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Improving the health of the community surrounding pharmacies through SmartOTC and enhancing the role of pharmacists

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Abstract

Introduction: Community pharmacists are frequently the first healthcare professionals consulted for minor illnesses such as the common cold. However, limited consultation time and inconsistent assessment practices may affect the quality of self-medication services.
Purpose: This study evaluated whether structured SmartOTC training improved pharmacists' knowledge, perceived task ease, and ability to complete application-based clinical tasks.
Method: A one-group pretest–post-test study was conducted among 23 licensed community pharmacists from partner pharmacies in Purwokerto, Indonesia, recruited using convenience sampling. The intervention included education, application demonstration, guided practice, independent case simulation, and post-intervention evaluation. Knowledge was assessed using a 20-item questionnaire, perceived task ease using seven Single Ease Question items, and operational performance using 16 predefined tasks. Data were presented as means, standard deviations, frequencies, percentages, and 95% confidence intervals. Pretest and post-test outcomes were compared using the Wilcoxon signed-rank test, with rank-biserial correlation used to estimate effect size.
Results: All participants completed the program. Knowledge scores increased from 58.91 ± 4.99 to 79.78 ± 10.82, with a mean change of 20.87 points (95% CI: 16.32–25.42). Overall SEQ scores improved from 4.98 ± 0.50 to 5.98 ± 0.50, with a mean change of 1.00 point (95% CI: 0.80–1.20). Task success increased from 61.41 ± 11.41% to 94.57 ± 6.87%, representing a 33.15-percentage-point improvement (95% CI: 25.98–40.32). All changes were significant ($p < 0.001$; rank-biserial $r = 0.99$).
Conclusion: Structured SmartOTC training was feasible and substantially improved pharmacists' knowledge, usability perceptions, and task performance. This approach may strengthen digital competence, standardize common-cold self-medication services, and support safer routine pharmaceutical care in community pharmacies.

Keywords: clinical decision support systems, common cold, community pharmacy, pharmacists, self medication

Introduction

Community pharmacies are among the most accessible healthcare facilities and often serve as the first point of care for people seeking treatment for minor illnesses (Alenezi et al., 2023). Self-medication is common because it is convenient and relatively affordable, particularly for conditions such as the common cold (Feeley et al., 2020). Pharmacists therefore have an important role in assessing symptoms, selecting appropriate non-prescription medicines, providing medication and self-care advice, and referring patients when necessary (Zavaleta-Monestel et al., 2026). Without a structured assessment, inappropriate medicine selection may lead to adverse effects, therapeutic duplication, contraindications, or delayed referral for more serious conditions (Al-Omrani et al., 2023).

Managing common cold complaints in community pharmacies can be challenging because the symptoms may resemble influenza, allergic rhinitis, sinusitis, or other respiratory illnesses (Al-Qudah et al., 2021). Pharmacists must consider symptom severity and duration, patient age, comorbidities, allergies, concurrent medicines, and warning signs before recommending treatment (Hamadouk et al., 2021). These decisions are often made within a limited consultation time, while documentation of self-medication services may not always be performed systematically (Loh et al., 2023). Differences in professional experience and clinical confidence may consequently result in variation in the quality and consistency of pharmacy services (Sato et al., 2020).

SmartOTC was developed as a mobile clinical decision support system to assist pharmacists in managing common cold self-medication (Neto et al., 2024). The application supports structured symptom assessment, identification of warning signs, consideration of age and comorbidities, selection of appropriate non-prescription medicines, provision of non-pharmacological advice, referral decisions, and storage of consultation records medication (Neto et al., 2024). SmartOTC is not intended to replace pharmacists' professional judgment. Instead, it provides a systematic workflow that may reduce missed information and support more consistent clinical decision-making in community pharmacies (PAYDAR et al., 2023).

The availability of a digital application does not automatically ensure its appropriate use (Borges Do Nascimento et al., 2023). Pharmacists require orientation, demonstration, and guided practice to understand the application's features and apply its recommendations correctly (Vukmirović et al., 2026). A community service program consisting of education, SmartOTC

demonstration, supervised practice, and task simulation was conducted among representatives of community pharmacies. This study aimed to improve pharmacists' knowledge, perceived ease of use, and ability to operate SmartOTC in supporting common cold self-medication services. Its outcomes were evaluated by comparing participants' knowledge, ease-of-use ratings, and task-completion success before and after the program, as well as by assessing their acceptance of the application after training.

Methods

Community Service Design

This community service program employed a one-group pretest–post-test evaluation design to assess changes in participants before and after SmartOTC training. The same participants were evaluated at both measurement points. The program consisted of a pretest, an educational session, a demonstration of the SmartOTC application, guided practice, independent case-based simulations, a post-test, a usability assessment, and participant feedback. This approach was used to evaluate changes in pharmacists' knowledge, perceived ease of application use, and ability to complete application-related tasks following the intervention.

Ethical Considerations

Ethical approval for this study was obtained from the Health Research Ethics Committee of Universitas Harapan Bangsa (Approval No. B.LPPM-UHB/1326/5/2026). All participating pharmacists provided written informed consent before participation. Participation was voluntary, and participants were informed that they could withdraw at any stage without penalty. The identities of the participants and participating pharmacies were kept confidential, and all results were reported in aggregate form. All study procedures were conducted in accordance with applicable ethical guidelines.

Setting and Participants

The study was conducted in community pharmacies in Purwokerto, Indonesia, involving 23 licensed community pharmacists recruited through convenience sampling. Participants were recruited from partner pharmacies and were eligible if they provided self medication services, had access to an Android device compatible with SmartOTC, and completed all study activities, including the pretest, training, guided practice, independent simulation, and post-test. Those who did not complete the program or experienced technical issues affecting the application simulation were excluded. The research team coordinated with pharmacy owners or managers,

prepared and tested the SmartOTC application, developed training and evaluation materials, and conducted a technical trial to ensure the readiness of the application, devices, and study procedures.

SmartOTC Intervention

The intervention comprised five sequential activities: an educational session on evidence-based common cold self-medication, a demonstration of SmartOTC features, guided practice using case-based scenarios, independent completion of 16 application tasks, and a post-intervention evaluation. The educational session covered symptom assessment, identification of red flags, patient-specific considerations, pharmacological and non-pharmacological management, and referral criteria. During guided practice, participants managed various patient scenarios under facilitator supervision and received immediate feedback. The post-intervention evaluation included a post-test, the Single Ease Question (SEQ) (Azizah et al., 2025), usability and feedback questionnaires, and an assessment of participants' experiences, perceived challenges, and willingness to use SmartOTC in routine community pharmacy practice.

Knowledge Testing

Participants' knowledge was evaluated before and after the program using a 20-item questionnaire (Ozoemena et al., 2019). Each correct answer received one point, whereas an incorrect answer received no points. The total score was converted to a scale ranging from 0 to 100, with higher scores indicating better knowledge of common cold assessment, medicine selection, patient education, and referral criteria.

Perceived Task Ease

Perceived ease of application use was assessed using the Single Ease Question (Azizah et al., 2025). Participants rated seven task groups or aspects of application use on a seven-point scale ranging from 1, indicating "very difficult," to 7, indicating "very easy." Higher scores reflected greater perceived ease of completing the evaluated tasks. SEQ scores were collected before and after guided practice.

Task Success

Task success was used as an objective indicator of participants' ability to operate SmartOTC. Each participant completed 16 predefined tasks. Successful task completion was coded as 1, whereas unsuccessful completion was coded as 0. The participant-level task success rate was expressed as the percentage of successfully completed tasks (McIntosh et al., 2019).

Post-intervention Usability

Usability was assessed after the training and independent task simulations using a 31-item questionnaire rated on a seven-point Likert scale. Because the instrument differed from the standard 10-item, five-point System Usability Scale, the result was reported as a normalized usability composite score rather than a standard SUS score (Moura et al., 2021). The composite score ranged from 0 to 100, with higher scores indicating more favorable usability perceptions.

Participant Feedback

Qualitative feedback was collected through short open-ended questions (LaDonna et al., 2018). Participants were asked to identify the most helpful application features, describe technical or operational difficulties, indicate tasks that remained difficult, provide suggestions for improvement, and state whether they were willing to use SmartOTC in routine pharmacy services. Responses were summarized into common themes.

Data Analysis

Data were analyzed using IBM SPSS Statistics (IBM Corp, 2020).Continuous variables were summarized using means and standard deviations or medians and interquartile ranges, as appropriate. Minimum and maximum values were also reported. Categorical variables were presented as frequencies and percentages. Because the sample size was relatively small and the evaluated outcomes were bounded or ordinal, pretest and post-test scores were compared using the Wilcoxon signed-rank test. Separate analyses were performed for knowledge scores, overall SEQ scores, and participant-level task success rates. The magnitude of pretest–post-test changes was estimated using rank-biserial correlation. Effect sizes were interpreted cautiously, with values of approximately 0.10 considered small, 0.30 considered moderate, and 0.50 or greater considered large. Changes in the success of each individual task were assessed using the exact McNemar test. When multiple task-level comparisons were performed, the Holm adjustment was applied to control for multiple testing. Internal consistency was evaluated using Cronbach's alpha for the SEQ items and the post-intervention usability questionnaire. All statistical tests were two-sided, and a p-value of less than 0.05 was considered statistically significant.

Results & Discussion

To the best of our knowledge, this is the first evaluation of a structured SmartOTC training program for community pharmacy personnel. As presented in Table 1, the intervention

was associated with significant improvements in knowledge, perceived task ease, and task-completion success, with large rank-biserial effect sizes. These findings suggest that the combination of focused education, application demonstration, guided practice, and independent simulation produced meaningful changes within the participating group. Participant feedback further supported the practical value of SmartOTC for structured patient assessment, treatment recommendations, and referral decisions. The findings also emphasize that successful implementation of a digital clinical decision-support tool depends not only on its technical functions but also on the quality of user orientation and practical training.

The SmartOTC community service program involved 23 representatives from partner community pharmacies, all of whom completed the pretest, educational session, application demonstration, guided practice, independent task simulation, and post-test. The training introduced the principal functions of SmartOTC and allowed participants to apply the application to simulated common cold cases. The structured training and evaluation required approximately 15–30 minutes per participant. Each participant completed seven assessments of perceived task ease and 16 predefined operational tasks. The complete participation rate indicates that this brief training format was feasible within the community pharmacy setting, where pharmacists often have limited time for conventional training activities.

Table 1. Pretest–post-test outcomes following SmartOTC training

Outcome	Pretest mean ± SD	Post-test mean ± SD	Mean Change (95% CI)
Knowledge Score (0-100)	58.91 ± 4.99	79.78 ± 10.82	20.87 (16.32–25.42)
SEQ overall (1–7)	4.98 ± 0.50	5.98 ± 0.50	1.00 (0.80–1.20)
Task success (%)	61.41 ± 11.41	94.57 ± 6.87	33.15 (25.98–40.32)

Note: P value <0.001; rank biserial r = 0.99

Participants' mean knowledge score increased from 58.91 ± 4.99 at pretest to 79.78 ± 10.82 at post-test, corresponding to an improvement of 20.87 points (95% CI: 16.32–25.42; $p < 0.001$). Individual changes are presented in **Figure 1**. This improvement may be explained by the integration of theoretical education with direct application to simulated common cold cases. Participants were required to apply symptom assessment, patient-specific considerations, treatment selection, counseling, and referral criteria within a structured clinical workflow rather than learning these concepts in isolation. Case-based practice may therefore have strengthened the connection between clinical knowledge and its practical application in community pharmacy

services (Zekan et al., 2020). Immediate feedback from facilitators may also have corrected misunderstandings and reinforced the rationale behind appropriate recommendations (Hammad et al., 2022). Although causality cannot be established because no comparison group was included, the findings support the use of focused, case-based education when introducing pharmacist-oriented decision-support technologies.

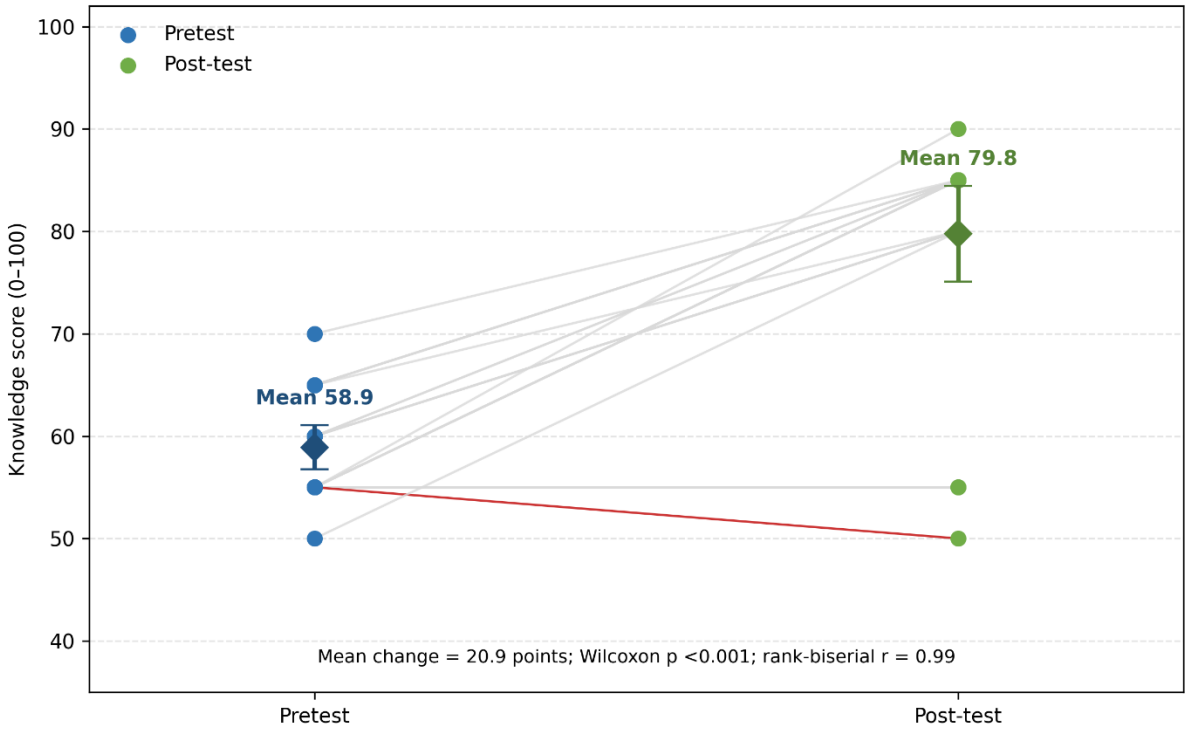


Figure 1. Change in knowledge scores after SmartOTC training

Perceived ease of use also improved following the demonstration and guided practice sessions. The mean overall SEQ score increased from 4.98 ± 0.50 to 5.98 ± 0.50, representing an average improvement of 1.00 point (95% CI: 0.80–1.20; $p < 0.001$). As illustrated in **Figure 2**, most participants reported higher task-ease scores after completing the training and guided practice. The post-test score exceeded the commonly cited SEQ reference value of 5.5, suggesting that participants generally perceived the evaluated tasks as easy to very easy. This improvement likely reflects greater familiarity with the interface, a clearer understanding of the application workflow, and reduced uncertainty when interpreting recommendations (Bogaerts et al., 2024). Guided practice have reduced cognitive burden by helping participants develop a clearer mental model of the steps required to complete each task (DelNero et al., 2025). The internal consistency of the SEQ items increased from a Cronbach's alpha of 0.668 at pretest to 0.919 at post-test,

indicating more consistent ratings after participants became familiar with the application. However, this increase should be interpreted cautiously because Cronbach's alpha may also be influenced by response homogeneity. Similarly, the SEQ value of 5.5 should be regarded as a contextual benchmark rather than a strict threshold for acceptable usability.

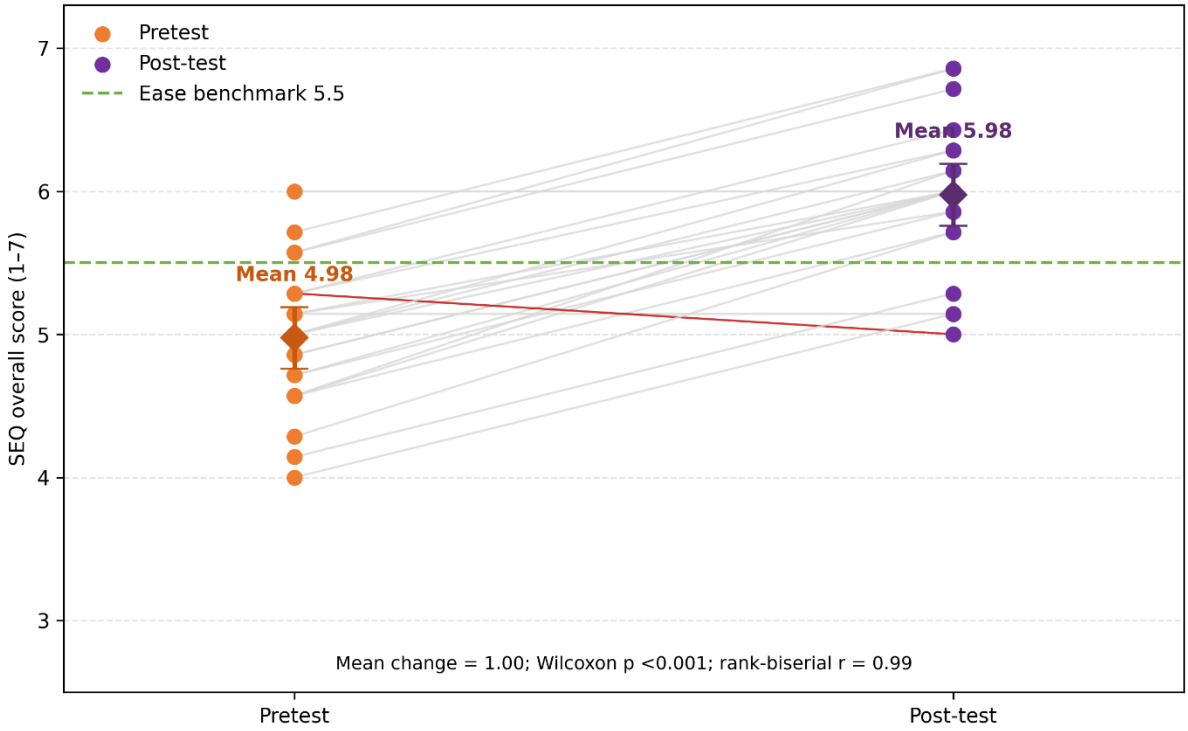


Figure 2. Change in perceived task ease after guided practice

The mean task success rate increased from 61.41 ± 11.41% before training to 94.57 ± 6.87% after training, corresponding to an improvement of 33.15 percentage points (95% CI: 25.98–40.32; $p < 0.001$). Task-level results are presented in **Figure 3**. This objective improvement complements the participants' subjective SEQ ratings. Participants not only reported that SmartOTC became easier to use but also demonstrated greater ability to complete the required operational tasks independently. Repetition, guided correction, application demonstration, and simulated cases have supported procedural learning and reduced navigation errors (Stultz et al., 2023). The consistency between the higher SEQ scores and improved task success strengthens the interpretation that the program enhanced both perceived and demonstrated usability. Task completion was not uniformly perfect (Sigle et al., 2020). Tasks with lower post-test success should be reviewed to determine whether they involve unclear instructions, excessive navigation

steps, ambiguous terminology, or more demanding clinical decisions (Waldock et al., 2025). These tasks should be prioritized in future interface refinement and training materials.

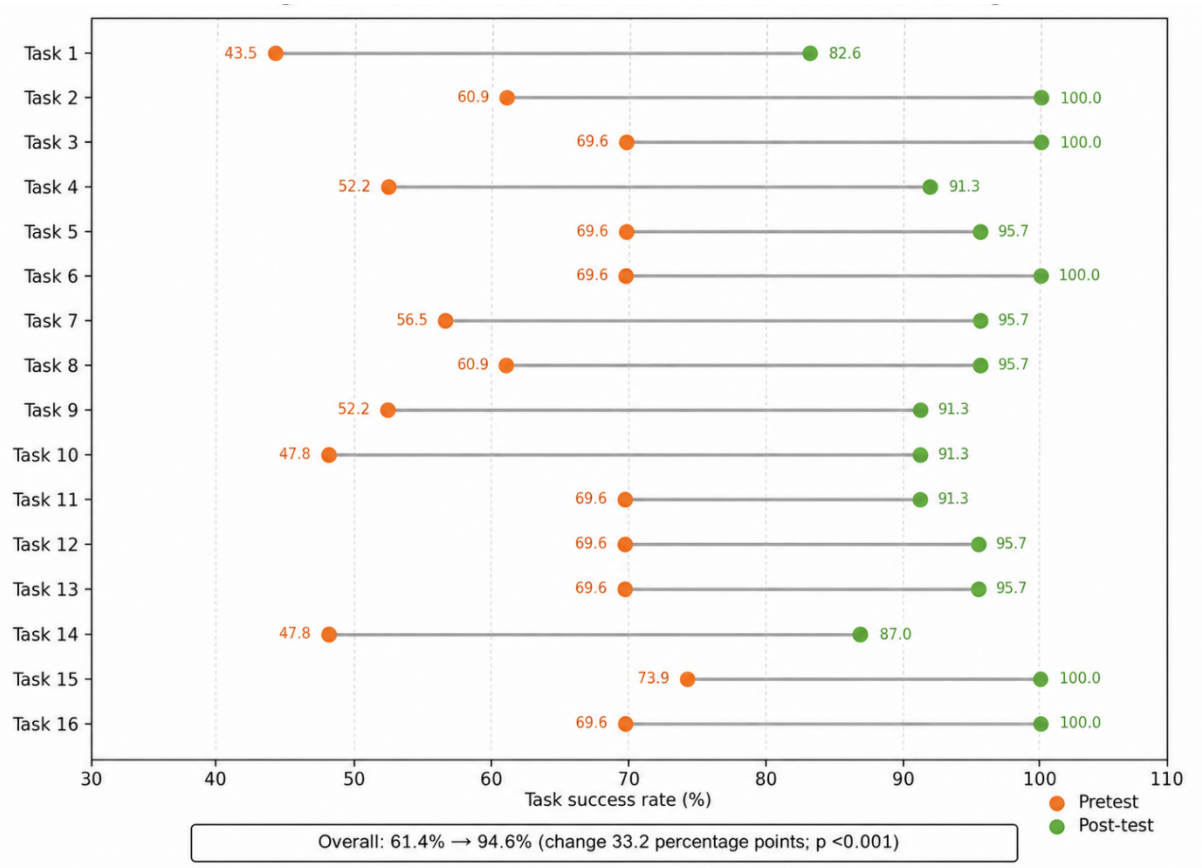


Figure 3. Task-level success before and after SmartOTC training

Participant feedback provided additional context for the quantitative findings. Participants reported that SmartOTC facilitated a more structured assessment of patients presenting with common cold symptoms. The treatment recommendations were generally considered clear and understandable, while the red-flag feature was viewed as particularly useful for identifying patients requiring medical evaluation or referral. These findings indicate that SmartOTC support pharmacists in organizing symptom assessment, patient characteristics, therapeutic recommendations, non-pharmacological advice, and referral criteria within a single workflow. Such standardization may reduce the omission of important information and improve consistency in self-medication services across community pharmacies (Amador-Fernández et al., 2022). The consultation-record function also support continuity, accountability, and documentation (Fynn et al., 2025). SmartOTC should remain a supportive tool rather than a

replacement for professional judgment, as pharmacists remain responsible for interpreting patient information and making final clinical decisions.

Participants also identified several areas for improvement. Requests for a brief user guide or video tutorial suggest that initial training should be reinforced with accessible post-training resources. Suggestions to simplify selected navigation steps provide practical directions for user-centered application refinement. Participants' interest in expanding SmartOTC to other minor illnesses also indicates that the clinical decision-support model may have broader relevance. Future development could include conditions such as cough, allergic rhinitis, fever, dyspepsia, and minor pain, provided that each clinical pathway undergoes appropriate content validation and usability testing.

The program's main strength was the use of complementary outcomes that assessed educational, perceptual, and operational dimensions. Knowledge scores measured learning, SEQ scores captured perceived ease, task success reflected actual performance, and participant feedback provided contextual information regarding application value and improvement needs. The direct involvement of community pharmacy representatives and the use of simulated clinical cases also strengthened the practical relevance of the program. The relatively short duration and complete participation suggest that this model may be incorporated into continuing professional development, pharmacy-network meetings, onsite mentoring, or blended learning activities.

This evaluation has two important limitations. The one-group pretest–post-test design without a control group limits causal interpretation because repeated testing, facilitator assistance, and increased familiarity with the application may also have contributed to the observed improvements. In addition, the program involved only 23 representatives from partner pharmacies, and outcomes were assessed immediately after training. The small, context-specific sample limits generalizability, while the absence of longer-term follow-up prevents conclusions regarding whether the improvements were sustained during routine practice. Future evaluations should include larger and more diverse samples, a comparison group, longer follow-up, and assessment in real patient consultations.

Conclusion

The SmartOTC community service program was feasible to implement and was associated with meaningful improvements in pharmacists' knowledge, perceived ease of use, and ability to complete application-related tasks. The combination of focused education, application

demonstration, guided practice, and case simulation supported participants in using SmartOTC more confidently and systematically for common cold self-medication services. Participant feedback further indicated that the application may assist structured patient assessment, treatment recommendations, and referral decisions. Although the findings should be interpreted cautiously because of the uncontrolled design and small sample, SmartOTC training represents a promising approach to strengthening digital competence and supporting more consistent pharmaceutical care in community pharmacies.

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