.3)
Pharmacists normally take enough breaks (approximately 45 minutes for a shift of more than six hours) and do not work more than eight hours per day	7 (36.8)	6 (31.6)
We don't have patient safety problems in this unit	2 (10.5)	4 (21.1)
Procedures and systems are good at preventing errors from happening	3 (15.8)	5 (26.3)
It is not just by chance that more serious mistakes do not happen around here	17 (89.4)	14 (73.7)
Pharmacists take adequate breaks during shifts	4 (21.1)	6 (31.6)
Average PRR for environmental domain	25.8%	27.9%
Human factors domain		
Pharmacists work together as a team to get the work done	18 (94.8)	16 (84.2)
Pharmacists clearly understand their roles and responsibilities	15 (78.9)	13 (68.4)
Pharmacists treat each other with respect	17 (89.5)	14 (73.7)
Pharmacists are actively doing things to improve patient safety	16 (84.2)	16 (84.2)
After making changes to improve patient safety, pharmacists evaluate their effectiveness	5 (26.3)	10 (52.6)
Pharmacists usually do not work in a hurry to minimise the patient crowd	2 (10.5)	3 (15.8)
Patient safety is never compromised to get more work done	15 (78.9)	14 (73.7)
Pharmacists who are new to this pharmacy receive adequate training	11 (57.9)	11 (57.9)
Average PRR for human factors domain	65.1%	63.8%
Supervisor factors domain		
Encourages steps taken to ensure patient safety	15 (78.9)	13 (68.4)
Seriously considers staff suggestions for improving patient safety	14 (73.7)	11 (57.9)
Whenever pressure builds up, supervisor does not encourage pharmacists to work faster, taking shortcuts	10 (52.7)	9 (47.4)
Takes immediate actions when there is an error, without ignoring	17 (89.5)	12 (63.2)
Average PRR for supervisor factors domain	73.7%	59.2%

** Denominator-number of respondents (n=19); **'Positive response' includes participants who either strongly agreed or agreed

Table 2. Continued

Variables of the questionnaire	Positive Response Rate (PRR) n (%)	
	Before the intervention	**After the intervention**
Communication factors domain		
Staff ideas and suggestions are valued in this pharmacy	14 (73.7)	11 (57.9)
Pharmacists will freely speak up if they see something that may negatively affect patient care	15 (79.0)	17 (89.5)
All pharmacists are informed about errors that happen in this unit	16 (84.2)	12 (63.2)
Pharmacists feel free to question the decisions or actions with influence on patient care taken by of those with more authority	11 (57.9)	14 (73.7)
Pharmacists discuss ways to prevent errors from happening again	18 (94.7)	14 (73.7)
Pharmacists encourage patients to talk to us about their medications	8 (42.1)	10 (52.6)
Pharmacists spend enough time talking to patients about how to use their medications	2 (10.5)	3 (15.8)
Pharmacists tell patients important information about their new prescriptions	14 (73.7)	17 (89.5)
Pharmacists inform patients if there are any changes (e.g. increase or decrease of the dose, change in a medication, adding or omitting a medication) in the prescription	19 (100)	19 (100)
Average PRR for communication factors domain	68.4%	68.4%
Documentation factors domain		
Usually pharmacists report and document errors even though it was noticed and corrected before reaching the patient	0 (0)	0 (0)
Usually pharmacists report and document errors that happened but has no potential to harm the patient	1 (5.3)	0 (0)
Usually pharmacists report and document errors which could have done a patient harm but did not happen	1 (5.3)	0 (0)
Average PRR for documentation factors domain	3.5%	0
Response and reactions to mistakes		
This pharmacy is good at preventing mistakes	5 (26.3)	5 (26.3)
Pharmacists are treated fairly when they make mistakes	8 (42.1)	14 (73.7)
When a mistake happens, pharmacists try to figure out what problems in the work process led to the mistake	13 (68.4)	14 (73.7)
Pharmacists in this pharmacy learn from their mistakes rather than punishing them	15 (78.9)	16 (84.2)
When the same mistake keeps happening, pharmacists change the way they do things	12 (63.2)	16 (84.2)
Pharmacists do not feel like their mistakes are held against them	3 (15.8)	3 (15.8)
Mistakes have led to positive changes in this pharmacy	14 (73.7)	18 (94.7)
When an event is reported, it does not feel like the person is being written up, and not the problem	7 (36.8)	10 (52.6)
Average PRR for response and reactions to mistakes domain	50.6%	63.1%

** Denominator-Number of respondents (n=19); **'Positive response' includes participants who either strongly agreed or agreed

Table 3. Comparison of Mean Composite Scores (MCS) before and after the intervention

Domain	MCS before the intervention	MCS after the intervention	P value
Environmental	3.41	3.38	0.076
Human	2.53	2.50	0.165
Supervisor	2.26	2.54	0.065
Communication	2.50	2.45	0.418
Documentation	3.94	3.78	0.343
Response and reactions to mistakes	2.83	2.50	0.345

MCS: Mean Composite Score; P value<0.05 was considered as statistically significant.
1: Strongly Agree; 2: Agree; 3: Neither agree nor disagree; 4: Disagree; 5:Strongly disagree

Table 4. Changes in participant awareness of factors related to safety culture

Domain	Number of "Don't know" answers before the intervention	Number of "Don't know" answers after the intervention	P value
Environment factors	4	0	0.045
Human factors	1	1	No change
Supervisor factors	3	4	0.705
Communication factors	2	1	0.563
Documentation factors	2	2	No change
Response and reactions to mistakes	13	3	0.012
Total	25	11	0.019

DISCUSSION

Medication dispensing is a complex process which requires knowledge and intellect of the pharmacist. However, human errors are unavoidable and implementing safe healthcare systems and procedures are essential to help minimise these errors. The present study evaluated the level of safety culture and the effect of an educational intervention on safety practices of dispensing pharmacists within six domains. Domains such as, human factors, supervisor factors, communication factors, and response and reactions to mistakes, had a PRR of more than 50%. Environmental factors and documentation factors gained PRR values less than 50%. Although a significant change due to the intervention was not found ($p>0.05$) on any safety domain assessed, there was a significant drop ($p=0.019$) in the total number of "don't know" responses to the study questionnaire, indicating that the educational intervention had an impact on improving the knowledge on safety culture of the participants. This drop was seen in the environmental factors domain, communication factors domain, and response and reactions to mistakes domain.

According to our findings, most participants perceived that environmental and documentation domains in the study setting did not support a safety culture, as opposed to human, supervisor, communication, and

response to reaction domains that favoured safety. Documentation practices scored the lowest average PRR. As evident from the safety culture survey, proper documentation practices were not implemented in the study setting. Participants also did not focus on safe documentation practices in the poster prepared by them, most probably because they did not perceive documentation as an important safety aspect. Poor documentation which is a reported problem in implementing a safety culture practice may lead to the underreporting of medication errors. (19) Ashcroft (20) stated that fear of blame, pressure of work, and loyalty to colleagues are factors that discourage healthcare professionals to report errors.

Inadequate staff is another challenge in implementing a safety culture. (21, 22) Adequate staff is important to employ safety practices. Understaffing increases workload and stress. Oborne (23) identified stress recognition (recognising that he or she is in stress) too as an important dimension of safety culture and that safety may be affected when staff is tired. Samsuri *et al.* (22) reasons that, whenever stress is a threat on safety, a high stress recognition ability among healthcare professionals is needed so that they could be more vigilant of their own performances. However, with inadequate staffing this higher stress recognition may not be helpful to implement a safety culture.

Supportive physical layouts, procedures, and systems are essential areas to establish safety culture (1, 3, 24) and as evident from this study, pharmacists too perceived the importance of these elements in establishing a safety culture. In addition to supplying the basic environmental requirements, computerised decision support systems, computerised prescribing systems, bar-code assisted medication dispensing systems, and automated dispensing machines are some of the technologies used worldwide to avoid human errors and create safe systems, although technology too can introduce different errors to the system. (2, 3) An uninterrupted working environment is essential in implementing safety culture. A low PRR (21.1% - 26.3%) was obtained in this study for the variables, 'minimum interruptions during work' and 'free of clutter'. An interventional study conducted in Switzerland to study medication safety issues due to interruptions among nurses during medication preparation reported a significant drop in interruptions after training staff about the effects of medication safety due to interruptions and wearing safety vests with "do not disturb" labels. The authors of this study acknowledge that health managers should create awareness on minimising interruptions through staff education. (25)

The communication factors domain gained a PRR of 68.4% both before and after the intervention. Although pharmacists agreed that they adequately informed prescription changes to the patients, informed new patients about their medications (details such as indications of medications, their doses, frequencies, and common side-effects), provided verbal instructions and responded to patient queries, most believed they did not spend enough time talking to patients on the use of medication (10.5% before the intervention and 15.8% after the intervention). Emphasising on communication activities in the educational poster developed by the pharmacists taking part in the present study, demonstrates their awareness on the importance of communication in establishing a safety culture. A survey among community pharmacists in Kuwait reported a PRR of

73% - 92% for the tested variables on communication. (16) PRRs for communication ranged from 27% - 74.4% in a study conducted in Saudi Arabia (26) and 73% - 93% in a study conducted in the USA (14) indicating that pharmacists in different parts of the world had identified proper communication as an important aspect of safety culture.

A PRR over 50% was obtained for each variable assessed in the supervisor factors domain. This domain assessed the role of the direct supervisor in-charge on safety culture and the findings are consistent with previous studies (27) where direct supervisors were found to be more committed to safety than senior leaders, and managerial impact on safety culture was fairly high. (22) However, in contrast, Samsuri *et al*., (22) citing other studies (8, 20, 28) argues that the influence of management had a negative impact on safety culture.

Factors such as teamwork, understanding responsibility, respecting each other, were assessed under the human factors domain which had an average PRR of 65.1% before the intervention and 63.8% after the intervention of this study. Other studies also reported an environment with positive teamwork among pharmacists. (16, 26, 29) Schell (30) states that "a shared, team-based responsibility structure" is a characteristic of a safety culture. It will motivate individuals to report incidents as there is shared responsibility, allowing organisations to take necessary action effectively and efficiently.

Responses and reactions to mistakes domain had a PRR of 50.6% before the intervention and 63.1% after the intervention. This value remained between 46% and 85.3% in other studies that were conducted to assess the safety culture in pharmacy units (13, 14, 16, 26). The way of responding to mistakes is important in establishing a safety culture. A "blame and shame culture" hinders healthcare professionals from reporting errors. Healthcare institutes should have a platform to acknowledge errors, recognise the inevitability of errors, and foresee possible errors to establish systems that could minimise them. (4)

The composite scores or PRRs related to the safety culture assessment did not change considerably after the intervention. Hence the findings of this study on one hand may indicate that our educational intervention was not effective enough in educating participants on safety culture, or on the other hand, participants were already aware of safety culture and safety practices were in place in the study hospital. A previous study had shown that educational interventions were able to increase attitudes towards patient safety among pharmacy students. (10) Another study had recommended educating staff on the science of safety, after conducting safety measurement studies. (27) Clinical training and guidelines, implementing information technology, organisational structures and industry regulations have been suggested as safety culture improvement methods. (4) Furthermore, educational interventions like workshops have increased the rate of incident reporting, which is a vital part of a safety culture. (9) Training with multidisciplinary team work sessions have elevated some safety culture domains such as organisational learning, expectations on supervisors and managers, communication openness and non-punitive response to errors. (31) It was also noticeable that continuous educational programmes for several days over a period of time had changed safety culture (10-12) rather than a single day

educational intervention. (9) Our findings too indicated an improving trend in knowledge after the intervention as the total numbers of "don't know" answers reduced. Accordingly, we expect the adherence to safety practices also to increase in the study setting.

Domains that had a low PRR must be improved. A comprehensive system to report and document mistakes should be introduced in pharmacies since it is a mandatory step for the establishment of a sound safety culture. Pharmacists should develop a systematic approach to enable proper professional communication with patients to ensure that the patients understood the written and verbal information about their medication. Apart from educational interventions, attention should be paid to providing the required resources needed for more practice-based changes such having as a properly organized dispensing environment and adequate staffing aiming at enhancing safety culture.

There were only a limited number of pharmacists in the study setting and hence the small sample size, which is a limitation of this study, was inevitable. There was also limited time between the intervention and the administration of the questionnaire after the intervention limiting the ability to assess if pharmacists actually internalized the safety culture aspects introduced at the workshop. Moreover, it should be acknowledged that a significant drop of 'don't know' answers should not necessarily indicate an improvement in knowledge.

CONCLUSION

Among the six domains of safety culture assessed, the highest average PRR was obtained for the supervisor domain before the educational intervention while the communication domain scored the highest PRR after the educational intervention. PRRs or mean composite scores of any domains did not change significantly after the educational intervention ($p>0.05$). However, a reduction of "don't know" answers to the questionnaire after the intervention ($p=0.019$), suggested a possible increase in awareness on safety culture knowledge gathered through the educational intervention. However, an increase in 'don't know answers may not necessarily indicate an improvement in knowledge which is a limitation of this study. We suggest that educational interventions combined with more practice-based changes will result in a greater improvement of safety culture practices than educational interventions alone. Authors propose this study to be taken as a model to other institutes to assess their safety status and identify strengths and weaknesses of their own systems.

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AUTHOR'S DECLARATION:

The authors declare that all persons listed as authors have read and given approval for the submission of this manuscript.

COMPETING INTERSTS:

The authors declare that they have no conflict of interests.

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