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Original Article

Knowledge and Practices of Insulin Self-Administration Among Hospitalized Diabetes Patients in Lahore

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ABSTRACT

Background: Insulin therapy is an essential component of diabetes management; however, improper insulin self-administration (ISA) can lead to treatment complications and poor glycemic control. Inadequate patient knowledge and incorrect injection practices remain significant barriers to effective diabetes management, particularly in low-resource healthcare settings. Objective: To assess the knowledge and practices of insulin self-administration among hospitalized patients with diabetes mellitus and identify sociodemographic and clinical factors associated with these outcomes. Methods: A cross-sectional observational study was conducted among 78 hospitalized diabetes patients receiving insulin therapy at CH Rahmat Hospital, Lahore. Data were collected using a structured questionnaire and an observational checklist assessing knowledge and practical insulin injection techniques. Descriptive statistics summarized participant characteristics, while chi-square tests were used to evaluate associations between independent variables and knowledge or practice scores using SPSS version 26, with statistical significance defined as $p<0.05$. Results: Among the participants, 50.0% demonstrated average knowledge, 34.6% poor knowledge, and 15.4% good knowledge of insulin self-administration. Practice assessment revealed that 37.2% had poor practices, 29.5% fair practices, and 33.3% good practices. Age ($p=0.004$), education ($p<0.001$), monthly income ($p=0.019$), duration of diabetes ($p=0.002$), family history ($p<0.001$), and previous ISA training ($p=0.002$) were significantly associated with knowledge levels. Practice scores were significantly associated with age ($p=0.038$), duration of diabetes ($p=0.025$), and family history of diabetes ($p<0.001$). Conclusion: Significant gaps exist in insulin self-administration knowledge and practices among hospitalized diabetes patients, highlighting the need for targeted educational interventions and structured training programs to improve diabetes self-management and reduce insulin-related complications. Keywords: Diabetes mellitus, insulin self-administration, injection technique, patient education, diabetes management.

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INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from impaired insulin secretion, insulin action, or both. The global burden of diabetes has increased substantially over recent decades, posing major challenges to healthcare systems worldwide. According to international epidemiological estimates, more than 530 million adults are currently living with diabetes, and this number is projected to exceed 780 million by 2045, with the majority of cases occurring in low- and middle-income countries (1). Pakistan is among the countries most affected by the rising prevalence of diabetes, ranking among the top ten nations globally in terms of disease burden. Rapid urbanization, sedentary lifestyle patterns, dietary transitions, and limited access to preventive healthcare services have contributed significantly to the increasing incidence of diabetes in the country (2,3).

Insulin therapy remains a cornerstone in the management of both type 1 diabetes and advanced stages of type 2 diabetes. Appropriate insulin administration is essential for maintaining glycemic control, preventing acute metabolic complications, and reducing the long-term risk of microvascular and

macrovascular damage (4). However, insulin therapy requires patients to possess adequate knowledge and skills related to insulin self-administration (ISA), including correct preparation of insulin, appropriate injection technique, rotation of injection sites, safe needle disposal, and adherence to recommended timing of administration. Failure to perform these steps correctly may lead to complications such as hypoglycemia, lipohypertrophy, infection, inconsistent insulin absorption, and poor glycemic control (5).

Previous research has shown that knowledge and practices related to insulin self-administration vary widely among diabetic patients, particularly in resource-limited settings. Several studies conducted in South Asia and Sub-Saharan Africa have reported moderate to poor levels of knowledge regarding insulin injection techniques and diabetes self-management practices (6,7). In Pakistan, studies conducted in tertiary care hospitals have demonstrated that a significant proportion of diabetic patients lack adequate understanding of proper insulin injection procedures, including the correct injection angle, site preparation, and safe disposal of syringes (8,9). Similar findings have been reported in Ethiopia and other low-resource settings, where limited access to structured diabetes education programs contributes to inadequate patient knowledge and suboptimal insulin administration practices (10).

Sociodemographic and clinical characteristics are important determinants influencing diabetes self-management behaviors. Factors such as age, educational level, socioeconomic status, duration of disease, and prior training in insulin administration have been shown to significantly affect patients' ability to perform insulin injections correctly (11). Lower educational attainment and limited health literacy have consistently been associated with poorer understanding of insulin therapy instructions, which may compromise adherence and treatment outcomes (12). Furthermore, patients with longer disease duration or a family history of diabetes may develop better self-management skills through repeated exposure to healthcare education and practical experience (13).

Despite the increasing prevalence of diabetes in Pakistan, there remains limited evidence regarding the level of knowledge and practical competence related to insulin self-administration among hospitalized diabetic patients. Most previous studies in the region have relied primarily on self-reported data, which may be subject to recall bias and may not accurately reflect actual patient practices (9). Direct assessment of insulin injection practices among hospitalized patients provides an opportunity to identify practical skill gaps and to evaluate factors that influence patient competence in insulin self-administration. Understanding these factors is essential for developing targeted educational interventions aimed at improving diabetes self-management and reducing insulin-related complications.

Given the substantial burden of diabetes in Pakistan and the importance of proper insulin administration in achieving effective glycemic control, it is necessary to evaluate both knowledge and practical skills related to insulin self-administration among diabetic patients receiving hospital care. Therefore, the present study aimed to assess the level of knowledge and practices related to insulin self-administration among hospitalized patients with diabetes mellitus at CH Rahmat Hospital, Lahore, and to identify sociodemographic and clinical factors associated with these outcomes.

MATERIALS AND METHODS

A cross-sectional observational study was conducted to assess the knowledge and practices related to insulin self-administration among hospitalized patients with diabetes mellitus. The cross-sectional design was selected because it allows simultaneous assessment of exposure variables and outcome measures within a defined population at a single point in time, making it appropriate for evaluating associations between patient characteristics and self-management behaviors in clinical settings (14).

The study was carried out at CH Rahmat Hospital, Lahore, Pakistan, a tertiary care facility that provides inpatient and outpatient services to a large population of patients with chronic medical conditions, including diabetes mellitus. Data collection was conducted among hospitalized diabetic patients

receiving treatment in medical wards of the hospital. The hospital serves patients from diverse socioeconomic backgrounds across Lahore and surrounding districts, making it a suitable setting for evaluating variations in knowledge and practices related to diabetes self-management.

The study population consisted of adult patients diagnosed with diabetes mellitus who were receiving insulin therapy and were admitted to the hospital during the study period. Eligible participants included male and female patients aged 18 years or older who had been diagnosed with either type 1 or type 2 diabetes mellitus and were capable of self-administering insulin or had previous experience with insulin injections. Patients who were critically ill, unable to communicate effectively, or had cognitive impairment that prevented them from providing informed responses were excluded from the study. Participants were recruited using a consecutive sampling approach in which all eligible patients admitted to the selected wards during the study period were approached for participation until the required sample size was achieved.

The sample size for the study was calculated using a single population proportion formula based on previously reported prevalence estimates of adequate knowledge regarding insulin self-administration among diabetic patients. Assuming a prevalence estimate consistent with prior regional studies, a confidence level of 95%, and a margin of error of 10%, the minimum required sample size was determined to be 78 participants. This sample size was considered sufficient to provide reliable estimates of knowledge and practice levels and to allow exploratory analysis of associations between independent variables and study outcomes.

Data were collected using a structured questionnaire combined with an observational checklist designed to evaluate knowledge and practical skills related to insulin self-administration. The questionnaire included sections assessing sociodemographic characteristics such as age, gender, educational status, occupation, marital status, and monthly income. Clinical information including type of diabetes mellitus, duration of disease, family history of diabetes, and previous training in insulin self-administration was also recorded. The knowledge assessment component consisted of multiple items addressing fundamental aspects of diabetes and insulin therapy, including causes of diabetes, recognition of hyperglycemia and hypoglycemia symptoms, insulin storage practices, timing of insulin administration, appropriate injection sites, and safe disposal of syringes. Each correct response was assigned a score of one, while incorrect responses were scored as zero, allowing calculation of cumulative knowledge scores.

The practices related to insulin self-administration were evaluated through direct observation using a standardized checklist that assessed key steps involved in the injection process. Observed practices included hand hygiene prior to injection, checking insulin expiry date, preparation of insulin, proper mixing of insulin where applicable, drawing insulin into the syringe, site selection, skin preparation, injection technique, counting before needle withdrawal, and safe disposal of syringes and needles. Each practice step was categorized as not performed, partially performed, or correctly performed, and corresponding scores were assigned to quantify overall practice performance.

Operational definitions were established to categorize knowledge and practice levels. Knowledge scores were classified into poor, average, and good categories based on predefined score ranges derived from the total number of knowledge questions. Similarly, practice scores were categorized into poor, fair, and good practice levels according to cumulative scores obtained from the observational checklist. These categorizations enabled comparative analysis of patient performance across different sociodemographic and clinical variables.

Several methodological measures were implemented to reduce potential bias and enhance data reliability. The questionnaire and observational checklist were reviewed by clinical experts for content validity, and data collectors received training regarding standardized procedures for administering questionnaires and observing injection practices. Direct observation of insulin administration helped

minimize reporting bias commonly associated with self-reported practices. Data collection procedures were standardized across participants to ensure consistency in measurements.

Collected data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) software version 26. Descriptive statistics were calculated to summarize participant characteristics, knowledge levels, and practice patterns. Categorical variables were presented as frequencies and percentages. Associations between sociodemographic or clinical variables and knowledge or practice scores were examined using chi-square tests of independence. Statistical significance was determined at a p-value threshold of less than 0.05. Where appropriate, effect sizes and distribution patterns were examined to support interpretation of observed associations.

Ethical approval for the study was obtained from the relevant institutional review authority prior to data collection. All participants were informed about the objectives and procedures of the study, and voluntary informed consent was obtained before participation. Confidentiality and anonymity of participant information were maintained throughout the research process, and all collected data were used solely for academic and research purposes.

RESULTS

A total of 78 hospitalized patients with diabetes mellitus participated in the study, yielding a 100% response rate. The majority of participants were aged above 50 years (69.2%), followed by those aged 31–40 years (19.2%), 20–30 years (7.7%), and 41–50 years (3.8%). The gender distribution was relatively balanced, with 53.8% males and 46.2% females. Regarding educational status, 38.5% of participants had no formal education, 21.8% had primary education, 29.5% had secondary education, and 10.3% had university-level education. Most participants were married (88.5%), while 11.5% were unmarried. In terms of occupation, 41.0% were unemployed, 14.1% were formally employed, 24.4% were self-employed, and 20.5% belonged to other occupational categories. Monthly income data indicated that 59.0% earned ≤20,000 PKR, while 41.0% earned between 21,000–35,000 PKR (Table 1).

Table 1. Sociodemographic Characteristics of Participants (n = 78)

Variable	Frequency (f)	Percentage (%)
Age (years)		
20–30	6	7.7
31–40	15	19.2
41–50	3	3.8
Above 50	54	69.2
Gender		
Male	42	53.8
Female	36	46.2
Educational Status		
No formal education	30	38.5
Primary education	17	21.8
Secondary education	23	29.5
University education	8	10.3
Marital Status		
Married	69	88.5
Unmarried	9	11.5
Occupation		
Unemployed	32	41.0
Formal employed	11	14.1
Self-employed	19	24.4
Others	16	20.5
Monthly Income (PKR)		
≤20,000	46	59.0
21,000–35,000	32	41.0

Clinical characteristics showed that 53.8% of participants had type 1 diabetes, while 46.2% had type 2 diabetes. The duration of diabetes varied, with 35.9% reporting disease duration of 1–5 years, 32.1% reporting 6–10 years, 29.5% reporting more than 10 years, and 2.6% reporting less than one year since diagnosis. A family history of diabetes was reported by 41.0%, while 24.4% reported no family history, and 34.6% were unaware of their family history status. Regarding insulin self-administration training, 48.7% had previously received training, whereas 51.3% had never received formal instruction (Table 2).

Table 2. Clinical Characteristics of Participants (n = 78)

Variable	Frequency (f)	Percentage (%)
Type of Diabetes Mellitus		
Type 1	42	53.8
Type 2	36	46.2
Duration of Diabetes (years)		
<1	2	2.6
1–5	28	35.9
6–10	25	32.1
>10	23	29.5
Family History of Diabetes		
Yes	32	41.0
No	19	24.4
Don't know	27	34.6
Previous ISA Training		
Yes	38	48.7
No	40	51.3

Knowledge assessment of insulin self-administration revealed that 50.0% of participants demonstrated average knowledge, 34.6% exhibited poor knowledge, and 15.4% had good knowledge levels. Most participants correctly recognized diabetes as a disorder affecting blood glucose levels (94.9% correct responses). Knowledge regarding symptoms of hyperglycemia (73.1%) and hypoglycemia (76.9%) was relatively high. However, major deficiencies were observed in practical procedural knowledge. Only 29.5% of participants correctly identified handwashing as the first step of insulin administration, while 86.0% were unaware of the importance of allowing the injection site to air dry after alcohol cleansing. Knowledge about safe disposal of insulin syringes was extremely limited, with only 9.0% providing correct responses, highlighting a critical safety concern (Table 3).

Table 3. Knowledge of Participants Towards Insulin Self-Administration (n = 78)

Knowledge Question	Correct f (%)	Incorrect f (%)
Diabetes is a condition in which blood glucose increases	74 (94.9)	4 (5.1)
Causes of diabetes mellitus	50 (64.1)	28 (35.9)
Normal blood glucose range	40 (51.3)	38 (48.7)
Symptoms of hyperglycemia	57 (73.1)	21 (26.9)
Symptoms of hypoglycemia	60 (76.9)	18 (23.1)
Conditions requiring insulin therapy	64 (82.1)	14 (17.9)
First step in insulin self-administration	23 (29.5)	55 (70.5)
Importance of cleaning injection site	46 (59.0)	32 (41.0)
Allow injection site to dry after alcohol cleaning	11 (14.1)	67 (85.9)
Appropriate injection angle	36 (46.2)	42 (53.8)
Proper insulin storage	61 (78.2)	17 (21.8)
Correct timing of insulin administration	56 (71.8)	22 (28.2)
Recommended injection sites	39 (50.0)	39 (50.0)
Importance of rotating injection sites	42 (53.8)	36 (46.2)
Safe syringe disposal method	7 (9.0)	71 (91.0)

Assessment of insulin self-administration practices demonstrated that 37.2% of participants had poor practices, 29.5% had fair practices, and 33.3% demonstrated good practices. Approximately 50.0% of participants completely performed handwashing prior to injection, while 69.2% selected an appropriate injection site. However, adherence to several critical steps remained suboptimal. Only 42.3% properly cleaned the injection site and allowed it to dry before injection, while 34.6% safely disposed of used syringes and needles.

Table 4. Practices of Participants Towards Insulin Self-Administration (n = 78)

ISA Step	Not Done f (%)	Partially Done f (%)	Completely Done f (%)
Wash hands	19 (24.4)	20 (25.6)	39 (50.0)
Check expiry date/type of insulin	9 (11.5)	36 (46.2)	33 (42.3)
Bring insulin to room temperature	8 (10.3)	30 (38.5)	40 (51.3)
Roll insulin vial	19 (24.4)	30 (38.5)	29 (37.2)
Clean vial top with alcohol swab	27 (34.6)	23 (29.5)	28 (35.9)
Draw air equal to insulin dose	24 (30.8)	25 (32.1)	29 (37.2)
Insert needle at 90° and push air	18 (23.1)	25 (32.1)	35 (44.9)
Draw insulin and remove bubbles	15 (19.2)	26 (33.3)	37 (47.4)
Prepare injection without contamination	15 (19.2)	26 (33.3)	37 (47.4)
Select appropriate injection site	8 (10.3)	16 (20.5)	54 (69.2)
Clean site and allow drying	12 (15.4)	33 (42.3)	33 (42.3)
Inject slowly and release fold	13 (16.7)	25 (32.1)	40 (51.3)
Count before removing needle	13 (16.7)	25 (32.1)	40 (51.3)
Safe syringe disposal	34 (43.6)	17 (21.8)	27 (34.6)

Several participants partially performed essential steps such as checking insulin expiry dates (46.2% partially performed) and preparing insulin vials appropriately (38.5% partially performed) (Table 4).

Analysis of factors associated with knowledge scores demonstrated statistically significant associations with age (χ^2=19.34, p=0.004), educational status (χ^2=32.15, p<0.001), monthly income (χ^2=7.95, p=0.019), duration of diabetes (χ^2=21.01, p=0.002), family history of diabetes (χ^2=27.76, p<0.001), and prior insulin self-administration training (χ^2=12.61, p=0.002). In contrast, gender (p=0.088), marital status (p=0.549), and type of diabetes (p=0.177) were not significantly associated with knowledge scores (Table 5).

Similarly, analysis of factors associated with insulin self-administration practices showed statistically significant associations with age (χ^2=13.31, p=0.038), duration of diabetes (χ^2=14.44, p=0.025), and family history of diabetes (χ^2=21.67, p<0.001). Other variables including gender (p=0.523), education level (p=0.255), occupation (p=0.373), monthly income (p=0.063), and prior insulin training (p=0.069) were not statistically significant predictors of practice scores (Table 6).

DISCUSSION

This study evaluated the knowledge and practical competencies related to insulin self-administration among hospitalized patients with diabetes mellitus in Lahore and explored the sociodemographic and clinical factors associated with these outcomes. The findings demonstrate that although many patients possessed basic conceptual knowledge regarding diabetes, substantial gaps existed in procedural knowledge and practical execution of insulin injection techniques. Approximately half of the participants exhibited only average knowledge, while more than one-third demonstrated poor knowledge levels, highlighting a concerning deficiency in essential diabetes self-management competencies. These findings are consistent with previous investigations conducted in Pakistan and other low- and middle-income countries, which have similarly reported moderate to inadequate levels of insulin administration knowledge among diabetic populations (15,16).

A particularly important finding in this study was the limited understanding of critical procedural steps involved in insulin administration. Only a minority of participants correctly identified hand hygiene as the first step in insulin injection, and an overwhelming majority were unaware of the importance of allowing the injection site to dry after alcohol cleansing. Additionally, knowledge regarding safe syringe disposal was extremely limited. These deficiencies mirror observations reported in studies conducted in Ethiopia and other resource-constrained settings, where inadequate diabetes education and limited access to structured patient counseling programs contribute to poor insulin injection practices (17,18). Failure to adhere to recommended injection techniques can lead to complications such as injection site infections, lipohypertrophy, inconsistent insulin absorption, and increased risk of glycemic instability (19).

The practice assessment further revealed that only one-third of participants demonstrated good insulin self-administration practices. Although certain procedural steps such as injection site selection were correctly performed by a relatively high proportion of participants, several essential steps—including syringe disposal, injection site preparation, and insulin vial preparation—were frequently performed incorrectly or incompletely. Similar patterns of inconsistent adherence to recommended insulin injection techniques have been reported in studies conducted in South Asia and the Middle East, where limited healthcare infrastructure and inadequate patient education contribute to suboptimal self-care practices (20). These findings underscore the need for comprehensive and practical training programs that emphasize correct injection techniques and reinforce safe insulin administration behaviors.

The analysis of associated factors revealed that age was significantly related to both knowledge and practice levels. Older participants demonstrated lower knowledge and poorer practice scores compared with younger participants. This finding may reflect generational differences in health literacy and access to diabetes education resources. Previous studies have also identified advanced age as a predictor of reduced diabetes self-management competence, particularly in populations with lower educational attainment (21). These results highlight the importance of tailoring diabetes education programs to meet the needs of older patients, who may require more individualized training and reinforcement.

Educational attainment emerged as another significant determinant of knowledge levels. Participants with higher levels of education were more likely to demonstrate adequate knowledge regarding insulin administration. Education likely facilitates improved comprehension of medical instructions, enabling patients to better understand complex treatment regimens. Similar associations between education and diabetes knowledge have been documented in several international studies examining diabetes self-care behaviors (22). These findings reinforce the importance of developing educational materials that are accessible to patients with limited literacy, including visual demonstrations and simplified instructions.

Socioeconomic status also influenced knowledge levels, as participants with higher monthly income demonstrated better knowledge regarding insulin administration. Economic constraints may limit access to healthcare services, diabetes education programs, and necessary medical supplies, thereby affecting patients' ability to manage their condition effectively. Previous research has similarly highlighted the role of socioeconomic disparities in shaping diabetes self-management outcomes, particularly in low-resource settings (23).

Another important finding was the association between disease duration and both knowledge and practice scores. Patients with longer disease duration were more likely to demonstrate better understanding and improved practices related to insulin administration. This pattern likely reflects cumulative exposure to healthcare education and repeated experience with insulin therapy over time. Additionally, patients who reported a family history of diabetes exhibited significantly higher knowledge and practice scores. Familial exposure may facilitate informal learning through shared experiences and discussions regarding disease management.

Interestingly, although prior insulin self-administration training was significantly associated with knowledge levels, it was not significantly associated with practice scores. This observation suggests that knowledge alone may not necessarily translate into correct behavioral practices without continuous reinforcement and hands-on training. Previous studies have similarly emphasized the importance of ongoing practical demonstrations and periodic follow-up education sessions to ensure sustained adherence to correct insulin injection techniques (24).

The study possesses several strengths, including direct observation of insulin administration practices, which reduces reliance on self-reported behaviors and improves the accuracy of practice assessment. Additionally, the inclusion of multiple sociodemographic and clinical variables allowed a comprehensive evaluation of factors influencing insulin self-administration competencies. However, several limitations should be acknowledged. The cross-sectional design restricts the ability to infer causal relationships between variables. Furthermore, the study was conducted in a single hospital setting with a relatively modest sample size, which may limit generalizability to other healthcare settings. Future research employing longitudinal designs and larger multicenter samples would provide more robust evidence regarding determinants of insulin self-administration competence.

Overall, the findings highlight the urgent need for structured diabetes education programs focusing on insulin injection techniques, particularly for patients with limited educational backgrounds and older age groups. Healthcare providers should integrate practical training sessions, demonstration-based learning, and culturally appropriate educational materials to improve patient competence in insulin self-administration and reduce the risk of insulin-related complications.

CONCLUSION

The present study demonstrates that hospitalized patients with diabetes mellitus in Lahore exhibit substantial deficiencies in knowledge and practices related to insulin self-administration. Although many patients possess basic awareness of diabetes, critical gaps remain in procedural knowledge and injection techniques, particularly regarding hand hygiene, injection site preparation, and safe syringe disposal. Sociodemographic and clinical factors including age, education level, income, disease duration,

and family history significantly influenced knowledge and practice outcomes. These findings emphasize the need for targeted diabetes education programs and practical training interventions to enhance insulin self-administration competencies and improve overall diabetes management in similar healthcare settings.

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