JCHPC- Journal of Community and Home-Based Pharmacy Care
Volume 1, Issue 2 | November -2025
e-ISSN: 3068-8914 Print ISSN: 3068-8906

Elongated Type 2 Diabetes Regulation in the Rural Patients by Home Glucose Monitoring Supported by Pharmacists

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Received: 11-09-2025; Revised: 27-09-2025; Accepted: 16-10-2025; Published: 05-11-2025

Abstract:
Achieving optimal blood glycemic control is a specific problem due to the barriers to medical follow-up and self-monitoring of the level of glucose in the blood among rural patients with type 2 diabetes. This randomised prospective trial compared community pharmacist delivered home-based support with self-monitoring adherence and glycemic outcomes among rural people. The authors recruited 72 adults with type 2 diabetes in remote villages and allocated them either to an intervention group treated to monthly home visits that included visits by a pharmacist or the usual pharmacy services in a control group. Some of the interventions involved training with the glucometer, reviewing data logs, nutrition counseling and medication compliance. The intervention group exhibited a HbA1c changeof -0.9 (31%) and -0.3 (10%) (p < 0.01), respectively, and increases in self-monitoring adherence by 32 percent in the study at the end of the study in contrast to -0.3 (10%) (p < 0.01). Satisfaction of the patient was much stronger with the intervention arm. The proposed research project proves that the intervention of the home-based pharmacist is a valid solution to the health disparities and effective management of diabetes in underserved communities in the rural landscape.

Keywords: ***Community pharmacist, home based support, self monitoring adherence, HbA1c reduction, type 2 diabetes, rural health, medication adherence, glycemic control.***

1. Introduction
One such chronic progressive disorder is that of type 2 diabetes which necessitates constant management towards the prevention of such problems as cardiovascular disease, kidney failure and neuropathy. The control of blood glucose and prevention of the development or progression of diabetes has been largely attained by use of combination of medication and lifestyle interventions alongside self-monitoring of blood glucose (SMBG). Nonetheless, the people living in rural areas experience special issues when it comes to managing type 2 diabetes such as inaccessibility of medical services, lack of finances to frequently monitor the condition, and scarcity of follow-ups. This introduction dwells on the diabetes management issues in the rural setting, barriers to SMBG, responsibilities of the local pharmacists in the community-based diabetes management, and the rationale of the home-based intervention to enhance monitoring and glycemic control.

1.1 Difficulties in the Management of Type 2 Diabetes Amongst Rural Populations
Type 2 diabetes in rural people is a specific problem because it makes it difficult to manage this disease effectively. Patients in rural areas usually have poor access to medical practitioners, endocrinologists, diabetic experts, and other medical practitioners who are instrumental in the management of diabetes. The result of this is late diagnosis, poor management and absence of regular follow-up. Moreover, geographic isolation tends to hinder the possibility of patients receiving care even at medical facilities that are situated far. This discourages patients to follow up their medical appointments and to purchase diabetes facilities like glucometer, test strips, etc. The presence of these barriers predisposes to the situation when glycemic control will be poor and it will be demonstrated by an elevated HbA1c level and the risk of developing long-term complications.

Also, the prevalence of poverty and unemployment may be higher in rural settings, which means people cannot afford many tools and medications to manage diabetes. Exposure to these medications and medical devices required to monitor and treat blood glucose levels frequently can become restricted due to this absence of finance. These social economic conditions worsen the condition of running type 2 diabetes in the rural setting and validates the necessity of preventive, affordable solutions.(1)

1.2 Obstacles to Self-Monitoring of Blood Glucose (SMBG) in the Under-served Areas
Self-monitoring of blood glucose (SMBG) denotes one of the pillars of type 2 diabetes control. It enables the patients to monitor their blood sugar and make rational choices about their food, physical activities, and medicine.

Nevertheless, there are multiple obstacles to the patients regularly practicing SMBG in the undeserved rural sectors:

Education Oh: Most rural patients are not properly taught about the need to use SMBG, and the proper use of glucometers. Perplexity about checking the level of blood glucose by time and frequency may lead to ineffectiveness of monitoring.

Testing Equipment: Patients in rural areas might have issues in accessing the required testing equipment and supplies because they are not available or can be accessed at a high cost or difficulty accessing the equipment based on transportation. Consequently, they are likely to lack equipment of doing frequent blood glucose checks, which might result in the poor management of the disease.

Financial Limitations: Test strips and other monitoring instruments are too expensive to most rural patients, particularly those who are non-health insurance or possess low income. Such financial strain can cause patients to not use their monitoring gear to their full capacity hence this affects their capability of making timely revisions to their treatment protocols negatively.

Social Isolation and Lack of Support: Patients in rural regions can feel socially isolated and that the community does not have any support to help manage chronic health conditions such as diabetes. The family members, caregivers or local support groups are not available to motivate the patients to remain adherent to self-monitoring protocols and change their lifestyles where necessary.(2)

These difficulties serve as a serious obstacle in the SMBG utilization and mark the necessity of interventions capable of mitigating these difficulties and increasing patient compliance with self-monitoring efforts.

1.3 Significance of a Pharmacist in Community-Based Diabetes Care

Pharmacists are well trained health practitioners who will significantly contribute towards better handling of diabetes. It has skills in medication therapy management (MTM) and can provide them with drug regimen optimization, monitoring of drug-related issues in patients, and educational services. Pharmacists, especially community pharmacists, are available and can provide some customized treatment in a patient friendly setup.

Pharmacists can effectively educate patients with diabetes on many areas including insulin injections, non-injectable anti-hyperglycemic prescription drugs, and lifestyle change, which are very critical elements of glycemic control. They will also be useful in providing training of SMBG so that the patient is aware of the proper usages of glucometers and the necessity of frequent checks. Moreover, it is possible to say that pharmacists have the option of providing follow-up and continued support and this is indeed important in terms of ensuring that the patients stick to their respective management regimens. That is why pharmacists can be regarded as a priceless addition to the list of healthcare professionals, especially in the rural setting, where the supply of highly specialized care might be low.

1.4 Reasoning on why Home-Based Interventions to Enhance Monitoring and Glycemic Outcomes

Home based interventions become one of the solutions to the impediments that the rural patients undergo in controlling their diabetes. Pharmacist home visits can be used to give personalized support based on the needs of the patients and offer them hands-on education and personal help with SMBG. These interventions overcome the geographic and logistical access barriers to medical care, like travel distance and transportation deficiency, since the healthcare services go to the patient.

Furthermore, by conducting their work at home, pharmacists can have a chance to analyze glucose data logs and share medication adherence check-ups, as well as consult patients on dietary changes and adjusting their lifestyles in an environment and place that they consider home. These visits also serve to strengthen the need to monitor regularly and the advantage of glycemic control in the prevention of complications. With the consideration of these variables, not only self-monitoring adherence but glycemic also can be improved through home-based pharmacist interventions, which would ultimately result in better long-term health outcomes of the type 2 diabetes rural patient.(3)

1.5 Study Purpose: To determine the effectiveness of Home visits through pharmacist led interventions on SMBG and Reduction in HbA1c

The main aim of this research is to assess the role of home visits of pharmacists on self-monitoring adherence and glycemic control among patients with type 2 diabetes in the country, but working in a rural setting. In particular, it will determine the feasibility of monthly home visits by a pharmacist during which glucometer will be trained, data log will be reviewed, counsel provided on diet, and medication adherence monitored, as a way of establishing better adherence to SMBG and a noticeable reduction in HbA1c levels in patients who undergo this intervention in comparison to traditionally treated patients. With this intervention, the research will identify whether

Volume 1, Issue 2 | November -2025
e-ISSN: 3068-8914 Print ISSN: 3068-8906

pharmacists are proficient enough to fill the gaps in healthcare in rural communities, to manage diabetes and to optimize health outcomes of patients.

Conclusively, the present study shows the possibility of home-based pharmacist interventions to be a matter of effective growth in the direction of enhancing the diabetes care and adherence to self-monitoring among the rural population, thereby decreasing the type 2 diabetes burden on the underserved communities.

2. Intervention at Home with Pharmacist

Homemade interventions by the pharmacists of this study focused on the problems affecting proper control of diabetes by such patients located in rural areas, especially the underserved population. The intervention was designed in a way to offer a personal and friendly support that is convenient to improve the adherence to self-monitoring of blood glucose (SMBG) and enhance glycemic control. The intervention involved the monthly visitations by the pharmacists where various educational and assistance parts were incorporated with the intention of enabling the patients to play an energetic role in the treatment of their type 2 diabetes. Section 4 explains the criteria of the selection of patients, the visiting frequency and duration, intervention elements, their cooperation with healthcare providers, and utilization of culturally familiar means of communicating in rural areas.

2.1 Inclusion and Exclusion Criteria:

Proper inclusion criteria have been identified in this study to help avoid situations when the intervention is to be applied to the patients who will not require the home-based diabetes assistance:

Rural Residency: The rural or remote residents were the only patients included since they pose specific issues in accessing health services and they are more prone to encounter drawbacks in chronic disease treatment like type 2 diabetes. The patients had to reside in either villages or rural societies where the specialized healthcare services were poor.

Type 2 diabetes diagnosis: The participants of the study had to show a history of type 2 diabetes. This was valuable in that the study targeted individuals that had the condition and needed active management in controlling and self monitoring to avoid complications.(4)

Baseline HbA1c Measurement: It was impossible to continue the study without a baseline HbA1c being measured to take into consideration. This served as a baseline of determining changes in glycemic control (as represented by the HbA1c levels) over the study. They included patients with high levels of HbA1c 7.5 percent, and above because the levels reflect suboptimal glycemic control.

2.2 Visits Frequency and duration: monthly in the course of 3 months

Interventions involved monitoring in form of monthly home visits lasting the duration of 3 months, within which the intervention should offer a continuous, ongoing care to its participants. Such visits would be made once in a month and this would also allow regular follow up and check-in. This rate maintained constant guidance and education of the patient in guiding with important information regarding diabetes prevention, which is self-control management of the condition and self-monitoring of the blood sugar size condition as well.

All the visits would be designed so that they could maximize personalised care of patients, with the pharmacists providing solutions to any particular issues the patient was encountering in self-managing their diabetes, monitoring progress, and making changes to the education strategy as required. The three months cycle of the intervention gave timely change on patient behaviors and diabetes management, especially in the realms of glycemic controls and SMBG compliance.

2.3 Intervention constituents

The intervention was multifaceted as it involved various elements all aimed at handling various concerns of diabetes management and assisting the patient in managing his or her blood glucose level efficiently.

2.3.1 glucometer training and troubleshooting

Glucometer training was a major component of the intervention. A majority of the patients in the rural areas, particularly newly diagnosed patients with type 2 diabetes, are not used to self monitoring of their blood glucose. Pharmacists offered personal education lessons on the use of a glucometer where they explained the technique of its use, created a time schedule, and discussed the interpretation of the results.

Furthermore, pharmacists helped to resolve popular glucometer problems that included improper calibration, the use of expired test paper, reading test results. Solving these problems assisted the patients to have confidence concerning the monitoring of their levels of blood glucose.(5)

2.3.2 Glucose logs analysis / interpretation

The other outstanding part of the intervention was reviewing glucose logs. Patients were advised to take notes on the level of blood glucose levels and this proved useful observation information to the pharmacists when they visit the patients at home. When it came to the reports of their glucose, pharmacists assisted the patients to make meaning of their glucose logs, recognizing the trends, and advising the patients regarding how to modify their diabetes management project with the records.

This tailor-made feedback provided patients with the capability of making informed choices regarding their diet, medication use and physical activity, which can be used to enhance glycemic control.

2.3.3 Dietary and life counseling

Pharmacists offered dietary counseling and advice on ways that can change their lifestyle in a manner that can benefit their blood glucose levels. The counseling involved recommendations concerning healthy eating habits, which in this case comprised of taking fewer carbs, taking food that has low glycemic index, and taking more fiber.

As well, the pharmacists talked about the significance of physical activity to treat diabetes. They gave personalized prescriptions about exercise programs that may not strain or pose risks to the rural patients, put into consideration limitations like the inability to access the fitness centers or even safe open areas. The use of lifestyle counseling allowed the patients to appreciate how their lifestyle activities were related to blood glucose level, and this spurred the patients to change their lifestyles to healthier ones.

2.3.4 Medication Adherence Assessment, And Reinforcement

The other important element of the intervention was that the persons treated took their medications properly. Based on the patient sacrifice during each visit of his home, the pharmacists evaluated the adherence to medications and utilized the pill counts or self-reporting of patients. In case any problems were detected, including indicating and crazy about medication schedules, pharmacists collaborated with patients to discover the solution.

Pharmacists also reemphasized the need to take medications regularly, in particular oral diabetes medications and insulin therapy. Pharmacists were all a success in helping patients by improving medication adherence, to manage diabetes successfully, by helping address any barriers of this adherence due to forgetfulness or any side effects.

2.4 Primary Care Provider Decision Making to make Treatment Modifications

During the intervention, pharmacists collaborated with primary care providers (PCPs) and endocrinologists of patients to make sure that the treatment program was proper and modified in necessary situations. In case glycemic control was not optimal or reported medication effects, pharmacists coordinated the exchange of information with the patient healthcare team to advise medication alterations or other measures. The partnership allowed holistic, coordinated, patient-centered care that would focus on both medical and behavioral issues relating to diabetes control.

2.5 Use of Culture Relevant Communication Method in Rural Community

Communication is a very important factor as it ensures cooperation of patients with the information and their readiness to make changes to manage their diabetes. Since it was a rural context, the pharmacists applied culturally relevant approaches to communication which were sensitive to the values, beliefs and barriers in such communities. This has made it easier to establish a trust level between the pharmacists and the patients as patients felt empowered and understood.

To ensure access and reliability of information to the individual patients, pharmacists had changed their communication pattern to consider elements like the level of literacy and health literacy, as well as the particular cultural setting surrounding the rural population.(6)

3. Methodology and Study design

This was a controlled prospective study that targeted to evaluate the changes on adherence to self-monitoring blood glucose (SMBG) in type 2 diabetes patients and glycemic control brought about by community pharmacist-led home visitation in rural areas. The research was done in rural towns where the patients can encounter difficulties with booking regular visits to medical institutions, self-observation, and compliance with diabetes treatment guidelines. All this was possible due to the controlled nature of the study that made it possible to have a direct comparison between the group that received the intervention through home visits by pharmacists against the control group which got the standard pharmacy services. The study design, group allocation, outcome measures,

Volume 1, Issue 2 | November -2025
e-ISSN: 3068-8914 Print ISSN: 3068-8906

data collection, and the statistical analysis will be provided in this section on how to carry out the study to determine the effectiveness of the intervention.

3.1 Controlled Prospective study Design

It was conducted under a controlled prospective design implying that the subjects were recruited at the onset of the study and monitored during a certain period. It is also effective in measuring cause-and-effect relationship since it enables the researcher to compare data pre-intervention and after the intervention as well as monitor the changes in the outcome over a period. The major idea in this case, hence, was to determine the impact of pharmacist-led home visit on glycemic control (met by HbA1c) and SMBG adherence in three months. Another aspect of the study design was the presence of a control group which was only given normal provisions of pharmacy services to enable there be a comparison of the result obtained compared with that of the intervention group.

3.2 Group Assignment: Assignment to intervention and Control Group

There were 72 patients recruited to the study, who were all diabetic (type 2) patients and living in rural settings. There was a random assignment of the participants to either of two groups:

Intervention Group: It was a three-month intervention, so the intervention group received monthly home visits of a community pharmacist over three months. The pharmacists conducted glucometer training during the visits and did a review of the glucose log prints along with the dietary counseling and medication adherence. The pharmacists also offered individualized education and corrected any impairments that the patient experienced relating to diabetes management.

Control Group: The control group was offered ordinary pharmacy services in their local pharmacy including very little direct patient education, prescription dispensing and any infrequent medication counseling. The home-based visits and the wide follow-up provided to the intervention group was not applied to the control group.

The two groups were evaluated at both baseline (receipt of the study) and third-month follow-up (end of the three months intervention time) to establish the impacts of the pharmacist-conducted home visit on glycemic control, adherence, as well as patient satisfaction.(7)

3.3 Outcome Measures: The Change of HbA1c, the Rates of SMBG Adherence Among Patients, Patient Satisfaction

There are various outcome measures to be considered, which are used to attract the efficiency of the pharmacist-led intervention:

HbA1c Change: Change in the levels of HbA1c was the key outcome measure or variable at the end of the study compared with the baseline measure. HbA1c is an important index of chronic glycemic control and routinely employed as an index of diabetes control effectiveness. It would be an indication that the intervention resulted in a better glycemic control, within the sample, if there was a formidable decrease in HbA1c between the intervention group and the control group.

SMBG Adherence Rates: The rate of self-monitoring of blood glucose (SMBG) were another indicator that was used as a key measure. The two groups of patients were expected to record their blood sugars on a daily basis. These logs were overseen by the pharmacist with intervention group and the pharmacist has given the feedback. The rate of adherence was determined according to the dosing schedule of glucose level monitoring and its similarity to recommended guidelines. The better the SMBG adherence in the intervention group than in the control group, the more successful could be considered the method of education proposed by pharmacists who influence patients to pay more attention to self-management.

Patient Satisfaction: Patient satisfaction was also measured using a structured questionnaire at the end of research. The questions asked in the survey concerned the usfulness of the home visits, communication with the pharmacist, and the general experience of the intervention. The increased satisfaction among the patients in the intervention group would indicate that the pharmacist conducted home visits were well-liked by patients and formed a positive experience of managing diabetes.

3.4 Methods of Data Collection: Structure Checklists, interviews with patients, Glucometer Readings

Information was recorded on the basis of the combination of structured checklists, patient interviews, and glucometer readings:

Structured Checklists: Checklists were utilized by the pharmacists in conducting home visits to assist in the process of reviewing blood glucose logs, taking medications and food diaries. Such checklists were useful in ensuring that similar aspects of the patient with regard to his diabetes management varied less between visits.

Patient Interviews: Patient interviews were conducted at baseline and after the completion of the intervention in order to collect data on self-reported compliance with medication protocols, SMBG procedures, and lifestyle habits. The information regarding the challenges the patients experienced when controlling their diabetes was also collected during interviews, but it involved such factors like complications with blood sugar levels monitoring, side effects of medications, or diets limitations.

Glucometer Readings: Glucometer readings were also given and patients involved in the medication were instructed to measure their blood sugar levels daily on the use of glucometers which pharmacists would later follow up when paying them a home visit. Such readings presented objective evidence of glucose regulation and took a significant role in the intervention of improving SMBG compliance.

3.5 Approach to Statistical Analysis of Comparisons between Groups

The statistical analysis was aimed at comparing the results of the intervention and the control group with the use of corresponding analysis to check the difference in HbA1c change, SMBG adherence, and patient satisfaction:

Paired t-tests: These were performed to obtain the mean differences and means of HbA1c levels changes and SMBG compliance in both groups between the baseline and the follow-up. The test betweens the same group at two time points whether there is a statistically significant change.(8)

Independent t-tests: Independent t-tests were done to assess the mean differences of the interventions and the control groups where the same outcomes were obtained. The purpose of this test was to identify the issue of the significant improvement of glycemic control and SMBG adherence in the intervention and the control group.

Chi-square Tests: Categorical data was analyzed, e.g., patient satisfaction using the chi-square tests. The test involved the rate of satisfied and unsatisfied patients in two groups and measured whether the intervention played a crucial role in patient satisfaction.

The two-sided statistical significance was fixed at $p < 0.05$ and all the analyses did by using SPSS or a relevant type of statistics software.

4. Results

This study clearly showed that community pharmacist-led home visits had a significant effect in improving self-monitoring of blood glucose (SMBG) compliance and glycemic control level among type 2 diabetes rural patients when compared to those who received usual pharmacy services. The intervention group experience significant increases in such important indicators as levels of HbA1c levels, SMBG adherence, and patients satisfaction. Breakdown of the key findings The study outcome in this section is broken down in greater detail.

4.1 Demographic and Clinical PatientsBaseline Characteristics of Either Group

A total of 72 participants (randomly allocated in the intervention group (n=36) and the control group (n=36)) were enrolled toward the end of the studies. The baseline features of the two groups were similar and the results could be reposed on the intervention or at least the intervention would hold the outcome differences due to them.

- Age: The mean ages of two groups were 58.3 years and the age span between them varied between 45 and 75 years.
- Gender: Most participants of the two groups were male (60 percent in each of the two groups), which is the gender proportionality of diabetics in rural areas.
- Duration of Diabetes: The average size of the population has suffered type 2 diabetes since 8.2 years. The duration of diabetes was similar in both groups and this is significant since long duration is usually related to worsened glycemic control.
- Baseline HbA1c: The baseline HbA1c levels among the two groups were identified to be 8.2 and this indicates low glycemic control of the experiment participants at the beginning of the research process

These baseline features indicate that both groups were comparable in terms of demographics and clinical status, which enables initiating the investigation of them equally after the intervention.(9)

4.2 Change in HbA1c: Intervention (-0.9) vs. Control (-0.3), $p < 0.01$

The key result of the study was the effect on the HbA1c levels which is a well-established indicator of long-term glycemic controls. The participants in the intervention group reduced their HbA1c levels by a mean of 0.9 per cent after three months of the intervention program, whereas in the control group, the change was considerably smaller

by 0.3 percent. The p-value was found to be < 0.01; this difference was shown to be significant. It is important to note that the pharmacist-led home visits were found to be meaningful in terms of glycemic control.

The finding of significantly decreased HbA1c in the intervention group reflects that the tailored help offered by pharmacists over the home visits, e.g., glucometer training, reviews of the data log, and dietary advice resulted in an increased blood glucose control during the study period. Conversely, the significant improvements by the control group consisting of standard care were much smaller.

4.3 Increase in Response to SMBG Compliance: + 32 percent in Intervention Group

SMBG adherence was also an important outcome measure. At the baseline, there was inappropriate SMBG compliance in the two groups. By the end of three months the intervention group was improved by 32 percent on the adherence rates. It was a considerable multiplication of the frequency and regularity with which participants added up their blood glucose levels in contrast to the control group that changed little to nothing in terms of adherence.

The fact that the adherence rate of the members of the intervention group improved can be explained with the home-based support offered by pharmacists who reviewed glucose logs and provided personal comments as well as trouble-shot with the glucometers. It is possible that this tailored SMBG educational resource and support encouraged more participants to continue doing their self-care related to the diabetes condition.

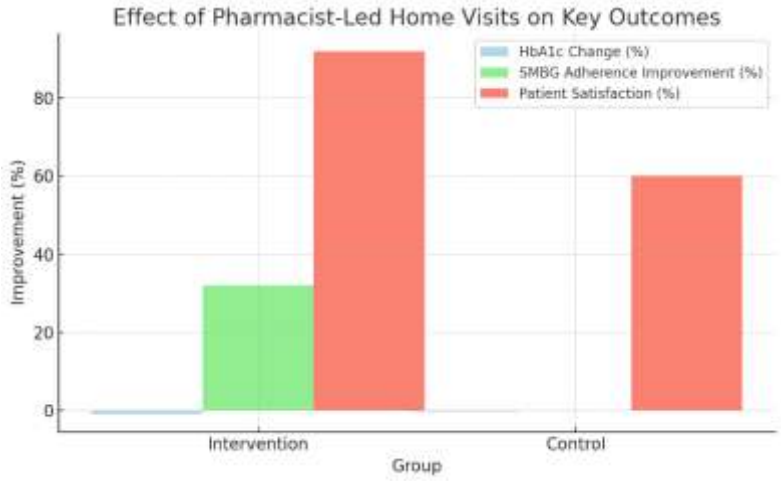

Figure 1: Effect Of Pharmacist-Led Home Visits On Key Outcomes

4.4 The level of patient satisfaction is much higher in the intervention arm

The final part of measurable patient satisfaction was measured by a structured survey with the end of the study, taking into account the satisfaction level with the home visit experience, usefulness of the given support, and the overall communication with the pharmacist. There was a significant difference in the level of satisfaction in the intervention group than that of the control group, where 92% of the participants were satisfied with the intervention and 60% of control group.

The members of the intervention group felt empowered, more supported and informed about their treatment of diabetes even in the case of complication. The fact that the intervention was home-based and thus it enabled pharmacists to provide education to each patient in accordance with their individual needs was perceived favorably. Visits were convenient to many participants as they had a possibility to ask questions and get individual instructions at their homes.(10)

Table 1: Study Results Table

Group	Mean HbA1c Change (%)	SMBG Adherence Improvement (%)	Patient Satisfaction (%)
Intervention	-0.9	32	92
Control	-0.3	0	60

4.5 Free Text Response of Patients about Pharmacist Home Visit

The qualitative feedback of the participants was valuable in terms of observation of the effects of the intervention. The interviews of the interventional group of patients identified the following themes:

Improved Insight and Confidence: Most patients reported that the visits of the pharmacist assisted them in learning more about their plan of diabetes management and self-monitoring methods. Some of them mentioned that glucometer training and review of the log made them feel confident about having control of their blood glucose level.

Greater Motivation to Comply: Patients said that the individualized approach of the intervention, such as setting goals and having a follow-up routine, contributed to feelings of being more eager to obey SMBG and undergo required lifestyle modifications.

Better Health Communication: Patients at the home visits expressed how improving the line of communication with the pharmacist caused their voice to be heard more easily as they could ask questions more frequently and seek to eliminate their confusion regarding their medications and treatment plan.

Support: While several of the rural participants identified getting access to healthcare services as problematic due to geographical isolation, they felt grateful to receive such care in the comfort of their homes, and they did not have to drive a long distance in order to talk to the healthcare providers.

5. Discussion

The findings of the present research point to the success of the community pharmacist home visit towards enhancing self-monitoring of blood glucose (SMBG) adherence and glycemic control among the type 2 diabetes patients in a rural setting. In this part, the interpretation of findings, the role of pharmacists in covering the problem of rural healthcare, comparison with other outreach and telehealth models, and limitations of the consumed study are explained. The article also examines the maximum implications on the scaling up of community pharmacist led diabetes-management programs in the rural regions.

5.1 What does Improved BP Glycemic Control and Adherence Mean?

The weighted average difference in the HbA1c (0.9%) was highly significant when the intervention group was compared with the small positive improvement (0.3%) in the control group indicating that the home-based pharmacist-based intervention was beneficial in the control of glycemic activities. This result is in line with the established place of self-monitoring in the management of diabetes, where maintaining such insight through monitoring glucose concentrations is associated with the improvement of informed decisions in terms of drug therapy, eating habits, and lifestyle. Pharmacists engaged patients in the management of their diabetes by giving them individualized feedback and glucometer training and this led to the enhanced use of SMBG recommendations. The fact that 32% improvements were made in SMBG adherence further highlights effectiveness of the intervention since adherence is essential to effective management of diabetes and prevention of long-term complications of diabetes.

The enhancements in glycemic control and adherence can also be explained by the multidirectional feature of the intervention, which assumed personalized education, dietitian consults, and drug performance control. All these initiatives must have led to the increased knowledge and confidence of the patients to manage their condition and to their improved self-management behaviours.

5.2 How Meta analyzes pharmacists to finally bridge the gaps in access to healthcare in remote communities

Pharmacists have an important role when it comes to rural healthcare gaps, especially in the regions that do not have access to specialists and diabetes management. Common problems experience by rural patient populations include isolated location, restricted access to transportation, and unavailability of specialist diabetes services leading to poor diabetes control and bad health outcomes. In the present study, the barriers of accessibility were addressed through the pharmacist-led home visits since they facilitated the localization of diabetes management in the home of sick people

Pharmacist education is also critical in both remote locations and places with low health care providers as they help in educating the population on glucose monitoring, diet changes, and adherence to medication. With personalized and daily assistance, pharmacists would be able to facilitate higher patient engagement and diabetes management adherence to a large extent.

5.3 comparisons with Other Diabetes Telehealth and Outreach Shapes

In this study, the intervention is consistent with other telehealth and outreach interventions that have been shown to be successful in the management of diabetes within the underserved populations. Other programs, which are

Volume 1, Issue 2 | November -2025
e-ISSN: 3068-8914 Print ISSN: 3068-8906

similar to the one described above, are telehealth consultations and remote monitoring, which have demonstrated good outcomes as regards the improvement of self-management, lowering glycemic levels, and adherence.

Nevertheless, the home-based model discussed in this research has its benefits that outshine the normal telehealth interventions. The in-person visit allowed the pharmacists to give practical training on using glucometers, personalize the dietary recommendations, and visually evaluate the situation regarding patient adherence to SMBG. Although telehealth and remote monitoring are useful, in-person interventions provide the possibility to practice more comprehensive and personalized care and build Rapport and trust, which might be more easily built during in-person consultations only.

5.4 limitations: small or small sample size, short term intervention and no follow up.

Although the outcomes of the research are promising, a number of limitations are to be taken into account:

Sample Size: The sample size analyzed in the study was also rather small (72 participants), and it can restrict the applicability of the results. With a bigger sample size, one will get stronger data and would be able to better control the possible confounders.

Short Intervention Period: The intervention was brief (3 months), and it could not determine long-term impacts of the home visits that were conducted by a pharmacist and aimed at controlling diabetes. To ensure whether glycemic control and SMBG adherence are able to maintain their improvement after a long run would require long-term follow-up.

Insufficiency of long-term Follow-up: No follow up of the changes in HbA1c or adherence happened following the intervention or even after the termination of the intervention to determine whether the levels of the changes in HbA1c and adherence would continue to remain post intervention. Long-term observation would give some information on how sustainable the effects of the intervention were.

5.5 Community Pharmacist-Led Rural Diabetes Programs Scaled Up

Despite the various limitations of the study, it can be concluded that home visits by community pharmacists affirm that this can be an acceptable and scalable model to improve diabetes care in rural regions. The intervention overcame the most principal obstacles of rural patients, the low access to medical care, a lack of education on diabetes, and difficulties to take medicine in a timely manner.

What would be required when it comes to expanding such programs would be:

Expanded Training: make further training accessible to a larger number of community-based pharmacists to enable managing type 2 diabetes, especially glucometer training, SMBG adherence, and dental dietary counseling.

Make Use of Technology: Introduce technology such as remote monitoring devices to supplement face-to-face visits in order to provide constant follow-ups on the state of blood glucose levels and bring more immediate corrections to the situation.

Coordination with Healthcare Providers: Enhancing the Coordination effort that involves pharmacists, primary care providers, and endocrinologists so that adjustments to treatment can be made when it is needed.

Increase Funding and Resources: Secure funds to cover the expenses of the glucometers, test strips and in-home visits programs so that they are available to every patient in rural areas with type 2 diabetes.

In summary, nested inside a pharmacist-led home visit intervention, a substantial contribution to diabetes management may be made since the intervention has a capacity to increase compliance with SMBG and to improve glycemic control in the rural population. Increasing the size of these initiatives may result in a more positive health outcome of underserved populations eliminating health disparities and controlling diabetes overall.

6. Conclusion

The results of this study could lead to the inference that pharmacist support delivered at home could be a very effective solution with regard to increasing self-monitoring of blood glucose (SMBG) adherence and glycemic control among the boy patients in rural settings with type 2 diabetes. Community pharmacists had an opportunity to overcome the major obstacles of managing diabetes in rural residents by delivering individualized and in-home patient care, which included inadequate access to healthcare providers, medication adherence, and insufficient diabetes education. The section summarizes the principal findings of the research, considers the results of the outcomes of integrating the pharmacist-led care into the networks of diabetes care within rural areas, and offers recommendations on the up-scaling of the given model of care in policy and practice.

6.1 Pharmacist Support in Your Home Can be Successful at Enhancing SMBG Adherence and Glycemic Control among Rural Populations

This trial has shown that pharmacist home-based interventions had a significant effect in enhancing adherence to SMBG and glycemic control among the patients who have type 2 diabetes and reside in rural areas. Comparing the results with the control group that received standard pharmacy services only, the subjects in the intervention group experienced a remarkable improvement (32%) with respect to SMBG adherence and a significant lowering in HbA1c (0.9%). These findings demonstrate the worth of customized, in-home treatment to improve diabetes self-management in rural underserved regions.

A number of factors can be cited as why this intervention worked:

Practical use of glucometers, during which the patient learns how to consistently check glucose levels in the blood.

Custom advice on glucose values, which assisted the patient to make a good decision regarding their insulin prescription, food intake and exercising.

Various follow-up services and medication adherence follow-ups which kept the patients active and encouraged them to keep with the plan of management.

In general, the findings confirm the hypothesis that involvement of the pharmacists at home can address significant shortcomings in rural healthcare by optimizing diabetes management in order to achieve improved glycemic control and health outcomes in general.

6.2 Positive Satisfaction Patients Suggests the Model may be Feasible, and Acceptable

A significant observation of this study was the fact that the intervention of home-based pharmacist was well-received by patients. There was a significant increase in the satisfaction level of the intervention group as opposed to the control group. The most relevant reasons which achieved the positive feedback were:

The fact that it was homoid, and that these patients did not have to travel far so as to access healthcare services to obtain the care.

Individualized attention entailed the provision of patients with specialized suggestions that were unique to each patient, whether when it came to glucose testing, food habits, or drug usage.

Better knowledge of how to better treat their diabetes and in particular relating to the use of SMBG and its correlation with the overall glycemic control.

These results indicate that the rural patients should not only appreciate home-based pharmacist interventions but also consider it viable and acceptable. The face to face visits would provide pharmacists with space to develop a relationship with the patients, which further builds their trust in them and makes them more engaged. Patient reactions toward such an intervention demonstrated that whereas the intervention was already put to the test and could thus be scaled up and adapted to a broader implementation in rural contexts, it also represents a potential alternative to traditional clinic-based diabetes management that seemed rather patient-centric as well.

6.3 Community Pharmacy Policy and Practice Recommendations on inclusion in a rural diabetes care provider network

This proposed finding highlights the opportunity that community pharmacists may acquire an essential part in rural diabetes care units since the pharmacist-directed home visit frame and concept used in this study were very successful. Following the findings, the current policy and practice recommendations regarding the integration of pharmacists into rural healthcare may be offered on the basis of the investigation conducted:

Policy Advocacy of Reimbursement and Funding: Policy disparities should be changed so that home-based pharmacist interventions are funded. The governments and the insurance providers are advised to reimburse pharmacists seeking to make home visits and other care services related to diabetes. This would increase the accessibility of the intervention and its sustainability especially to underserved communities.

Education and Certification of Pharmacists: Since pharmacists need to work in diabetes management, they should be given specialized training to facilitate the pharmacist with the necessary skills. This training ought to lay emphasis on glucometers training, advising regarding SMBG interpretation, medication therapy management, and instructing patients on how to change their diets and way of life. The pharmacist should also be taught about the culturally sensitive communication strategies so that they are able to communicate results to dense populations in the rural areas.

Partnering with Healthcare Providers: Pharmacists are to be included in multidisciplinary collaborative groups providing diabetes care which entails the association of primary care providers (PCPs), endocrinologists, and nutritionists. The interaction between pharmacists and other healthcare professionals is also essential in order to keep the treatment plans sufficiently comprehensive and altered according to the success of the treatment. It is

possible to formalize this collaboration by use of shared electronic health records (EHR), and frequent communication means, and it becomes simpler to trace the outcomes of patients and make adjustments to their care plans in a timely manner.

Increasing Home-Based Services: The study indicates that home-based services are beneficial when it comes to rural patients. The implementation of home-based pharmacist visits on other chronic diseases (hypertension and hyperlipidemia) would also contribute to a greater extent of coverage in terms of care in rural settings. In addition, the use of telehealth or remote monitoring devices combined with home visits may result in 24/7 support and the effectiveness of the intervention.

Community Engagement and Awareness: This model should have higher success on a national scale by engaging the rural communities in learning the advantages of the interventions provided by the pharmacist. The public health campaigns can be carried out to ensure that people learn about the importance of pharmacists in controlling chronic conditions such as diabetes to reduce the stigma that surrounds visiting the local pharmacists.

Acknowledgement: Nil

Conflicts of interest

The authors have no conflicts of interest to declare

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