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Ramanuj Swarnkar
Professor, Upchar College of Nursing, Jaipur, Rajasthan, India

Corresponding Author:
Ramanuj Swarnkar
Professor, Upchar College of Nursing, Jaipur, Rajasthan, India

A study to assess the effectiveness of structured teaching programme (STP) on knowledge regarding self-care among the patients with diabetes mellitus in selected rural areas of Jaipur

Ramanuj Swarnkar

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Abstract
Background: DMis a chronic metabolic disorder requiring effective self-care for management and complication prevention. Rural populations often lack adequate knowledge and self-care practices, necessitating educational interventions. To assess the effectiveness of a planned teaching programme (PTP) on improving knowledge and self-care practices among diabetic patients in selected rural areas near Mangalore, India.
Methods: A quasi-experimental, non-equivalent control group pre-test post-test design was used. Thirty diagnosed diabetic patients were purposively sampled, with 15 in the experimental group receiving PTP and 15 in the control group receiving no intervention. Baseline and post-intervention assessments of knowledge and self-care were conducted using structured questionnaires. Data were analyzed using descriptive and inferential statistics including paired and unpaired t-tests and chi-square tests.
Results: Post-intervention, the experimental group showed a significant increase in mean knowledge scores from 33.8 to 93.67 (P<0.001) and self-care practices from 41.67 to 70.53 (P< 0.01). No significant changes were observed in the control group. Improvements were noted across all domains, especially exercise and urine sugar monitoring, though some gaps remained. Education level was significantly associated with knowledge ($\chi^2 = 5.56$, P<0.05), and knowledge was linked to better self-care ($\chi^2 = 4.123$, P<0.05).
Conclusion: The Patient Training Program (PTP) significantly improved diabetes knowledge and self-care practices among rural patients. By empowering individuals with essential skills and information, it supported better disease management. Such structured educational interventions are crucial for underserved communities with limited healthcare access. Integrating these programs into primary care can help reduce diabetes-related complications. This approach is vital to addressing the growing diabetes burden in rural and resource-limited areas.

Keywords: Diabetes mellitus, self-care practices, PTP, rural health, health education intervention

Introduction
Diabetes mellitus (DM) is a group of metabolic disorders characterized by chronic hyperglycemia due to defects in insulin secretion, insulin action, or both. It affects carbohydrate, lipid, and protein metabolism [1]. The two main types are Type 1, caused by autoimmune destruction of pancreatic β-cells, and Type 2, which results from insulin resistance and impaired insulin secretion [2]. Its earliest documentation is found in the Ebers Papyrus of ancient Egypt around 1500 BC [1]. In India, the renowned physician Sushruta identified and described the disease as early as 1000 BC [3].
The International Diabetes Federation (IDF) estimates the number of people with diabetes in India to be 77 million in 2019, projected to rise to 134 million by 2045 [4]. Diabetes is a major global health concern. In 1995, the global prevalence of diabetes in adults was estimated at 4.0%, and it is projected to rise to 5.4% by 2025, with the number of individuals affected expected to increase from 135 million to 300 million. Notably, the majority of this rise is anticipated in developing countries, with India, China, and the United States contributing the largest numbers. By 2025, over 75% of people with diabetes will reside in developing nations, compared to 62% in 1995 [5].

According to a report by the WHO, DM affects approximately 346 million people worldwide, and if effective action is not taken to treat the condition, this number is predicted to double by the year 2030. About 80% of casualties reported due to diabetes occur in middle- and low-income nations [6].

Diabetes is not only widespread but also deadly. Diabetes was the eighth leading cause of death in the United States in 2021 based on the 103,294 death certificates in which diabetes was listed as the underlying cause of death. In 2021, diabetes was mentioned as a cause of death in a total of 399,401 certificates [6].

One major challenge for healthcare providers is meeting the ongoing needs of individuals with chronic conditions like diabetes. Regular follow-up is essential to prevent long-term complications; as strict metabolic control can delay or halt their progression. Beyond glycemic management, diabetic care involves preventing complications, limiting disability, and rehabilitation. Studies in India highlight poor treatment adherence due to negative attitudes and low health literacy. The use of home glucose monitors and HbA1c testing has promoted self-care, shifting greater responsibility onto patients. Research from Scotland emphasizes the vital role of healthcare professionals in helping patients understand blood glucose variations and take appropriate self-care actions [7, 8].

Diabetes is a serious but manageable condition through lifestyle changes, medication, and self-care. Yet, many patients especially in rural or less-educated areas lack the awareness for effective self-management. The seven key self-care behaviors include healthy eating, physical activity, blood sugar monitoring, medication adherence, problem-solving, healthy coping, and risk reduction. These are vital for better glycemic control and quality of life, but long-term adherence remains low. While social and demographic factors influence self-care, clinician support and a comprehensive approach are essential to improve outcomes and prevent complications [8].

The increasing burden of diabetes in India, especially in rural populations, underscores the urgent need for effective interventions that focus on diabetes self-care education. Structured teaching programmes (STPs) can play a vital role in enhancing patient knowledge, promoting behavioral changes, and preventing complications [9, 10].

Genetics contribute to diabetes, but environmental factors also play a crucial role. Active patient participation in self-care significantly impacts disease progression and complication prevention. Effective diabetes management depends on patients and healthcare providers being well-informed. The American Association of Clinical Endocrinologists and WHO stress the importance of patient education and involvement in care. Lack of formal self-management education increases the risk of complications fourfold. While self-management education improves glycemic control initially, ongoing education is needed to maintain benefits [11].

Diabetes education is crucial but must translate into self-care activities like following a diet, avoiding high-fat foods, exercising, self-monitoring blood glucose, and foot care to benefit patients fully. While lowering glycosylated hemoglobin is a key goal, evaluating changes in self-care behaviors is equally important for sustained progress. Self-monitoring of blood glucose is essential for managing diabetes, as it helps assess control and guide timely adjustments in treatment, diet, and exercise. Regular physical activity improves health outcomes in diabetics regardless of weight loss, with major health organizations recommending consistent exercise for all adults, including those with diabetes [12].

As observed during clinical practice, many patients lack basic knowledge about diabetes and its management, which contributes to poor disease outcomes. Therefore, there is a compelling need to implement and evaluate structured educational interventions that aim to empower patients with knowledge and skills required for proper self-care.

This study aimed to assess the effectiveness of a STP on self-care among patients with DM in selected rural areas of Jaipur. By evaluating patients' baseline knowledge, delivering targeted education, and measuring post-intervention outcomes, this study aims to identify whether STPs can bridge the existing knowledge gap and improve self-care practices.

Need for the study

India is currently recognized as the diabetes capital of the world by the WHO, with over 30 million individuals affected by diabetes mellitus a number projected to rise to 57 million by 2025. The burden of diabetes in India is compounded by increased susceptibility, urbanization, sedentary lifestyles, and poor awareness, especially in rural regions. Epidemiological surveys in Karnataka have shown a marked increase in diabetes prevalence, rising from 3-7% to as high as 11% among men in rural areas within a short span. Despite this alarming rise, diabetes management remains inadequate, with most patients showing poor adherence to medication, dietary regulations, exercise, and foot care.

Self-care plays a pivotal role in diabetes management, accounting for 98% of day-to-day care. However, a large number of patients remain uninformed or misinformed about essential practices, leading to serious complications such as nephropathy, neuropathy, ulcers, and cardiovascular diseases. The low literacy rate in rural Karnataka further limits patients' ability to access and apply diabetes-related knowledge effectively. STPs offer a solution by delivering systematic, comprehensible, and contextually relevant education. They empower patients with knowledge and skills needed for better self-care, thereby reducing the healthcare burden and improving quality of life.

Methods

Study design

A quasi-experimental, non-equivalent control group pre-test post-test design was employed to assess the effectiveness of a planned teaching programme (PTP) on self-care among patients with DMin a selected community near Mangalore.

Study setting

The study was conducted in Kulai, a community under Suratkal Primary Health Centre (PHC), located approximately 18 km from Mangalore, India. The sample for the experimental group was drawn from Kuchigudde and Honnakaatte, while the control group was selected from Gokul Nagar and Chitrapura.

Study population

The target population included all patients diagnosed with DMresiding in Kulai. A total of 30 patients fulfilling the

inclusion criteria were purposively sampled; 15 patients constituted the experimental group and 15 patients the control group.

Inclusion and exclusion criteria

Inclusion criteria for the study were patients diagnosed with DM who were currently receiving treatment, present at home during the period of data collection, aged above 11 years, able to understand and speak Kannada or English, and who provided informed consent to participate in the study. Patients who had impaired glucose tolerance but were not diagnosed with diabetes, those with professional qualifications in health, patients who were hospitalized during the data collection period, and those who were unable to respond, unconscious, or terminally ill were excluded from the study.

Study procedure

After obtaining informed written consent, baseline data including demographic and clinical information were collected using a structured interview schedule. Pre-test assessment of knowledge and self-care practices was conducted for both groups. The experimental group received an individualized PTP delivered at their homes using flashcards, a booklet, and demonstrations focused on diabetes self-care. The control group did not receive any intervention. Post-test assessments were conducted on the 8th day after the intervention for both groups using the same structured questionnaire.

Data collection tools

Structured interview schedule comprising three sections: demographic data, clinical information, and knowledge and self-care practices questionnaire (40 items; total score 180). Measurement instruments: weighing scale, measuring tape, blood pressure apparatus, and stethoscope

Data analysis

Data were entered into a master sheet and analyzed using descriptive statistics (mean, standard deviation, frequency, percentage) and inferential statistics (paired and unpaired t-tests, chi-square test) to evaluate the effectiveness of the intervention and associations between variables.

Results

A total of 30 patients diagnosed with DM were selected through purposive sampling based on predefined inclusion criteria. They were equally divided into two groups: Group I (experimental group) and Group II (control group), each consisting of 15 participants. The demographic data revealed that the majority of patients in both Group I (60%) and Group II (53.33%) were in the age group of 41-60 years. Gender distribution was nearly equal in Group I (46.67% male, 53.33% female), while Group II had more male participants (60%). Most of the participants were Hindus (Group I: 86.67%, Group II: 100%) and all were married in both groups.

With respect to educational status, primary education was most common (Group I: 53.33%, Group II: 60%). In terms of monthly income, a significant proportion in both groups earned between ₹2001-₹3000. The majority of participants were unemployed (Group I: 93.33%, Group II: 73.34%).

Clinical characteristics showed that a larger proportion of participants in Group II (80%) had been diagnosed with diabetes for less than 5 years, compared to 60% in Group I. The age of onset of diabetes was predominantly between 41-60 years in both groups. All participants reported receiving information about diabetes from health professionals. Regarding body mass index, 66.67% in both groups had values within the normal range. More than half of the participants in Group I (53.33%) and 46.67% in Group II were taking medications to control blood pressure. Blood sugar levels were above normal for 53.33% in Group I and 33.33% in Group II, while nearly half of Group II (46.67%) were unaware of their blood sugar status.

Urine sugar tests revealed that a majority of patients in Group II (60%) had a blue result, indicating lower sugar levels, compared to 26.67% in Group I. Most participants in both groups reported having additional health problems, primarily hypertension (Group I: 46.67%, Group II: 40%). A notable difference was observed in family history: 73.33% of patients in Group I reported a family history of diabetes, compared to only 13.33% in Group II.

The effectiveness of the PTP was assessed by comparing pre- and post-test knowledge scores in Group I and post-test scores between both groups. In Group I, pre-test knowledge scores ranged from 15 to 60, with the highest frequency (33.33%) observed in the 25-30 range. Following the PTP intervention, post-test scores improved markedly, ranging from 80 to 105, with the highest frequency (33.33%) in the 100-105 range, indicating a substantial gain in knowledge.

A comparison of post-test scores between Group I and Group II further emphasized the effectiveness of the PTP. All participants in Group I scored between 80 and 105, whereas all participants in Group II remained within the 15-50 range. The highest frequency in Group II was seen in the 30-35 range (33.33%), reflecting limited knowledge gain in the absence of intervention.

The findings of the study demonstrate a significant improvement in both knowledge and self-care practices among patients with DM who received the PTP. In Group I (experimental group), the mean pre-test knowledge score was 33.8, which markedly increased to 93.67 in the post-test. This improvement was statistically significant ($t = 22.10$, $P<0.001$), confirming the effectiveness of the PTP in enhancing patient knowledge. In contrast, Group II (control group) showed no change in knowledge scores, with a consistent mean of 30.00 in both pre- and post-tests.

Area-wise analysis in Group I revealed that prior to the intervention, knowledge was highest in the domain of diet (65.45%) and lowest in urine sugar monitoring. Post-intervention, all areas showed substantial improvement, particularly in exercise (increase of 83.92%) and urine sugar monitoring (90.27%). Despite these gains, a small knowledge deficit remained in areas such as urine sugar monitoring (9.73%) and DM basics (9%). When comparing post-test scores between the groups, Group I significantly outperformed Group II across all domains. For example, in the area of exercise, Group I scored 98.92% compared to 9.41% in Group II, and in complications, scores were 94.13% vs. 14.13% respectively. Unpaired t-tests confirmed these differences were statistically significant ($P<0.001$).

In terms of self-care practices, the mean pre-test score in Group I was 41.67, which increased significantly to 70.53 following the PTP ($t = 16.19$, $P<0.001$). No change was observed in Group II, whose mean remained at 41.67. Within Group I, pre-test scores were highest in skin care (72.5%) and diet (65.12%), and lowest in self-testing of

urine sugar. Post-intervention, skin care remained the highest at 99.13%, while exercise scored lowest at 84.33% (Table 1). Notably, self-testing of urine sugar remained unchanged, indicating a persistent gap in this area.

Table 1: Range, mean, median and standard deviation of pre and post-test knowledge score of patients in Group I and Group II.

Knowledge Score	Group	Mean (SD)	Median (Range)
Pre-test	Experimental	33.80 (11.50)	30 (18-60)
	Control	30.00 (8.15)	29 (17-50)
Post-test	Experimental	93.67 (6.21)	94 (84-101)
	Control	30.00 (8.15)	29 (17-50)
Data presented as mean (SD) unless otherwise specified. SD, standard deviation.			

Comparison of post-test self-care practice scores between the two groups showed significantly better outcomes in Group I across all areas except self-testing of urine sugar. The most pronounced differences were noted in foot care (91.77% in Group I vs. 19% in Group II) and skin care (99.13% vs. 68.38%). The overall post-test mean self-care score in Group I was significantly higher than in Group II (70.53 vs. 41.67; t = 14.06, P<0.001).

Improvement in urine sugar monitoring was also observed. In Group I, the proportion of patients with normal urine sugar levels (blue) increased from 26.67% in the pre-test to 53.33% in the post-test. In contrast, no improvement was noted in Group II (Table 2).

Table 2: Range, mean, median and standard deviation of pre and post- test self-care practice of patients in experimental and control group

Knowledge Score	Group	Range	Mean	Median	Standard deviation
Pre-test	Group I	22-56	41.67	41	8.43
	Group II	24-52	41.67	44	6.90
Post-test	Group I	63-75	70.53	72	3.35
	Group II	24-52	41.67	44	6.90
Data presented as n (%).					

Grading analysis further supported these findings. All patients in Group I progressed from very poor, poor, or average levels of knowledge and practice in the pre-test to the "good" category in the post-test. No such improvement was seen in the control group.

Chi-square analysis revealed a significant association between education level and knowledge scores (χ^2 = 5.56, P<0.05), indicating that higher education was linked to better diabetes-related knowledge (Table 3).

Table 3: Comparison of Mean Knowledge and Self-Care Practice Scores (Pre-test and Post-test) in Group I

Variable	Mean (Pre-test)	Mean (Post-test)	Mean Difference	SD	SE (d)	df	't' value	Significance
Knowledge Score	33.80	93.63	59.87	10.49	2.71	14	22.10	(P<0.001)
Self-care Practice Score	41.67	70.53	28.86	6.90	1.78	14		
Data presented as mean (SD) unless otherwise specified. SD, standard deviation.								

However, no significant association was found between self-care practice and demographic variables such as sex, income, duration of illness, or age of onset. Importantly, there was a significant association between pre-test knowledge and self-care practice scores (χ^2 = 4.123, P<0.05), suggesting that greater knowledge is associated with improved self-care behaviors (Table 4). Overall, the results strongly indicate the effectiveness of the PTP in enhancing both knowledge and self-care practices among patients with diabetes mellitus.

Table 4: Comparison of Post-test Knowledge and Self-Care Practice Scores between Group I and Group II

Variable	Group I (N=15) (Mean)	Group II (N=15) (Mean)	Mean Difference	SD	SE (d)	df	't' value	Significance
Knowledge Score (Post-test)	93.67	30.00	63.67	9.93	2.57	28	23.27	(P<0.001)
Self-care Practice Score (Post-test)	70.53	41.67	28.86	8.48	2.19	28		
Data presented as n (%).								

Discussion

The present study provides strong evidence supporting the effectiveness of a PTP in significantly enhancing both knowledge and self-care practices among rural diabetic patients. In the present study, the majority of participants in both Group I (60%) and Group II (53.33%) belonged to the age group of 41-60 years. This finding contrasts with a previous study where the majority of participants were younger adults aged 25-44 years (51%) [13].

In terms of gender, Group I showed an almost equal distribution (46.67% male, 53.33% female), whereas Group II had a higher proportion of males (60%). This pattern differs from earlier reports where females constituted the majority of diabetic patients (64%) [14]. These demographic differences highlight the importance of tailoring educational interventions to the gender and age profiles of specific communities.

The majority of participants were Hindus (Group I: 86.67%, Group II: 100%), which aligns with the regional religious demographics but may also suggest the need for culturally sensitive educational materials. Regarding educational attainment, a substantial number of participants had completed higher education, although another referenced study indicated that only a small percentage had completed graduation [15, 16]. This variability underscores the impact of educational background on diabetes knowledge, as confirmed in this study, where higher education was significantly associated with better knowledge scores (χ^2 = 5.56, P<0.05).

Most participants had been living with diabetes for less than 5 years (Group I: 60%, Group II: 80%), consistent with national trends showing a rising incidence of diabetes. This aligns with epidemiological projections estimating an increase from 19.4 million diabetic individuals in 1995 to 57.2 million by 2025 in India [16]. This recent diagnosis window is critical, as early interventions through PTP may

have a greater long-term impact on disease management.

Additionally, hypertension affects around 70% of diabetic patients twice as common as in non-diabetics highlighting a major comorbidity that significantly increases cardiovascular risk [17]. Conventional hypertension cut-offs may underestimate this risk, especially in younger patients. Age-specific data reveal a progressive increase in hypertension with age, from 24% in those aged 18-29 to 74% in those over 70 [18].

The analysis of pre-session and post-session was tested using student's t-test which revealed statistically very significant increase in all sub-sections of knowledge (P<0.05). Total mean score of knowledge increased from pre-session score 15.80±3.387 to post-session score 28.03±5.817 (P=0.00059).

The findings reveal poor adherence to physical exercise, with only 15.2% of participants following recommended levels indicating a critical gap in diabetes self-care. Interestingly, patients with a shorter duration of diabetes (≤5 years) showed significantly better dietary adherence, being nearly twice as likely to follow dietary recommendations compared to those with longer disease duration [COR = 1.8; P=0.040]. This suggests that motivation or disease fatigue may decline over time, reinforcing the need for continuous education and support.

In terms of knowledge, both Group I and II showed the highest baseline awareness in the area of diet (65.5% and 64%, respectively), reflecting that dietary information is more commonly known or emphasized. However, the low exercise adherence despite better diet knowledge highlights the need for targeted interventions focusing specifically on physical activity behaviors, which are often neglected in routine diabetes education.

In comparison, a study by Toljamo and Hentinen found that while most respondents complied with insulin treatment, 19% neglected other self-care tasks, particularly those requiring routine and lifestyle changes. Their analysis showed that smoking, living alone, and poor glycemic control were significantly associated with self-care neglect (P<0.05). These psychosocial and behavioral factors are crucial considerations in designing sustainable interventions [19].

Pre-test scores in both Group I and II showed the highest knowledge in the area of diet (65.5% and 64%, respectively), which mirrors findings from previous studies, where diet was the most commonly understood aspect of diabetes care [20]. However, this knowledge did not always translate into behavior, as shown by the poor physical activity adherence.

Chi-square analysis in the current study showed significant associations between pre-test knowledge and demographic factors like education, age, and occupation, consistent with previous findings [20]. However, no significant relationship was observed between demographic variables and self-care practices, except for knowledge itself ($\chi^2 = 4.123$, P<0.05). This underscores that knowledge acts as a key driver of behavior change, more so than demographic background.

Conclusion

The present study clearly demonstrates the significant effectiveness of a PTP in enhancing both diabetes-related knowledge and self-care practices among patients with DM residing in rural areas. Participants who underwent the educational intervention exhibited a remarkable increase in knowledge scores, rising from 33.8 to 93.67, alongside substantial improvement in self-care behaviors, with scores increasing from 41.67 to 70.53. These improvements were statistically significant and consistent across critical domains including dietary management, physical activity, foot care, and blood glucose monitoring. In contrast, the control group showed no meaningful changes in either knowledge or self-care, underscoring the impactful role of structured, targeted education in disease management.

Additionally, the study highlights that higher educational attainment is strongly correlated with improved diabetes-related knowledge, reinforcing the importance of tailoring educational interventions to the literacy levels of patients. Importantly, knowledge itself emerged as the most influential factor driving positive self-care behaviors, outweighing demographic factors such as sex and income. Despite the overall gains, some specific self-care areas such as urine sugar monitoring and maintaining regular physical activity remained inadequately addressed, signaling the need for continued education and behavioral reinforcement over time.

In summary, this study affirms that well-structured, community-based educational programs can effectively bridge critical knowledge gaps, foster sustainable behavioral changes, and ultimately improve health outcomes for diabetic patients. Given the rising diabetes burden in India, particularly in rural and underserved communities, integrating such educational interventions into primary healthcare frameworks is essential. This approach promises to enhance patient empowerment, improve disease control, and reduce the risk of long-term diabetes-related complications across vulnerable populations.

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