Journal of Public Health and Pharmacy
2775-4952 (Online - Elektronik)
Research Articles Open Access

A Quasi-Experimental Study of a Pharmacist-Led Community Educational Intervention on Medication Knowledge and Adherence among Older Adults with Chronic Illness in Surakarta

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ARTICLE INFO

Manuscript Received: 13 Oct, 2025
Revised: 04 Feb, 2026
Accepted: 24 Feb, 2026
Date of publication: 01 Jul, 2026
Volume: 6
Issue: 2
DOI: 10.56338/jphp.v6i2.8841

KEYWORDS

Health Education;
Pharmacists;
Medication Adherence;
Chronic Disease

ABSTRACT

Introduction: Chronic diseases such as diabetes mellitus and hypertension are increasingly prevalent among older adults and require long-term medication use. Despite receiving routine health education in primary care, many patients continue to show gaps in medication knowledge and adherence, which can lead to poor treatment outcomes. Pharmacist-led education has the potential to address these gaps by combining professional guidance with behavioral reinforcement. This study aimed to evaluate the effectiveness of a community-based, interactive educational program in improving medication knowledge and adherence among older adults with chronic diseases.
Methods: A quasi-experimental pretest–post-test design was conducted between June and August 2025 with 201 participants recruited from five primary health centers in Surakarta, Indonesia. Medication knowledge and adherence were assessed using a structured questionnaire administered before and after two pharmacist-led group education sessions. The educational sessions focused on proper medication use, lifestyle management, and strategies to reduce unintentional nonadherence. The questionnaire evaluated multiple domains of knowledge and self-reported adherence behaviors. Differences between pre- and post-intervention scores were analyzed using the Wilcoxon Signed-Rank test, with the level of statistical significance set at $p < 0.05$.
Results: The Wilcoxon Signed-Rank test revealed statistically significant differences between pretest and post-test scores for both medication knowledge and adherence. Knowledge scores increased significantly following the intervention ($Z = -10.624$, $p < 0.05$) indicating improved understanding of medication use and related health behaviors. Adherence scores also showed a significant increase ($Z = -9.767$, $p < 0.05$). The greatest improvements were observed in lifestyle-related knowledge, such as diet and physiscal activity, as well as in behaviors associated with unintentional nonadherence, including forgetting doses or failing to bring medications while traveling. Minimal changes were observed in knowledge regarding diabetes-specific medications, showed minimal change, suggesting adequate baseline familiarity.
Conclusion: The pharmacist-led community educational intervention was associated with statistically significant improvements in medication knowledge and adherence among older adults with chronic diseases. Further research is needed to assess the sustainability of these improvements over longer follow-up periods and across different primary healthcare settings.

Publisher: Pusat Pengembangan Teknologi Informasi dan Jurnal Universitas Muhammadiyah Palu

INTRODUCTION

Indonesia happens to a demographic transition towards an elderly population, characterized by an increasing number of older adults who remain active and support the country's economy (1). Over 70 years in the early 2000s to about 74.15 years in 2024, life expectancy at birth has grown nationally. Around 81,108 older adults were reported from the 2024 profile in Surakarta, highlighting the demographic transition's local scale (2). Moreover, health problems are reported to be experienced by more than half (51.44%), 42.81% experience recurring complaints, and the morbidity rate has reached 20.7%. Meanwhile, treatment has been already given to as many as 50.38% for their conditions (3). One of the main factors affecting medication adherence among older adults is medication knowledge. Insufficient knowledge can lead to reduce therapeutic effectiveness, increase the risk of adverse effects, and lead to medication waste (4). These numbers highlight the importance of treatments that promote self-management behaviors and show an increasing burden of chronic illness in older adults. Therefore, a crucial area for examining in this population can be indicated from medication-taking behavior

Medication adherence is a constant obstacle, especially for older adults who may have complicated regimens or be taking multiple medications. Polypharmacy—the use of multiple medications—has become increasingly common in this population and is strongly associated with reduced adherence, higher rates of treatment failure, and increased hospitalizations (5)(6). The prevalence of medication nonadherence among older adults with chronic diseases is less than 50% (7)(8)(9)(10). Additionally, older adults may have cognitive or physical issues that make it difficult for them to regularly take their prescriptions, which might lower their confidence in following recommended treatments (11). Through these challenges, numerous studies have linked improved adherence-related behaviors to interventions aimed at increasing patients' understanding of their treatment.

It can be investigated from previous studies that have found knowledge, attitudes, and motivation as prominent factors of adherence (12)(13). In addition, several existing programs have focused on improving medication-related behaviors among older adults. An activity conducted by community health initiatives such as CERDIK have been indicated to improve knowledge of chronic disease management, including diet and physical activity. Similarly, digital reminders delivered through WhatsApp or SMS can support short-term adherence by reducing missed doses. However, limitations still appear from both approaches. The impact of knowledge-based programs on long-term adherence is often constrained by low self-efficacy, while digital reminders do not adequately address more complex behavioral barriers, such as beliefs about medication effectiveness or confidence in self-management (3)(14)(15). There is a lack of locally appropriate strategies to encourage long-term medication adherence in Indonesia due to the paucity of evidence on community-based educational interventions given directly to older adults (16).

To cope with these limitations, this study explores a pharmacist-led, community-based intervention as a more comprehensive approach. The intervention integrates structured education, group-based discussion, and behavioral reinforcement to improve medication knowledge, adherence, and self-efficacy among older adults. The approach is consistent with Social Cognitive Theory, which emphasizes that behavior change is shaped by the interaction of personal factors, skills, and environmental support. By addressing multiple components simultaneously, pharmacist-led interventions may offer a more comprehensive approach to supporting medication adherence than interventions that focus on a single component, as suggested in previous literature. Although most existing evidence comes from high-income countries or disease-specific populations, evaluating such interventions in the Indonesian context is essential to develop guidance that is relevant to community-dwelling older adults (16). This study intends to fill this knowledge gap by assessing how well an interactive community-based educational program may improve medication adherence and knowledge among older adults in Surakarta. By delivering structured pharmacy-led education directly to older adults in the community, programs can be tailored to their specific needs, reinforcing both knowledge and adherence in a practical, real-world context. To address this gap, this study aims to evaluate the effectiveness of a community-based interactive educational program in improving knowledge and medication adherence among older adults in Surakarta.

METHOD

A quantitative approach with a quasi-experimental one group pretest-posttest design was applied in this study. Data collecting technique used questionnaires implemented before and after the pharmacy-led educational intervention. Before the intervention, the pretest was conducted and then three weeks after the completion of the

educational sessions the posttest was carried out. The study investigated observed pre-post improvements in medication knowledge and adherence among older adults enrolled in the Prolanis program at community health centers.

Older adults with chronic diseases living in Surakarta were the target population. Purposive sampling was used to determine participants through five primary health centers with high coverage of elderly health services (17). A total of 201 participants were enrolled. Inclusion and exclusion criteria were addressed to find out eligibility. Inclusion criteria were: age 60 years or older, diagnosis of at least one chronic disease requiring long-term medication, residence in the community (not institutionalized), and willingness to participate, as indicated by written informed consent. Exclusion criteria were: cognitive impairment or communication difficulties that interfered with questionnaire completion, and severe acute illness during the study period.

The educational intervention consisted of two structured group sessions delivered by pharmacists. The first session was conducted immediately after baseline data collection, followed by a second session one week later. The sessions addressed basic medication information, appropriate medication use, and practical strategies to support adherence (14). Participants completed the same questionnaires before the intervention and three weeks after the second session to capture short-term changes in knowledge and adherence.

Two instruments were implemented in this study: a knowledge questionnaire on medication use and the Morisky Medication Adherence Scale (MMAS-8). Both instruments underwent rigorous validity and reliability testing prior to implementation to ensure their suitability for use with older adults in a community setting. The knowledge questionnaire was pilot-tested with 30 participants. Item validity was assessed using a 5% significance threshold ($\alpha = 0.05$). Results indicated that all items exceeded the critical value of 0.361, confirming their ability to adequately measure the intended construct. Therefore, no items required revision or removal. Reliability testing was subsequently performed using Cronbach's alpha, which demonstrated acceptable internal consistency ($\alpha > 0.60$), indicating that the instrument produced stable and consistent results across items (18). For medication adherence, the Indonesian version of the MMAS-8 was adopted. Previous psychometric evaluations had demonstrated strong measurement properties, with a Cronbach's alpha coefficient of 0.824 and a test–retest reliability of 0.881 based on Spearman's rank correlation. These findings support the use of MMAS-8 as a robust tool for assessing adherence behaviors in the Indonesian context.

By combining a locally validated knowledge questionnaire with an internationally recognized adherence scale, the study ensured methodological rigor while also maintaining contextual relevance. This process was particularly important given that older adults in community settings may present different levels of health literacy and medication-taking behaviors compared with patients in clinical environments. Data were analyzed using SPSS for identifying participants demographic, level of knowledge, level of compliance and the relationship of pharmaceutical education programs to respondents' knowledge and compliance.

Ethical Approval

This study was reviewed and approved by the Health Research Ethics Committee of Dr. Moewardi General Hospital, Surakarta (No. 1.233/VI/HREC/2025). Each prospective participants was approached with a clear explanation of the study design, its aims, and the expected time commitment. They were also informed of their rights, including the option to decline or withdraw from the study at any time without affecting their access to care or other services. Consent was documented in writing, and strict measures were taken to protect participants' identity and personal data.

RESULTS

Participants Demographics

Around five primary health centers in Surakarta were involved in this study, each representing the facility with the highest coverage of elderly health services within its subdistrict. According to the Surakarta Health Office, the city reported 72,056 older adults in 2024, with an overall elderly health service coverage of 100%. For this study, there was one primary health center with the highest elderly service coverage chosen from each subdistrict: Pajang (6,242), Jayengan (3,813), Sangkrah (6,882), Sibela (6,741), and Gambirsari (7,257). From these sites, a total of 201 older adults enrolled in the Prolanis program participated in the study.

The demographic characteristics of participants was shown in Table 1. The majority were female (n = 173, 86.1%), aged 60–74 years (n = 190, 94.5%), and had completed senior high school (n = 78, 38.8%). These characteristics are consistent with previous evidence showing that women and younger-old adults are more likely to engage in community-based chronic disease management programs due to higher health awareness and better mobility.

Table 1. Demographic characteristics of participants

Characteristics	Description	Frequency	%
Gender	Female	173	86.1
	Male	28	13.9
Age	60-74 years	190	94.53
	75-90 years	11	5.47
Education level	Elementary school	36	17.91
	Middle school	42	20.90
	High school	78	38.81
	University/College	45	22.39

Knowledge of Older Adults on Medication Use and Chronic Disease Management

Table 2. Respondents' Level of Knowledge Regarding Drug Use

Level of Knowledge	Before (%)	After (%)
Good	40.8	73.6
Moderate	33.3	25.9
Low	25.9	0.50
Total	201	100

Table 2 summarizes participants' overall knowledge levels regarding medication use before and after the educational intervention. Prior to the program, 40.8% of participants were classified as having good knowledge, 33.3% as moderate, and 25.9% as low. Three weeks after completing the educational sessions, good knowledge increased to 73.6%, moderate knowledge decreased to 25.9%, and low knowledge declined to 0.5%.

These transformations indicate that the educational program was associated with the most notable improvements in understanding the importance of taking medication for chronic conditions, adopting lifestyle modifications, and making healthier dietary choices. In contrast, knowledge related to certain drug-specific information, such as diabetes medications, showed less change, highlighting persistent gaps that may require additional attention. These findings also reflect improvements in communication skills and health awareness among service providers in primary health care centers, who actively educate patients on risks associated with unhealthy diet, smoking, and a sedentary lifestyle (19).Adequate knowledge is essential for adopting healthy behaviors and supporting adherence to Prolanis guidelines, whereas limited understanding can impede proper self-care (1).

Medication Adherence

Medication adherence was evaluated using the MMAS-8 scale, with overall compliance levels summarized in Table 3. Differences in adherence patterns were observed between the pre- and post-intervention assessments. In particular, a shift was seen among participants who initially reported low compliance, alongside increases in the proportions classified as having moderate and high compliance.

Table 3. Respondents' Level of Compliance Regarding Medication Use

Level of compliance	Before education		After education	
	n	%	n	%
High	43	21.39	77	38.31
Moderate	88	43.78	108	53.73
Low	70	34.83	16	7.96
Total	201	100	201	100

Changes were observed in both unintentional nonadherence, such as forgetting to take medication during daily activities or when traveling, and intentional nonadherence, including skipping doses or discontinuing medication without consulting a physician. Participants also reported fewer difficulties related to the daily burden of medication use and greater consistency in following their prescribed treatment regimens. Taken together, these concurrent changes suggest a temporal association between participation in the educational sessions and more favorable medication-taking behaviors among older adults.

Educational efforts that focus on improving understanding of medication use, including correct dosage and timing, recognition of symptoms of underuse or overuse, and the provision of educational materials, have been widely associated with increased patient awareness and adherence-related behaviors (20). Patient compliance recognized as a key factors in achieving therapeutic goals in chronic disease management, although noncompliance remains a persistent challenge in clinical practice (21). Consistent with this literature, the patterns observed in this study support an associative relationship between educational exposure and adherence behaviors; however, given the one-group pretest–posttest design, these findings should be interpreted cautiously and not as evidence of a causal effect.

Effect of Education on Knowledge and Adherence

Since all variables were not normally distributed ($p < 0.001$), the Wilcoxon signed-rank test was applied. As shown in Table 4, the analysis indicated a statistically significant. The Wilcoxon signed-rank test showed statistically significant differences in both medication knowledge and medication adherence scores before and after the educational program. For medication knowledge, a significant change was observed ($Z = -6.12$, $p < 0.001$), with a moderate effect size ($r = 0.43$), indicating a meaningful magnitude of change. Medication adherence also showed a statistically significant difference ($Z = -5.38$, $p < 0.001$), with a small-to-moderate effect size ($r = 0.38$), suggesting a modest but relevant improvement in adherence-related behaviors observed over the study period

Table 4. Wilcoxon signed-rank test results for knowledge and adherence

Variable	Z	p-value	Effect size (r)
Knowledge	-10.624	< 0.001	0.43
Adherence	-9.767	< 0.001	0.38

DISCUSSION

This study showed explored changes in older adults' knowledge and medication adherence following participation in a pharmacist-led educational program conducted in the community. The findings suggest that participants had a relatively adequate foundation in basic knowledge about chronic disease medication, which was likely shaped by routine health education at primary healthcare services. However, observable gaps remained in lifestyle-related aspects of medication adherence. Participants who participated in repeated educational sessions demonstrated observable improvements in lifestyle behaviors and reductions in unintentional non-adherence, such as forgetting doses or not bringing medication when traveling. In contrast, knowledge about diabetes-specific medications showed minimal change, suggesting that participants' baseline understanding in this domain was already adequate. Nevertheless, persistent adherence challenges indicate the presence of gaps where practical barriers to adherence had not been fully addressed.

The group-based and repeated format of the educational sessions may have supported changes in knowledge and adherence-related behaviors. During the sessions, pharmacists encouraged discussions among participants, allowing them to share experiences and feelings. From the perspective of Social Cognitive Theory, behavior change in older adults regarding medication use occurs when personal factors, such as knowledge and self-efficacy, interact positively with the environment. In this study, observable changes appeared more evident in contexted where pharmacists' guidance was combined with peer interaction. These patterns were primarily reflected in lifestyle-related knowledge and practical adherence behaviors, suggesting that peer engagement may have facilitated participation and normalization of shared challenges. Peer interaction may have facilitated engagement and normalization of shared challenges.

In this study, the educational program was delivered by gathering all older adults in one location, rather than providing one-on-one counseling, and repeated sessions were conducted within a short interval. Repeated educational

exposure may have contributed to improvements in knowledge related to lifestyle and adherence. Through repeated education, pharmacists can reinforce key messages, allowing participants to ask questions when they face difficulties in applying the information. The involvement of peer participants also contributes to educating others. While pharmacists played a central facilitative role, involving peers provides real experiences that help participants gain a better understanding in solving problems, particularly those related to medication adherence. This finding is consistent with previous studies showing that providing information alone is not sufficient, especially regarding issues such as polypharmacy, forgetfulness in taking medication, or other adherence barriers among older adults. This observation is consistent with previous studies reporting associations between pharmacist-led education and improved adherence-related behaviors (22).

Therefore, these findings highlight the potential role of the pharmacist's role in the community. Several studies in Indonesia have also mentioned that older adults have very limited knowledge about the medications they take, and their adherence is also low. This is not only influenced by factors such as age, education, sex, or occupation but also by the duration of illness. The present findings aligned with existing evidence, suggesting that although older adults already possess good basic knowledge, behavioral gaps remain that require reinforcement through repeated education. These gaps are not only related to cognitive ability but also psychological aspects. Previous research has shown that feelings of worry and frustration affect nonadherence among stroke patients (23). This condition has also been observed in patients with diabetes or hypertension. They feel frustration over strict dietary changes and fatigue from lifelong medication use and decrease their motivation. These observations suggest the relevance of educational approaches that address psychological and experiential aspects, such as peer-supported education. Healthcare professionals should adopt innovative strategies to ensure consistent follow-up and make educational sessions more interactive, engaging, and responsive to patients' needs (24).

Evidence from other contexts also supports these conclusions. In Indonesian primary care, patients were found to hold basic medication knowledge but still struggled with lifestyle modification and practical adherence behaviors. based on previous research found that only one-third of community pharmacy clients in Spain achieved adequate medication literacy, with age and education emerging as significant predictors (25). These findings are consistent with reports that community-level education is associated with improvements in medication-related knowledge and behaviors. From the Social Cognitive Theory perspective, this reflects the role of personal factors (such as medication literacy) and environmental support (through professional guidance) in shaping behavioral change.

Interpretation of Key Findings

Our findings showed that pharmacist-led education helped strengthen older adults' understanding and habits in taking their medications. Rather than in technical drug knowledge, the most notable improvements were seen in daily practices such as remembering medication schedules, bringing medicines when traveling, and making lifestyle changes. This suggests that group-based and repeated learning sessions play a significant role in how education is received, not only because of the pharmacist's role but also through peer interaction. Sharing experiences made the information easier to absorb, supported by a sense of mutual understanding among participants.

Comparison with Previous Studies

Previous studies conducted in high-income countries have shown that pharmacist-led education significantly improves medication adherence (20, 22), but most were limited to clinical or hospital settings. In contrast, the present study extends this approach by incorporating a community-based model of pharmacist-led education. Despite operating with more limited resources, the behavioral changes achieved were comparable. This model shifts the pharmacist's role from merely providing drug information to becoming an active facilitator of behavior change. Unlike the CERDIK program, which mainly focuses on health literacy and general interventions, this program integrates interactive sessions and behavioral reinforcement while also addressing emotional barriers that are often overlooked in conventional health education.

Limitations and Cautions

This study has a several limitations. A one-group pretest–posttest design was used to examine changes in medication knowledge and adherence following a pharmacist-led educational program in a community setting. While

this design is appropriate for capturing short-term changes within routine primary health care practice, the absence of a control or comparison group limits causal interpretation. Observed improvements may also reflect testing effects, maturation, or concurrent educational activities routinely delivered through the Prolanis program at participating health centers.

In addition, outcomes were assessed shortly after completion of the educational sessions. Therefore, the findings reflect short-term changes and should not be interpreted as evidence of sustained improvements in knowledge or long-term medication adherence. All outcomes were measured using self-reported questionnaires, which may be influenced by social desirability and recall bias. Nevertheless, self-reported adherence measures are commonly used in community-based research, and the use of standardized and validated instruments supports the reliability of the observed patterns.

Recommendations for Future Research

Future research could implement longer educational periods with ongoing monitoring to evaluate the effectiveness of group education interventions. In addition, involving the community as agents of change could be considered as another important strategy. The shifting role of pharmacists in primary healthcare, not only as medication experts but also as health educators, can be integrated and serve as a transformative step toward improving older adults' behavioral change.

CONCLUSION

This study found that pharmacist-led education in community settings significantly influence older adults' understanding and adherence. Group-based education with interactive sessions helps address gaps in health education. Active participation of older adults, through sharing their experiences, it gives real-life examples of the challenges they face. These findings address gaps in health education, highlighting the relationship between psychological factors towards knowledge and adherence among older adults. It is also indicate a shift in the role of pharmacists within the community toward strengthening chronic disease management in this population.

AUTHOR'S CONTRIBUTION STATEMENT

RSP was responsible for the conceptualization of the study. The methodology, formal analysis, and software development were carried out jointly by RSP, KK, and AW. Ethical considerations and data collection were managed by RSP, MA, and UN. The investigation was conducted by RSP, KK, and AW, while data curation and validation were undertaken by RSP, RS, KK, and AW. The original draft was prepared by RSP and RS, with subsequent review and editing also completed by RSP and RS. Funding acquisition was the responsibility of RSP. All authors reviewed and approved the final version of the manuscript and agreed to take responsibility for all aspects of the work.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

We used ChatGPT only to assist with translation and to ensure grammatical accuracy in English. All data analysis, interpretation, and the writing of this article were entirely carried out by the authors.

SOURCE OF FUNDING STATEMENTS

This research was funded by the Ministry of Higher Education, Science, and Technology, Directorate General of Research and Development.

ACKNOWLEDGMENTS

The authors would like to express their gratitude to Universitas Sahid Surakarta for providing institutional support for this study. Appreciation is also extended to the Primary Health Care centers in Surakarta for their assistance with participant recruitment and data collection. This study was supported by the Ministry of Higher

Education, Science, and Technology, Directorate General of Research and Development, Republic of Indonesia. The authors are also deeply grateful to all older adults who took part in this research for their valuable time and contributions.

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