



Changes in Patient Safety Culture in Pharmacists after Training and Application of the Model in Pharmacy Referral Program: A Pre-Post Quasi-Experimental Study

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Abstract

Patient safety culture in community pharmacies requires adequate knowledge, operational tools, and continuous organizational learning. This study assessed changes in pharmacists' knowledge and patient safety culture following training and two months of model implementation. A pragmatic one-group pretest–posttest quasi-experimental study involved 29 pharmacists from 12 Pharmacy Referral Program pharmacies in Jakarta, Bogor, Depok, and Tangerang. Approximately three-hour training sessions were delivered in six groups, followed by the implementation of a module, incident classification guide, and logbook. Safety culture was measured using a 63-item, 14-dimension instrument adapted from the Agency for Healthcare Research and Quality (AHRQ). Knowledge scores increased from 21.59 to 25.48 ($Z = -4.685$; $p < 0.001$; $r = 0.87$). Total safety culture scores increased from 269.59 to 274.38, representing a 4.79-point difference (95% CI: 3.58–6.01; $t(28) = 8.07$; $p < 0.001$; $d_z = 1.50$). Significant improvements were observed in responses to mistakes, overall safety perceptions, incident awareness and identification, and mistake documentation. Training and model implementation were associated with improvements in targeted safety culture dimensions, although documentation remained the lowest-scoring dimension. Controlled studies with longer follow-up periods and cluster-adjusted analyses are needed to further evaluate effectiveness and sustainability.

INTRODUCTION

Patient safety is determined not only by individual competence but also by values, norms, communication, work systems, and the way organizations learn from mistakes. The World Health Organization places safety culture, health worker competence, patient engagement, and reporting and learning systems as important elements in the Global Patient Safety Action Plan 2021–2030 (World Health Organization, 2021). In medication services, risks can arise from prescription receipt, preparation, labeling, handover, and the provision of information to patients (Astuti et al., 2023; Bourne et al., 2022; Paulino et al., 2019; Siegel et al., 2024; Vaismoradi et al., 2020).

Community pharmacies are recurring healthcare service points with high transaction volumes and often limited interaction time. Pharmacies that serve the Drug Referral Back Program (DRR) have additional responsibilities because they maintain medication continuity for patients with chronic diseases. Pharmaceutical service standards require the management

of medications and clinical pharmacy services that are oriented toward quality and safety (Ministry of Health of the Republic of Indonesia, 2016). However, the absence of incident reporting systems, fear of blame, and unstructured communication can hinder learning from mistakes identified both before and after medication delivery (Gong, 2022; Mahat et al., 2022).

The Agency for Healthcare Research and Quality developed the Community Pharmacy Survey on Patient Safety Culture to assess staff perceptions of organizational support for patient safety (Agency for Healthcare Research and Quality, 2019). A systematic review showed that safety culture in community pharmacies still varies across countries, with error documentation, workload pressure, and responses to errors identified as areas requiring further improvement (Kwon et al., 2023). Similar findings have been reported in Qatar, Egypt, Saudi Arabia, and other countries (Al-Tehewy et al., 2023; Easwaran et al., 2023; Owusu et al., 2021; Radwan & Salameh, 2023).

Preliminary research on community pharmacies serving DRR in Indonesia also showed that teamwork and informal learning were stronger than error documentation and formal system support (Hartianty et al., 2026). This issue cannot be adequately addressed through theoretical training on knowledge alone. Interventions need to combine training with workflow-based tools, such as incident classification systems, incident logbooks, communication between shifts, and non-blaming discussions of errors. Meta-analyses have shown that patient safety education can improve healthcare workers' safety culture; however, the effects are influenced by study design quality, contextual factors, and consistency of implementation (Agbar et al., 2023).

Evidence regarding safety culture interventions in Indonesian DRR pharmacies remains limited. This study aims to assess: (1) changes in pharmacists' knowledge immediately after training; (2) changes in the total patient safety culture score after two months of model implementation; and (3) the dimensions of safety culture that changed. The research hypothesis was that there would be differences in scores before and after the intervention. Because there was no control group, the findings were interpreted as temporal changes following the intervention rather than evidence of causal effects.

The intervention was structured as a gradual chain of change. Training was expected to initially enhance pharmacists' knowledge regarding incidents, documentation, responses to errors, communication, and learning processes. This knowledge was then translated into practice through a two-month operational implementation toolkit. Repetitive practices were expected to influence perceptions, habits, and work norms, which were reflected in safety culture scores. Thus, knowledge scores represented immediate learning outcomes, whereas safety culture represented a more distal organizational outcome (Bisbey et al., 2021; Duryan et al., 2020; Lyubikh et al., 2022; Shekh & Islam, 2023; Shekh & Sadiq, 2024).

The framework was consistent with SEIPS 3.0, which views safety as the result of interactions among people, tasks, technology, organizations, and the work environment (Carayon et al., 2020). This systems perspective recognizes that patient safety culture is not merely an individual attribute but emerges from complex interactions within the work system. The implementation outcomes framework also distinguishes acceptance, adoption, appropriateness, feasibility, fidelity, penetration, cost, and sustainability from service outcomes (Proctor et al., 2011). Therefore, changes in cultural scores should be interpreted alongside evidence of model implementation rather than solely as consequences of training attendance.

This dual framework enables a more nuanced interpretation of the findings by acknowledging that changes in safety culture scores must be understood within the context of implementation fidelity and broader organizational and system factors shaping practice.

METHODS

Design and research location

This study was a quantitative evaluation stage of a multiphase mixed-methods research project. A pragmatic quasi-experimental one-group pretest–posttest design was used, with paired measurements obtained from the same pharmacists before and after the intervention. The research was conducted at 12 Drug Referral Back Program (DRR) pharmacies in Jakarta, Bogor, Depok, and Tangerang. Training sessions were conducted in six groups from May 5 to June 6, 2026, using online, hybrid, or offline modes according to participant availability. Each training session lasted approximately three hours. The training materials and implementation tools were subsequently applied for two months before outcome reassessment.

Research participants

Participants were recruited using total sampling from pharmacists who met the eligibility criteria in the 12 selected pharmacies. The inclusion criteria were pharmacists practicing in DRR pharmacies, having more than one year of work experience, and providing direct services to patients with type 2 diabetes mellitus. Pharmacists who practiced fewer than five hours per day were excluded. Participants who did not complete the entire research process were considered dropouts. The paired analysis included 29 pharmacists with complete pretest and posttest data that could be matched using research codes.

Training and application of the model

The intervention priorities were determined based on interview findings, low baseline scores, and the feasibility of improvement within the study period. The main intervention targets were error documentation, error response, and incident awareness and identification. Supporting dimensions included open communication, communication about errors, communication between shifts, and organizational learning and continuous improvement.

The training materials covered safety culture, fair culture, identification and classification of Kejadian Potensial Cedera (KPC), Kejadian Nyaris Cedera (KNC), Kejadian Tidak Cedera (KTC), and Kejadian Tidak Diharapkan (KTD), documentation and reporting procedures, non-blaming responses to errors, effective communication, intershift communication, root cause analysis, and continuous learning. The training methods included lectures, case discussions, incident classification exercises, documentation simulations, and implementation plan development. Each pharmacy received modules, classification guides, and printed or digital logbooks. The materials were implemented in routine pharmacy services for two months and monitored through observations, document reviews, and pharmacist confirmation.

Outcomes and instruments

The learning outcome was measured using the number of correct responses on a knowledge test administered immediately before and after training using the same questions. The primary outcome was the patient safety culture score measured before training and after two months of model implementation. The safety culture instrument was adapted from the Agency for Healthcare Research and Quality (AHRQ) Community Pharmacy Survey on Patient Safety Culture and adjusted based on qualitative findings from the DRR pharmacy

context. The final instrument consisted of 63 items across 14 dimensions using a 5-point Likert scale, with higher scores indicating better patient safety culture.

The 14 dimensions assessed were physical space and environment, teamwork, staff training and skills, response to errors, organizational learning, overall perception of safety, implementation and compliance with standard operating procedures (SOPs), incident awareness and identification, reporting and data utilization systems, communication openness, patient counseling, cross-shift communication, communication about errors, and error documentation. The retained dimensions met the validity and reliability criteria established during instrument development.

Data analysis

Participant characteristics were presented as frequencies and percentages. Data normality was assessed using the Shapiro–Wilk test. Knowledge scores were not normally distributed and were analyzed using the Wilcoxon signed-rank test, with effect size calculated as $r = |Z|/\sqrt{N}$. The total safety culture score showed a normal distribution and was compared using a paired-samples t-test, with Cohen’s d_z calculated as the mean difference divided by the standard deviation of the differences. Two normally distributed dimensions, namely response to errors and overall perception of safety, were analyzed using paired-samples t-tests, while the remaining 12 dimensions were analyzed using the Wilcoxon signed-rank test. A two-tailed significance level of 0.05 was applied, and analyses were performed using SPSS version 25.

Ethical considerations

All participants received information about the study, provided written informed consent, and were identified using research codes to maintain confidentiality. Ethical approval was obtained from the Health Research Ethics Committee of Pancasila University (No. 131/KEPK-FFUP/IV/2025).

RESULTS AND DISCUSSION

Characteristics of pharmacists

All 29 pharmacists had paired data. Most are women (79.31%), aged 20-29 years (55.17%), have worked for more than four years (51.72%), and serve as pharmacists in charge (58.62%). The combination of young pharmacists with more than half of the participants having long work experience provided the context that the intervention was accepted by participants with diverse career stages.

Table 1. Characteristics of pharmacists in the study (n=29)

Features	n	%
Gender		
Male	6	20,69
Women	23	79,31
Age		
20-29 years old	16	55,17
30-39 years old	8	27,59

Features	n	%
40-49 years old	4	13,79
50-59 years old	1	3,45
Working period		
<2 years	8	27,59
2-4 years	6	20,69
>4 years old	15	51,72
Departments		
Pharmacist in charge	17	58,62
Accompanying pharmacist	12	41,38

Changes in knowledge and total score of safety culture

A total of 28 pharmacists obtained higher knowledge scores and one pharmacist had the same score; There is no decline. The average increased by 3.90 points, from 21.59 to 25.48. The Wilcoxon test showed a significant change ($Z=-4.685$; $p<0.001$) with a large effect size ($r=0.87$). These findings suggest that the material succeeded in improving conceptual mastery immediately after training, but did not in itself prove a change in practice.

After two months of implementation, the total score of safety culture increased from 269.59 to 274.38. The average difference of 4.79 points had a 95% IK3.58-6.01 and had a different meaning ($t(28)=8.07$; $p<0.001$). Cohen's d_z of 1.50 indicates consistent changes between individuals. However, the absolute increase is equivalent to about 1.52% of the instrument's maximum score and the initial score has reached 85.58% of the maximum, so the standard effect size needs to be read along with the possible ceiling effect and the magnitude of the absolute change.

Table 2. Change in knowledge and total score of patient safety culture (n=29)

Exterior	Before average (SD)	After average (SD)	Differences	Statistics	p	Efek
Knowledge	21,59 (1,70)	25,48 (0,91)	+3,90	Wilcoxon; $Z=-4,685$	<0.001	$r=0,87$
Total safety culture	269,59 (22,53)	274,38 (20,42)	+4,79	$t(28)=8.07$; IK95% 3.58-6.01	<0.001	$d_z=1.50$

Changes according to the dimensions of safety culture

Four of the 14 dimensions have a meaningful increase. Error documentation increased the most, at 1.59 points, followed by incident awareness and identification by 0.97 points. Responses to errors and overall perception of safety increased by 0.55 points each. The openness of communication showed a tendency to increase by 0.48 points, but had not yet reached statistical significance ($p=0.061$).

Based on the positive response, incident awareness and identification increased from 81.61% to 98.85%, while error documentation increased from 43.45% to 55.17%. Although

the documentation shows the largest change, this dimension still had the lowest positive response at the final evaluation. This suggests that training and use of incident logbooks can initiate change, but establishing documentation habits requires longer organizational support.

Table 3. Score of 14 dimensions of safety culture before and after the application of the model (n=29)

Dimensions	Before average (SD)	After average (SD)	Differences	Test	p
Physical space and environment	30,93 (3,40)	30,93 (3,37)	0,00	Wilcoxon	1,000
Teamwork	31,21 (4,29)	31,31 (4,20)	+0,10	Wilcoxon	0,083
Training and skills of staff	21,86 (2,36)	21,90 (2,32)	+0,03	Wilcoxon	0,317
Response to errors	19,76 (2,17)	20,31 (2,07)	+0,55	Paired t	0,002
Organizational learning	17,41 (1,78)	17,48 (1,66)	+0,07	Wilcoxon	0,317
Overall perception of security	26,00 (2,63)	26,55 (2,25)	+0,55	Paired t	0,005
Implementation and compliance of SOPs	22,72 (2,42)	22,72 (2,30)	0,00	Wilcoxon	1,000
Incident awareness and identification	12,03 (1,59)	13,00 (1,04)	+0,97	Wilcoxon	<0.001
Data reporting and utilization systems	9,00 (1,25)	9,00 (1,25)	0,00	Wilcoxon	1,000
Open communication	17,66 (2,77)	18,14 (1,98)	+0,48	Wilcoxon	0,061
Patient counseling	13,03 (1,94)	13,10 (1,82)	+0,07	Wilcoxon	0,317
Cross-shift recipe communication	17,72 (2,42)	17,79 (2,34)	+0,07	Wilcoxon	0,655
Communication about errors	13,03 (2,15)	13,34 (1,72)	+0,31	Wilcoxon	0,137
Fault documentation	17,21 (4,97)	18,79 (3,66)	+1,59	Wilcoxon	0,001

Model implementation

Verification shows that communication between shifts, communication regarding errors, re-examinations, and counseling have been implemented throughout the pharmacy. Incident documentation began at eight pharmacies and resulted in 20 records, while LASA tagging was applied consistently across seven pharmacies. Teach-back and identity verification have not been consistent. The variation suggests that intervention exposures are not identical between pharmacies and helps explain why the changes are concentrated in the dimensions most directly supported by the material and device.

Table 4. Summary of verification of the implementation of the model in 12 pharmacies

Components	Reach	Remarks
Intershift communication	12/12	Implemented throughout pharmacies
Communication about offenses	12/12	Implemented during passings and/or briefings

Components	Reach	Remarks
Re-examination of the drug	12/12	Implemented before submission
Patient counseling	12/12	About 1-15 patients per week
Incident documentation	8/12	A total of 20 incidents were documented
LASA Marking	7/12 consistent	Three have not been consistent; two have not yet implemented
Teach-back	Not consistent yet	Not yet routine in all pharmacies
Identity verification	Not consistent yet	Not routine in the entire service process

Meaning of increased knowledge

The increase in knowledge occurred in almost all participants and had a large effect size. These results are in line with the meta-analysis of Agbar et al. (2023), who found that patient safety education programs can improve the safety culture of healthcare workers. However, the meta-analysis also showed high heterogeneity and sensitivity of results to study quality. Therefore, the change in knowledge in this study should be seen as a prerequisite for change, not as evidence that practice has changed automatically.

The training uses case examples, incident classification exercises, documentation simulations, role plays, and implementation plans so that it is closer to daily tasks than just delivering theory. The pre test is given shortly before the training starts, while the post test is given immediately after the training session ends.

Changes in safety culture and intervention targets

The four dimensions that change mean that they have a direct relationship with the objective of the intervention. Case classification and training guidelines support incident awareness and identification; the logbook provides a documentation mechanism; discussion of a fair culture influences the response to wrongdoing; And the series of activities can reinforce the general perception that safety is a pharmacy's concern. The fit between the intervention components and the changing dimensions reinforces the empirical evidence on the system in progress.

Documentation remains the lowest dimension despite experiencing the largest increase. These findings are consistent with international studies that position documentation, reporting environments, and response to errors as common weaknesses of community pharmacies (Al-Tehewy et al., 2023; Kwon et al., 2023; Owusu et al., 2021). Documentation requires time, an easy format, a sense of psychological security, the support of the person in charge, and the use of data for improvement. Without feedback, record-keeping can be perceived as an administrative burden and difficult to maintain.

High initial scores in the physical space, SOPs, training, and organizational learning allow the increase in scores to be less clearly visible. Therefore, the most powerful interpretation lies in changing the dimension of priorities, not in the claim of a comprehensive transformation of organizational culture.

Undeveloped dimensions and levels of compliance in plan implementation

The immutability of physical space, reporting systems, and SOP compliance can be understood because these components are structural and require organizational decisions

beyond the authority of the participants. Some other dimensions already have high initial scores. The openness of communication approaches statistical significance, but changing the norms of communication about mistakes requires a sense of psychological security and repeated experience that reports are used for learning, not punishment.

The Proctor framework emphasizes that adoption and adherence to implementation are different from effectiveness (Proctor et al., 2011). In this study, all pharmacies adopted some practices, but documentation was found in only eight pharmacies and the implementation of teach-back and identification was inconsistent. Training is also provided through different methods. Subsequent research needs to establish intervention indicators, frequency of incident logbook use, number of audit-feedback, and management involvement to assess the relationship between implementation compliance and score change.

Implications for DRR pharmacies

The model can be used as an initial framework for improving safety culture in DRR pharmacies with three priorities: the ability to recognize incidents, simple incident logging, and system improvement-oriented responses. The incident logbook should be followed by periodic brief meetings to review the pattern of events and determine preventive measures.

Strengths and limitations of research

The strength of the study was the use of the same participants at two times, contextualized instruments for DRR pharmacy, multicomponent interventions, and practice verification after training. The analysis also separates the immediate knowledge output from the safety culture after implementation.

The main limitation was the absence of a control group, the sample was only 29 pharmacists from 12 urban pharmacies. Two months is not enough to assess sustainability. Training is provided in different modes. Implementation compliance is not uniform, and the entire culture score is self-report based. Many dimensions have a high initial score so a ceiling effect is possible. Post-intervention reliability and measurement invariance have not been analyzed.

CONCLUSION

The training lasted approximately three hours, followed by two months of model implementation among 29 pharmacists in 12 Drug Referral Back Program (DRR) pharmacies. The intervention was followed by increases in knowledge scores and total patient safety culture scores. Meaningful improvements were observed primarily in error response, overall perception of safety, incident awareness and identification, and error documentation. Documentation remained the lowest-scoring dimension at the final evaluation. Given the one-group design without a control group, the findings indicated changes following the intervention but did not establish a causal relationship.

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