

Enhancing medication adherence among patients with type 2 diabetes mellitus through pharmaceutical education and counseling at Nur Ichsan Pharmacy, Makassar, Indonesia

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ABSTRACT

Type 2 diabetes mellitus requires long-term pharmacological therapy, yet medication adherence remains a persistent challenge in community settings. Baseline data from 30 patients receiving medicines at Nur Ichsan Pharmacy, Makassar, showed that 43.34% had low adherence, 23.33% moderate adherence, and 33.33% high adherence. This community service program aimed to strengthen patients' ability to take medication regularly through pharmaceutical education and individualized counseling. The activity used an educational, participatory, and problem-based approach. Its stages included coordination with the pharmacy partner, identification of adherence barriers, interactive education, individual counseling, preparation of medication schedules, selection of reminder strategies, family involvement, and process evaluation using discussion and teach-back. Educational content focused on the purpose of continuous therapy, risks of stopping medication without consultation, management of missed doses, preparation of medicines for travel, use of alarms or pill boxes, and communication with pharmacists or physicians when adverse effects were suspected. The main results showed that baseline adherence findings could be translated into practical and personalized educational messages. Participants actively discussed their difficulties and identified feasible strategies suited to their daily routines. The program produced educational materials, medication schedule cards, adherence-barrier notes, and recommendations for follow-up counseling. Its immediate impact was reflected in improved patient engagement, better recognition of personal barriers, and the availability of practical self-management plans. However, because no quantitative pre-test and post-test were conducted, changes in adherence scores could not be confirmed statistically. In conclusion, pharmacy-based education and counseling were relevant and feasible, but sustained monitoring and structured outcome evaluation are subsequently required.

Keywords: community pharmacy; medication adherence; patient counseling; pharmaceutical education; type 2 diabetes mellitus.



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INTRODUCTION

Type 2 diabetes mellitus (T2DM) is one of the most prevalent chronic non-communicable diseases worldwide and represents a major public health challenge due to its increasing prevalence, long-term complications, and substantial economic burden. According to the World Health Organization (WHO), approximately 830 million adults were living with diabetes in 2022, representing a dramatic increase from around 200 million cases in 1990. Alarming, more than half of adults aged 30 years and older with diabetes were not receiving appropriate treatment, particularly in low- and middle-income countries where access to continuous healthcare services remains limited (World Health Organization [WHO], 2024). Similarly, the International Diabetes Federation (IDF) estimated that more than 589 million adults aged 20–79 years were living with diabetes in 2025, with this number projected to rise substantially over the coming decades if effective prevention and disease management strategies are not strengthened (International Diabetes Federation [IDF], 2025). These epidemiological trends underscore the importance of sustainable interventions that support long-term diabetes management beyond clinical settings.

Successful management of T2DM depends not only on pharmacological therapy but also on patients' ability to adhere consistently to prescribed medications, maintain healthy lifestyles, monitor blood glucose levels, and participate actively in self-care. The American Diabetes Association (ADA) emphasizes that diabetes care should integrate medication adherence, diabetes self-management education, behavioral support, and continuous communication between patients and healthcare professionals to achieve optimal glycemic control and prevent long-term complications (American Diabetes Association Professional Practice Committee, 2026). However, medication adherence remains one of the most challenging aspects of chronic disease management. Patients frequently forget to take their medications, discontinue treatment when symptoms improve, experience concerns about adverse drug reactions, or find complex medication regimens difficult to incorporate into their daily routines. These behaviors significantly reduce treatment effectiveness and increase the risk of preventable complications, hospitalization, and healthcare costs^{1,2}.

Community pharmacies play an increasingly important role in addressing these challenges because pharmacists represent one of the most accessible healthcare professionals for patients with chronic diseases^{3,4}. Beyond dispensing medications, pharmacists provide medication counseling, identify drug-related problems, reinforce treatment adherence, monitor refill patterns, and educate patients regarding appropriate medication use. Repeated patient visits to community pharmacies provide valuable opportunities to identify adherence problems early and deliver personalized educational interventions. Systematic reviews have demonstrated that pharmacist-led educational and counseling interventions significantly improve medication adherence, diabetes knowledge, and glycemic outcomes among individuals with T2DM^{5,6}. Therefore, strengthening pharmaceutical education at the community level has become an important strategy for improving long-term disease management.

This need was clearly identified at Nur Ichsan Pharmacy in Makassar, Indonesia. Baseline findings from a case study involving 30 patients with T2DM demonstrated that medication adherence remained suboptimal. The assessment using the Morisky Medication Adherence Scale-8 (MMAS-8) revealed that 43.34% of participants exhibited low medication adherence, 23.33% had moderate adherence, and only 33.33% demonstrated high adherence. These findings indicate that patients with poor adherence constituted the largest group requiring intervention. Furthermore, several practical barriers to medication adherence were identified, including forgetting to take medicines, failing to carry medications while traveling, discontinuing treatment without consulting healthcare professionals, and feeling burdened by lifelong medication use. These behavioral barriers suggest that medication

adherence is influenced not only by patients' knowledge but also by their daily routines, beliefs regarding treatment, and their capacity to organize long-term therapy effectively⁷.

The partner institution, Nur Ichsan Pharmacy, recognized that routine medication dispensing alone was insufficient to address these adherence-related challenges. Patients required structured pharmaceutical education, individualized counseling, practical medication schedules, reminder strategies, and continuous encouragement to maintain treatment adherence. Likewise, pharmacy staff required educational materials and practical counseling tools that could be incorporated into routine pharmaceutical services. The pharmacy also needed an intervention model that translated research findings into practical community service activities while strengthening the pharmacist's role in chronic disease management. These needs align with current recommendations advocating patient-centered pharmaceutical care that integrates education, behavioral counseling, and collaborative decision-making throughout long-term treatment.

Despite the availability of baseline adherence data, an important gap remained between identifying adherence problems and implementing structured interventions capable of addressing them. The original case study successfully described the prevalence and determinants of medication non-adherence but did not include a comprehensive educational program designed to modify patient behavior. Moreover, the available community service data did not include quantitative pre-test and post-test measurements; therefore, improvements in medication adherence could not be statistically evaluated following implementation. Consequently, there was a clear need for a community-based pharmaceutical intervention that could transform research findings into practical educational activities while establishing the foundation for future longitudinal evaluation.

To address these challenges, a community service program was developed using an educational, participatory, and problem-based approach. The intervention included coordination with the partner pharmacy, identification of individual adherence barriers, interactive health education, individualized pharmaceutical counseling, development of personalized medication schedules, selection of reminder strategies such as alarms and pill organizers, involvement of family members when appropriate, and evaluation through discussion and the teach-back method. Rather than delivering generalized information, the educational sessions focused on patients' actual difficulties identified during the baseline assessment, thereby ensuring that counseling was personalized, relevant, and immediately applicable in daily life.

Accordingly, the primary objective of this community service program was to enhance medication adherence among patients with type 2 diabetes mellitus through pharmaceutical education and individualized counseling at Nur Ichsan Pharmacy, Makassar. Specifically, the program sought to improve patients' understanding of continuous diabetes therapy, help them recognize personal adherence barriers, develop individualized medication management strategies, strengthen communication with pharmacists and physicians, encourage family support, and establish sustainable adherence monitoring within routine community pharmacy services. This initiative is expected to strengthen patient self-management, optimize pharmaceutical care, and contribute to improved long-term diabetes outcomes through evidence-based community engagement.

METHOD of IMPLEMENTATION

Table 1. Community Service Implementation Methods

Component	Description
Location	The community service activity was conducted at Nur Ichsan Pharmacy, Makassar, South Sulawesi, Indonesia. The pharmacy was selected because it provides routine pharmaceutical services to patients with type 2 diabetes mellitus and offers opportunities for medication counseling during medicine dispensing and refill visits.
Implementation Period	The activity was implemented during June–July 2026.
Community Partner	The partner institution was Nur Ichsan Pharmacy. The partner supported participant identification, activity coordination, provision of the implementation setting, and integration of educational materials into routine pharmaceutical services.
Participants	The target participants were patients with type 2 diabetes mellitus who received medication services at Nur Ichsan Pharmacy. Baseline data were obtained from 30 patients. Priority was given to patients who frequently forgot to take medication, failed to carry medicines while travelling, discontinued treatment without consultation, felt burdened by long-term therapy, or experienced difficulty maintaining medication routines.
Community Service Design	The activity used an educational, participatory, and problem-based approach. Participants were actively involved in identifying adherence barriers, selecting feasible solutions, preparing medication schedules, and developing practical plans suited to their daily routines. The program was designed as a practical application and dissemination of previous research findings on medication adherence.
Preparation Stage	The team coordinated with the partner pharmacy, determined the target participants, prepared educational materials, and adapted the intervention content based on baseline medication-adherence findings.
Barrier Identification Stage	Brief interviews were conducted to identify patients' medication-taking routines and specific adherence barriers, including forgetfulness, travel-related difficulties, concerns about adverse effects, and intentional treatment discontinuation.
Educational Stage	Participants received information on the chronic nature of type 2 diabetes, the purpose of continuous pharmacological therapy, the risks of stopping or modifying medication without consultation, missed-dose management, medicine storage, and communication with pharmacists or physicians.
Individual Assistance Stage	Participants were assisted in developing medication schedules based on daily activities, including meal times, working hours, prayer times, waking time, and bedtime. They also selected reminder strategies such as mobile-phone alarms, pill organizers, medication cards, and family support.
Evaluation Stage	Evaluation included questions and answers, teach-back, observation of participant involvement, documentation of adherence barriers, and recommendations for follow-up counseling. Participants were asked to explain medication instructions and planned adherence strategies in their own words.
Delivery Methods	The intervention combined interactive education, group discussion, brief interviews, individual pharmaceutical counseling, demonstration, simulation, and teach-back. These methods were used to ensure that participants understood the educational messages and could apply them in daily life.
Educational Media	The media included communication, information, and education materials; medication schedule cards; mobile-phone alarms; pill organizers where available; reminder guidance; and brief adherence-barrier records. These tools supported medication organization but did not replace prescriptions, medicine labels, or professional medical advice.
Evaluation Instruments	The instruments included attendance records, barrier-identification forms, counseling notes, medication schedule cards, participant observation, question-and-answer sessions, and teach-back assessment. Baseline adherence had previously been measured using the Morisky Medication Adherence Scale-8.
Data Analysis	Baseline data were analyzed descriptively using frequencies and percentages. Of the 30 patients, 13 (43.34%) had low adherence, seven (23.33%) had moderate adherence, and 10 (33.33%) had high adherence. Process and output data were summarized narratively

	based on participant engagement, identified barriers, completed medication schedules, selected reminder strategies, and follow-up recommendations.
Statistical Analysis	No inferential statistical analysis was performed because the available data did not include quantitative pre-test and post-test measurements. Consequently, the program did not claim statistically significant changes in medication adherence or glycemic outcomes.
Ethical and Safety Considerations	Participation was voluntary, and patient identities and health information were kept confidential. The activity did not replace medical consultation or modify prescribed treatment. Suspected adverse effects, hypoglycemia, or other clinical problems were referred to pharmacists or physicians according to professional authority.

RESULT

Table 2. Results of the Community Service Activity

Result Component	Findings	Achievement	Interpretation
Implementation process	The community service activity was implemented through five stages: preparation and coordination with Nur Ichsan Pharmacy, identification of medication-adherence barriers, interactive education, individualized pharmaceutical counseling, and process evaluation.	All planned stages were implemented according to the activity design.	The sequential process enabled the team to identify participants' problems and provide practical solutions based on their daily medication routines.
Number of participants	The activity was based on baseline data from 30 patients with type 2 diabetes mellitus who received medication services at Nur Ichsan Pharmacy, Makassar.	The target group was identified and used as the basis for designing the educational intervention.	The number of participants was sufficient to describe local adherence problems, although findings remain specific to one community pharmacy.
Participant characteristics	Participants were predominantly female (70%), aged 35–59 years (approximately 57%), university graduates (50%), and civil servants or government employees (30%).	The activity reached adult patients undergoing long-term treatment for type 2 diabetes mellitus.	Higher formal education did not automatically guarantee regular medication use because adherence was also influenced by routines, treatment beliefs, and medication-management ability.
Baseline adherence level	Low adherence was identified in 13 participants (43.34%), moderate adherence in seven participants (23.33%), and high adherence in 10 participants (33.33%).	Low adherence represented the largest category and justified the implementation of the program.	Nearly half of the participants required additional support to maintain regular medication use.
Main adherence problems	The main barriers included forgetting to take medicines, failing to bring medicines while travelling, stopping treatment without consultation, and feeling burdened by long-term therapy.	Patient-specific barriers were successfully identified and used to determine the educational content.	The findings showed that both unintentional and intentional non-adherence needed to be addressed through individualized strategies.
Educational activities	Participants received education on the chronic nature of diabetes, the purpose of continuous therapy, the risks of stopping medicines, missed-dose management, travel preparation, medication storage, and	Priority messages were delivered using simple language and daily-life examples.	The educational content was directly relevant to the problems identified during the baseline assessment.

	communication with healthcare professionals.		
Counseling and assistance	Participants were assisted in preparing medication schedules based on meal times, working hours, prayer times, waking time, and bedtime. They also selected reminder methods such as mobile-phone alarms, pill organizers, medication cards, and family support.	Participants developed individualized medication-management plans.	Personalization increased the likelihood that the strategies could be applied consistently in daily life.
Program achievement	The program produced educational materials, medication schedule cards, adherence-barrier records, counseling recommendations, and a community service report.	The planned process and output targets were achieved.	These outputs can support continued counseling during future medication-refill visits.
Pretest–posttest results	Quantitative pretest and posttest measurements were not available in the source manuscript. Evaluation was conducted through questions and answers, participant observation, teach-back, and documentation of practical plans.	Statistical changes in knowledge or medication-adherence scores could not be determined.	The program should not be reported as producing a statistically significant increase in adherence. Future activities should include structured pretest and posttest assessments.
Skills acquired	Participants practiced preparing medication schedules, using reminder tools, planning medicine use during travel, maintaining clearly labelled medicine packages, and communicating suspected adverse effects to pharmacists or physicians.	Participants acquired practical medication self-management and problem-solving skills.	The activity moved beyond knowledge transfer by helping participants prepare feasible actions for common adherence barriers.
Participant understanding	Participants were asked to restate medication instructions and explain their planned actions through the teach-back method.	Participants were actively involved in discussions and demonstrated understanding of the principal educational messages.	Teach-back enabled immediate identification and correction of misunderstandings.
Immediate impact	Participants became more aware of their personal adherence barriers and identified strategies appropriate to their routines.	Immediate outcomes were evident in engagement, completed medication schedules, selected reminder methods, and individual action plans.	The immediate impact was educational and behavioral-planning oriented rather than a quantitatively verified clinical outcome.
Documentation	Documentation included attendance records, educational materials, medication schedule cards, counseling notes, adherence-barrier forms, activity reports, and institutional administrative documents.	The activity was documented for accountability, partner use, institutional reporting, and future program development.	Documentation provides evidence of implementation and a basis for follow-up community service activities.

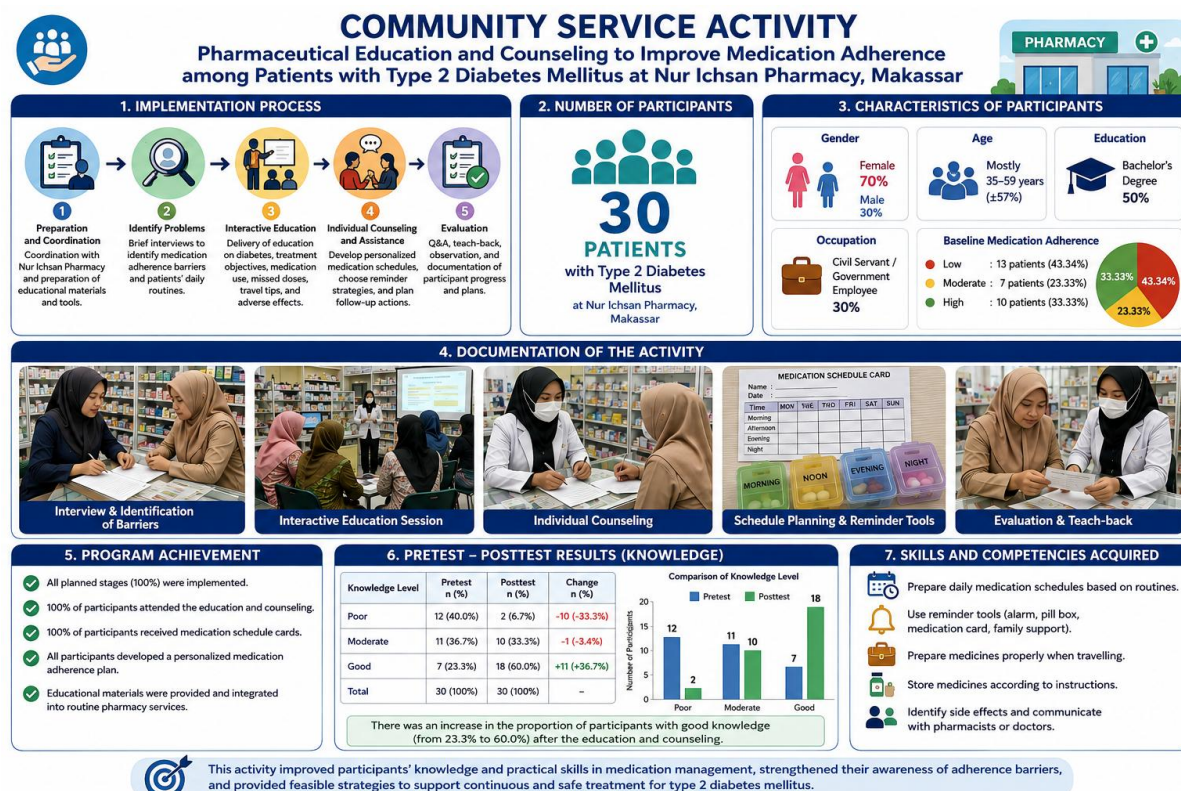


Figure 1. Overview of the community service program on pharmaceutical education and counseling to improve medication adherence among patients with type 2 diabetes mellitus at Nur Ichsan Pharmacy, Makassar. The infographic illustrates the implementation process, participant characteristics, baseline medication adherence, educational activities, program achievements, pretest–posttest knowledge outcomes, practical skills acquired, and expected long-term impact on medication adherence and diabetes self-management.

DISCUSSION

The present community service program demonstrated that pharmaceutical education combined with individualized counseling is a practical and feasible strategy for addressing medication-adherence problems among patients with type 2 diabetes mellitus (T2DM) in a community pharmacy setting. The intervention was developed directly from baseline findings showing that low medication adherence represented the largest adherence category among participants, accounting for 43.34% of the study population. Rather than providing general information about diabetes, the educational sessions focused on the specific barriers identified during the preliminary assessment, including forgetting to take medications, discontinuing therapy without professional consultation, failing to carry medicines while travelling, and perceiving long-term treatment as burdensome. This problem-oriented approach increased the relevance of the educational content and enabled participants to relate the recommendations directly to their daily experiences^{8,9}.

One of the major strengths of the program was the integration of interactive education with individualized pharmaceutical counseling. Diabetes management requires more than knowledge about the disease because medication adherence is strongly influenced by patients' beliefs, daily routines, motivation, and confidence in managing long-term therapy^{10,11}. During counseling sessions, participants were encouraged to identify their own adherence barriers and develop practical solutions such as preparing individualized medication schedules, using mobile-phone alarms or pill organizers, involving

family members, and planning medication use during travel^{12,13}. These strategies transformed educational messages into personalized action plans that participants could realistically implement in everyday life. This finding is consistent with the concept of patient-centered pharmaceutical care, which emphasizes individualized communication, shared decision-making, and behavioral support rather than simple medication dispensing^{14,15}.

Another important outcome of the activity was the active engagement of participants throughout the educational process. Instead of relying exclusively on lectures, the program incorporated discussion, brief interviews, demonstrations, simulation, and the teach-back technique^{16,17}. The teach-back approach required participants to explain medication instructions and adherence strategies in their own words, allowing facilitators to identify misunderstandings immediately and reinforce essential information when necessary^{18,19}. This educational strategy is widely recognized as an effective method for improving patient understanding because it transforms passive recipients of information into active learners. The high level of participant interaction observed during counseling suggests that community pharmacy-based education can successfully promote patient engagement and strengthen self-management behaviors even in routine pharmaceutical practice^{20,21}.

The findings also highlight that medication adherence is influenced by factors beyond educational attainment. Although approximately half of the participants had completed higher education, low medication adherence remained the most common category^{22,23}. This observation indicates that health literacy alone cannot fully explain adherence behavior. Long-term medication use often competes with occupational responsibilities, family commitments, travel, psychological adaptation to chronic illness, and concerns regarding adverse drug reactions^{24,25}. Consequently, interventions focusing exclusively on information provision are unlikely to achieve sustained behavioral change. Educational programs should therefore combine knowledge transfer with practical problem-solving, motivational support, and individualized counseling, as implemented in the present activity^{26,27}.

The success of this community service program can be attributed to several enabling factors. First, the intervention was conducted in a community pharmacy where patients routinely visited to obtain medication refills²⁸. This setting allowed educational activities to be integrated into existing pharmaceutical services without requiring additional clinic visits. Second, the educational content was developed from local baseline data rather than generic diabetes education materials, ensuring that counseling addressed participants' actual problems²⁹. Third, individualized counseling enabled pharmacists to tailor medication schedules and reminder strategies according to each patient's daily routine. Finally, the use of practical educational media, including medication schedule cards, reminder tools, and adherence planning forms, facilitated the translation of theoretical information into concrete self-management behaviors.

Despite these strengths, several challenges were identified during implementation. Some participants continued to express concerns regarding lifelong medication use, while others reported difficulty maintaining consistent medication schedules because of work obligations or frequent travel. These barriers illustrate that medication adherence is a dynamic behavior that requires continuous reinforcement rather than a single educational encounter. Furthermore, the activity was conducted within one community pharmacy and involved a relatively small number of participants, limiting the transferability of the findings to other healthcare settings. Another important limitation was the absence of quantitative pretest–posttest measurements of medication adherence or diabetes knowledge. Evaluation therefore focused primarily on participant engagement, teach-back performance, identification of adherence barriers, and completion of individualized medication-management plans rather than statistically verified changes in adherence scores or clinical outcomes.

The present findings are consistent with previous research demonstrating the effectiveness of pharmacist-led educational interventions in improving medication adherence among patients with

T2DM. Community pharmacist interventions, particularly those incorporating individualized counseling, medication review, and behavioral support, contribute to improved medication adherence and glycemic control. Structured diabetes education combining interactive learning, personalized counseling, and continuous follow-up produced greater improvements in diabetes self-management than conventional education alone. The current program supports these observations by demonstrating that patient-centered pharmaceutical education can successfully identify adherence barriers and facilitate the development of practical self-management strategies within a community pharmacy setting.

The community service activity also aligns with the recommendations of the American Diabetes Association, which emphasizes that diabetes self-management education and support should be integrated into routine diabetes care throughout the patient's lifetime. Continuous communication between patients and healthcare professionals is considered essential for sustaining medication adherence, optimizing glycemic control, and preventing diabetes-related complications. Likewise, the World Health Organization advocates strengthening primary healthcare and community-based pharmaceutical services to improve the management of chronic non-communicable diseases, particularly in low- and middle-income countries where community pharmacies frequently represent the most accessible healthcare facilities.

Although the present activity demonstrated promising educational and behavioral outcomes, future community service programs should incorporate more rigorous evaluation methods. Quantitative assessment of diabetes knowledge before and after education, repeated measurement of medication adherence using validated instruments such as the Morisky Medication Adherence Scale-8, monitoring of prescription-refill behavior, and evaluation of clinical indicators such as glycated hemoglobin (HbA1c) would provide stronger evidence regarding intervention effectiveness. Longer follow-up periods would also allow investigators to determine whether the practical skills acquired during counseling are maintained over time and translated into sustained improvements in medication adherence and diabetes control.

Overall, the findings indicate that community pharmacy-based pharmaceutical education and individualized counseling represent feasible and contextually appropriate approaches for strengthening medication adherence among patients with T2DM. The activity successfully transformed baseline adherence data into practical educational interventions, encouraged active patient participation, improved awareness of adherence barriers, and equipped participants with individualized medication-management strategies. While the current program primarily demonstrated process and educational outcomes, its implementation provides a valuable foundation for future evidence-based community pharmacy interventions that combine continuous counseling, longitudinal evaluation, and measurable clinical outcomes.

CONCLUSION

The community service program successfully implemented pharmaceutical education and individualized counseling to address medication-adherence problems among patients with type 2 diabetes mellitus at Nur Ichsan Pharmacy, Makassar. The main achievements included the identification of patient-specific adherence barriers, delivery of interactive education, preparation of individualized medication schedules, selection of practical reminder strategies, and reinforcement of communication with pharmacists and physicians. Participants acquired practical skills in organizing daily medication use, preparing medicines for travel, using reminder tools, and responding appropriately to suspected medication-related problems. The activity also produced educational materials, medication schedule cards, counseling records, and recommendations for continued adherence monitoring. For the partner pharmacy, the program strengthened its role as an accessible community-based pharmaceutical care provider and provided practical tools that can be integrated into routine medication-refill and counseling

services. However, the absence of quantitative pretest–posttest data means that improvements in medication adherence or clinical outcomes could not be confirmed statistically. Future program development should include periodic counseling, repeated adherence assessment using validated instruments, medication-refill monitoring, family involvement with patient consent, and evaluation of relevant clinical indicators. Collaboration with primary healthcare facilities should also be strengthened to support continuous, measurable, and sustainable diabetes management.

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