

Knowledge, Attitude and Practice Regarding Insulin Pen Devices Among Nurses in Tertiary Hospital of Karachi

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ABSTRACT

Objective: To assess the knowledge, attitudes, and practices of insulin pen devices among nurses in a tertiary care hospital.

Methodology: This observational cross-sectional questionnaire-based study was conducted at Dow University of Health Sciences in Karachi. All registered nurses of either gender who consented to participate and had a minimum of one year of experience were included in the study. The knowledge and attitudes of the nurses were assessed on the basis of their personal encounters with patients diagnosed with diabetes mellitus and their use of insulin pen devices.

Results: A total of 246 nurses completed the survey. The majority were aged 30-40 years (n = 138, 56.09%), and most were female (51.2%), single (53.6%), and resided in urban areas (78%). Additionally, 75.6% held a bachelor's degree, and 12.19% were head nurses. Approximately 192 nurses (78%) reported personal connections with diabetes patients, with doctors being the primary information source (48.8%). Approximately 73.2% felt confident in teaching the technical skills required to use insulin pen devices to their colleagues. However, only 29.27% reported using these devices in practice, whereas 71.13% found it easier to measure insulin compared with vials and syringes. Nearly 97.56% believed that insulin pens are convenient for patients to carry while traveling.

Conclusions: The nurses demonstrated good knowledge, attitudes, and practices regarding diabetes mellitus and the use of insulin pen devices among diabetes mellitus patients. Improved nurse knowledge and skills in insulin pen use can reduce errors, enhance patient education, and improve glycemic control. Therefore, identified gaps in attitude and practice highlight the need for structured training to ensure safer insulin use and better diabetes outcomes.

KEYWORDS: Diabetes, Insulin, Nurses, Perception, Survey, Syringes.

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INTRODUCTION

Numerous studies have demonstrated that insulin pen devices are significantly more effective than the

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traditional vial-and-syringe method in achieving optimal glycemic control.¹ These devices also offer notable health benefits for diabetes patients, including fewer hypoglycemic events, fewer emergency visits, and improved medication adherence.² Despite these advantages, there are marked differences in the preference regarding insulin delivery methods across different countries. In some regions, traditional vial and syringe methods are prevalent because of cost and availability issues.³

Nurses play a crucial role in managing diabetes, particularly in tertiary care hospitals. To provide effective care, they must be knowledgeable and follow best practices. A study conducted in Nepal evaluated insulin pen device usage among 67 nurses in a tertiary care hospital and reported that their proficiency was suboptimal. Consequently, nurses strongly advocated for educational programs to improve training on the proper use of these devices.⁴ Research also indicates that nurses generally prefer insulin pen devices over traditional vial-and-syringe methods.⁵ In one study, approximately 83% of nurses expressed interest in using insulin pens.⁶ Additionally, another study revealed that most nurses favour insulin pens for hospitalized diabetes patients because of their ease of use and lower risk of needle-stick injuries.⁷

Nurses play a vital role in managing diabetes mellitus within the community. To ensure effective diabetes management and improve patients' quality of life, they must have the necessary knowledge, skills, and attitudes toward insulin administration. Numerous studies have examined nurses' behaviors regarding insulin pen devices, highlighting gaps in knowledge and suboptimal practices. For example, a survey conducted in March 2017 in Northern Ireland identified deficiencies in nurses' knowledge and practices related to insulin administration.⁸ Furthermore, although patients are generally willing to use insulin pen devices, barriers often arise from physicians and nurses, primarily due to their limited awareness and understanding of the benefits of these devices.⁹ Similarly, nurses lack adequate knowledge regarding diet, foot care, and the complexities of diabetes, largely as a result of insufficient training.¹⁰⁻¹² Many systematic reviews have identified gaps in nurses' knowledge and use of insulin pen devices. They emphasize the need for training to ensure safe practices and improve patients' long-term outcomes.^{13,14}

This study assessed nurses' knowledge, attitudes, and practices regarding insulin pen devices in a tertiary care hospital. It evaluated how many nurses felt comfortable using these devices, highlighting the need for basic training and workshops to ensure safe use. Improved familiarity may enhance patient education and adherence to insulin therapy and reduce needle-stick injuries. The inclusion of insulin pen training in nursing curricula could further prepare nurses before they enter clinical practice.

METHODOLOGY

This observational cross-sectional questionnaire-based study was conducted at Dow University Hospital (DUH), Dow University of Health Sciences (DUHS), in Karachi from February 2022 to January 2023. Registered nurses were recruited via a nonprobability random sampling technique. The study hospital has approximately 1,000 registered nurses. Using the Raosoft calculator with a population size of 1,000, a sample of 278 nurses was determined on the basis of a 95% confidence interval, a 5% margin of error, and a 50% response distribution.

The inclusion criterion was registered nurses of both genders with at least one year of experience who consented to participate. The exclusion criteria were nurses from intensive care, the operating room, and emergency wards, as they typically do not administer insulin subcutaneously via insulin pens, as do those with less than one year of experience or who declined to participate.

Following ethical approval, eligible nurses were enrolled in the study. A predesigned questionnaire was used to collect data (attached as the questionnaire supplementary file). Prior to the main study, the questionnaire was pilot tested among 30 registered nurses who met the eligibility criteria but were not included in the final analysis. Data were collected on age, sex, marital status, education, and years of experience. Knowledge was assessed regarding diabetes management, including signs of hypoglycemia and hyperglycemia. Practice variables included diabetes care, insulin storage, administration site, injection technique, and expiry date. Attitudes were evaluated on the basis of communication about insulin pen devices among colleagues, awareness of new devices, ease of measuring doses, and practicality of carrying insulin pens while traveling.

Statistical analysis: Statistical analysis was performed via Statistical Package for the Social Sciences version 26.0. Descriptive statistics were used to summarize the sociodemographic characteristics of the nurses, as well as their knowledge, attitudes, and practices regarding insulin pen devices. The knowledge scores were categorized as insufficient (<50%), average (51–60%), or good (>60%). Practices and attitudes were considered correct or positive if the score was above 60% and incorrect or negative if it was below 60%.

Categorical variables are presented as frequencies and percentages, whereas continuous variables are expressed as the means with 95% confidence intervals. Pearson correlation analysis was used to assess relationships between demographic variables. The chi-square test was applied to examine associations between categorical variables. One-way analysis of variance (ANOVA) was used to compare means across more than two groups. A p value ≤ 0.05 was considered statistically significant.

Table-I: Demographic Characteristics of the Nurses (N = 246).

Characteristic	Category	N	%
Age (years)	20-30	96	39.02
	30-40	138	56.09
	40-50	6	2.43
	>50	6	2.43
Gender	Male	120	48.78
	Female	126	51.21
Marital Status	Single	132	53.65
	Married	114	46.34
Residence	Rural	54	21.95
	Urban	192	78.04
Educational Level	Diploma	60	24.39
	Bachelor's Degree	186	75.60
Occupational Status	Nurse	12	4.87
	Professional Nurse	18	7.31
	Registered Nurse	186	75.60
	Head Nurse	30	12.19
Years of Work in Hospital	<5 years	90	36.58
	≥5 years	156	63.41

RESULTS

A total of 246 nurses completed the survey. The majority were aged 30–40 years, female, single, and resided in urban areas. Most held a bachelor's degree, with only 12.19% working as head nurses. The detailed demographic characteristics are provided in Table-I.

Statistical analysis revealed several significant relationships among the participants' demographic variables. A strong positive correlation was found between years of work in the hospital and age group ($r = 0.572$, $p < 0.01$), indicating that older nurses had more experience. Years of work also correlated significantly with occupational status ($r = 0.347$, $p < 0.05$), suggesting that more experienced nurses were more likely to hold advanced roles. Age group was also positively associated with occupational status ($r = 0.328$, $p < 0.05$). Additionally, a significant relationship was observed between gender and residence ($r = 0.426$, $p < 0.01$), with female nurses more commonly residing in urban areas (Table-SI).

Knowledge: Approximately 78.04% of the nurses ($n = 192$) had personal experience with diabetes mellitus through their immediate family members, whereas 2.43% ($n = 6$) reported exposure through more distant relatives. The remaining 19.51% ($n = 48$) had

no personal exposure to the disease. Professionally, doctors were identified as the primary source of information regarding diabetes mellitus and insulin therapy by 48.78% of participants, followed by patients (34%), other nurses (10%), and head nurses (7%). The

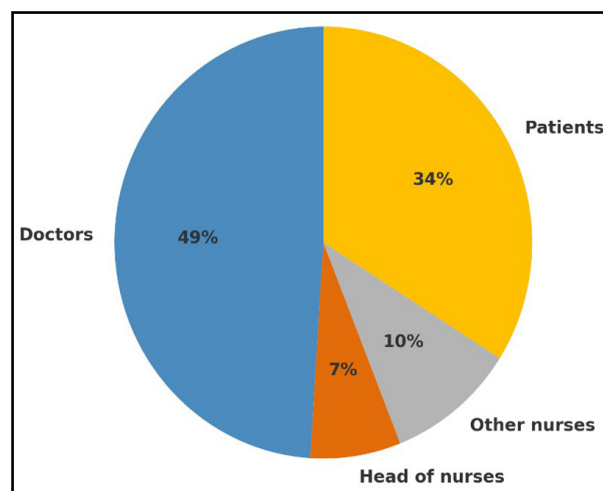


Fig.1: Sources of Diabetes Mellitus and Insulin Therapy Knowledge Among Nurses ($n = 246$).

Table-SI: Correlation of the participants' demographics.

		<i>Years of work in that hospital</i>	<i>Age group</i>	<i>Sex</i>	<i>Marital status</i>	<i>Residence</i>	<i>Educational levels</i>	<i>Occupational Status</i>
Years of work in that hospital	Pearson Correlation	1	0.572**	-0.133	0.300	-0.158	0.158	0.347*
	Sig. (2-tailed)		0.000	0.406	0.057	0.323	0.323	0.026
Age group	Pearson Correlation	0.572**	1	-0.254	0.231	-0.262	0.162	0.328*
	Sig. (2-tailed)	0.000		0.109	0.147	0.098	0.312	0.037
Gender	Pearson Correlation	-0.133	-0.254	1	0.124	0.426**	0.241	0.159
	Sig. (2-tailed)	0.406	0.109		0.439	0.006	0.129	0.322
Marital status	Pearson Correlation	0.300	0.231	0.124	1	-0.216	0.186	0.073
	Sig. (2-tailed)	0.057	0.147	0.439		0.175	0.244	0.651
Residence	Pearson Correlation	-0.158	-0.262	0.426**	-0.216	1	0.110	-0.231
	Sig. (2-tailed)	0.323	0.098	0.006	0.175		0.492	0.147
Educational levels	Pearson Correlation	0.158	0.162	0.241	0.186	0.110	1	0.229
	Sig. (2-tailed)	0.323	0.312	0.129	0.244	0.492		0.150
Occupational Status	Pearson Correlation	0.347*	0.328*	0.159	0.073	-0.231	0.229	1
	Sig. (2-tailed)	0.026	0.037	0.322	0.651	0.147	0.150	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

designation of Head Nurse reflected professional rank and experience within the institution rather than a distinct educational qualification. Most Head Nurses held the same academic qualification (bachelor's degree in nursing) as other participants but had greater clinical and managerial experience.

This finding suggests that physicians play a central role in disseminating diabetes-related knowledge within the clinical setting (Fig.1).

Only 21.7% of the nurses reported knowledge of the signs and symptoms of hypoglycemia. In contrast, 39.1% correctly identified polyuria as a key symptom of hyperglycemia in diabetic patients (Fig.2).

Practices: Over half of the nurses (53.66%) reported not keeping insulin vials at room temperature before injection, while 58.54% washed their hands before patient contact. A majority (73.17%) always checked insulin expiration dates, and 78.05% mixed insulins only per the instructions. Most nurses (63.41%) regularly changed injection sites, and nearly all

(97.56%) preferred the abdomen for administration. All nurses lifted the skin during injection, primarily using the index finger and thumb (80.49%). Over half (63.41%) of the samples released their skin after the syringe was removed. Nearly all (92.68%) avoided injecting through clothing, and 73.17% used a 90-degree angle. While 58.54% always used alcohol wipes before injection, only 31.71% reported massaging the site afterward (Table- SII).

Attitude: Approximately 73.17% of the nurses reported effectively communicating the technical use of insulin pen devices to colleagues. However, only 29.27% used pen devices frequently in practice. While 71.13% found pens easier for measuring insulin than vials and syringes did, only 43.90% were aware of newly launched devices. Nearly all the participants (97.56%) believed that pen devices were convenient for patients during travel (Table-SIII).

Most participants demonstrated average (40.5%) to good (36.5%) knowledge, along with correct practices

KAP regarding insulin pen devices

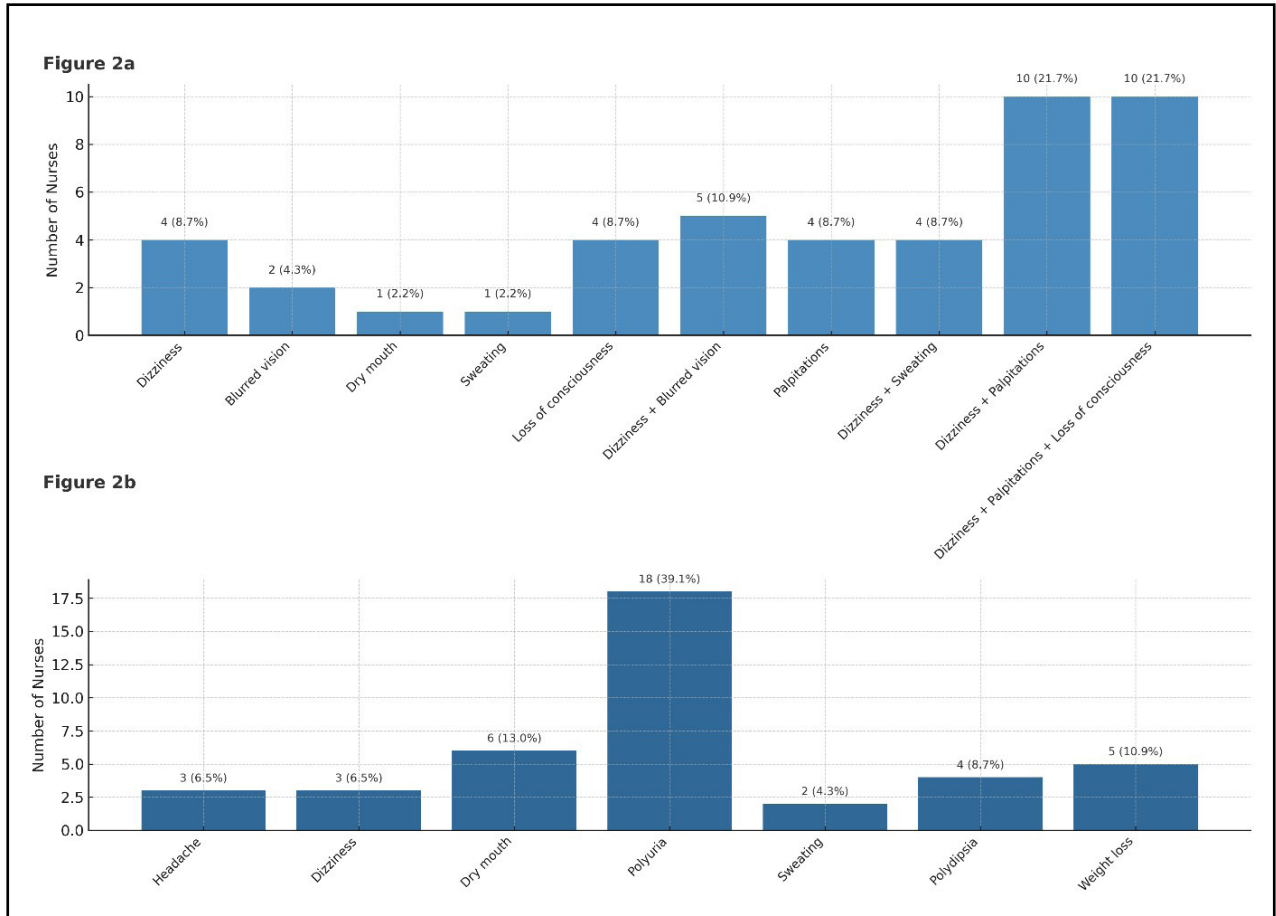


Fig.2a: Nurses' knowledge of hypoglycemia. Fig.2b: Nurses' knowledge of hyperglycemia.

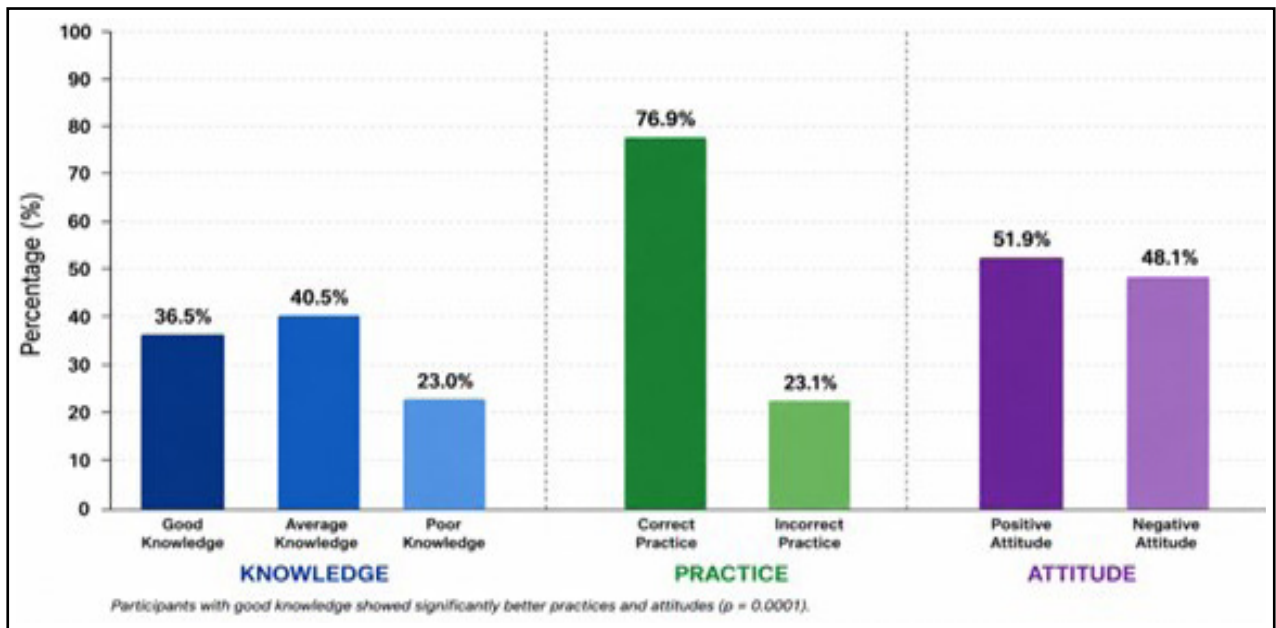


Fig.3. Distribution of Knowledge, Practice, and Attitude (KAP) Scores Among Nurses Regarding Diabetes Management, Insulin Administration, and Insulin Pen Device Use (n = 246).

Table-SII: Practices of the participants (n=246).

<i>Practice based questions</i>		N	%
Before injection, do you keep the vials at room temperature?	Yes	114	46.34
	No	132	53.66
When you wash your hand while giving insulin	Before touching the patient	144	58.54
	Before Drawing insulin	102	41.46
While injecting insulin, do you check the expiry?	Rarely	24	9.76
	Sometimes	18	7.32
	Usually	24	9.76
	Always	180	73.17
While giving insulin, do you MIX more than one kind of insulin?	Yes	12	4.88
	No	42	17.07
	As per instructions	192	78.05
While giving insulin, did you usually change the site of injection	Rarely	18	7.32
	Sometimes	42	17.07
	Usually	30	12.20
	Always	156	63.41
What is the usual site to inject insulin?	Abdomen	240	97.56
	Thigh	6	2.44
Why giving insulin, do you examine the site of injection for any pain, inflammation and swelling?	Never	24	9.76
	Rarely	12	4.88
	Sometimes	48	19.51
	Usually	24	9.76
	Always	138	56.10
While giving insulin, did you lift the skin at the site of injection	Yes	246	100.00
	No	0	0.00
If yes, then, which finger do you use to lift off the skin	Index & thumb index	198	80.49
	Thumb & middle fingers	48	19.51
While giving insulin, when you release lifting of skin	Before removal of the insulin syringe	90	36.59
	After removal of the insulin syringe	156	63.41
While giving insulin, did you inject insulin through clothes	Never	228	92.68
	Rarely	6	2.44
	Sometimes	6	2.44
	Usually	6	2.44
While giving insulin, which angle did you use	25degrees	30	12.20
	45degrees	36	14.63
	90degrees	180	73.17

KAP regarding insulin pen devices

Do you massage the site for active re-absorption?	Yes	78	31.71
	No	168	68.29
While giving insulin, do you use alcohol wipes prior to injection?	Never	42	17.07
	Rarely	12	4.88
	Sometimes	24	9.76
	Usually	24	9.76
	Always	144	58.54

(76.9%) and positive attitudes (51.9%) toward diabetes management and insulin pen use. Notably, participants with good knowledge also showed significantly better practices and attitudes ($p = 0.0001$) (Fig.3).

DISCUSSION

The prevalence of type 2 diabetes mellitus has increased rapidly globally over the last few decades.¹⁵ Moreover, the global prevalence of type 2 diabetes is expected to reach 10.23% by 2050.¹⁶ Insulin therapy is commonly administered in hospital settings, making it essential for nurses to possess adequate knowledge and skills related to insulin injection. Deficiencies in technique are often attributed to insufficient training, highlighting the critical need for ongoing education. Improving nurses' understanding of insulin administration can enhance adherence to recommended guidelines for proper insulin use.¹⁷ This study aimed to assess the knowledge, attitudes, and practices of insulin pen devices among nurses in tertiary care hospitals. With the objective of identifying how many registered nurses are comfortable using insulin pen devices at the study institute, proper

training and workshops should be initially conducted to familiarize them with safe usage of insulin pen devices, which would ultimately lead to teaching sessions for patients, resulting in better compliance with insulin treatment in diabetic patients than with insulin syringes. In addition, the chances of needle stick injury can be further minimized with the use of insulin pen devices.

Most of the participants had average (40.5%) to good knowledge (36.5%) (total satisfactory knowledge = 77%) regarding diabetes mellitus and the use of insulin pen devices. These results are comparable to the results of other previous studies.^{4,8,18-20} In contrast, a study conducted in Northern Ireland reported a lack of knowledge and practices among nurses regarding diabetes and its management.⁸ Another study reported that the use of insulin pen devices is perceived as safe, effective, and easy.²¹

There was a significant relationship between years of working in hospitals and age groups, years of working in hospitals and occupational status, age group and occupational status (32.8%), and sex and residence, with p -values of 0.01 and 0.05, respectively. These findings

Table-III: Attitude of the participants regarding insulin pen devices (n=246).

Attitude based questions		N	%
Do you effectively communicate the technical skills of using insulin pen devices to your fellow colleagues	Good	180	73.17
	Best	66	26.83
Do you have the latest information regarding newly launched pen devices in market	Yes	108	43.90
	No	138	56.10
Do you think insulin pen device is easy to carry by patient during travelling?	Yes	240	97.56
	No	6	2.44
In your practice, how frequently do you use the insulin pen devices as compared to insulin syringes	Never	12	4.88
	Rarely	30	12.20
	Sometimes	60	24.39
	Usually	72	29.27
	Always	72	29.27

reveal that registered nurses and heads of nurses have more knowledge than other types of nurses do and that the number of years of working experience significantly correlates with the knowledge, attitudes, and practices of nurses. Similarly, another study conducted among Chinese nurses concluded that diabetes educators had greater knowledge than other types of nurses did.²⁰ Another study revealed that nurses had insufficient knowledge of diabetes and its management.²²

Moreover, the study revealed that most nurses practice as per the guidelines for diabetes management. Similarly, Shogbon et al. reported that more than half of the study nurses in tertiary care settings had knowledge of the most recent guidelines for diabetes and insulin injection.⁶ Another study conducted in Nepal revealed that insulin pen device practices among nurses were suboptimal and therefore highlighted the need for educational intervention imperatively.⁴

Moreover, nurses reported correct practices (76.9%) and attitudes (51.9%) regarding diabetes mellitus and the use of insulin pen devices. Another study revealed that 96.85% of nurses achieved an overall positive attitude.²⁰ However, in contrast to the current results, Theofanidis reported a poor compliance rate among nurses related to the practice of insulin injection.¹⁸

Furthermore, the current study revealed that, among fellow colleagues, 73.17% of nurses effectively communicate the technical skills of using insulin pen devices. Unfortunately, only 29.27% of the nurses used insulin pen devices, and 71.13% of the nurses found it easier to measure insulin units via pen devices than via vials and syringes. Similarly, one more study concluded that nurses felt more confident and comfortable with the use of insulin pen devices than with syringes and vials.⁶ Similarly, another study concluded that approximately two in three (67.28%) nurses felt that they needed training on insulin injection. Furthermore, a quarter of the study nurses could not teach diabetic patients effectively about techniques involving insulin injection.²⁰ Thus, patient education regarding correct and safe practices of insulin injection could also be improved by increasing the knowledge of nurses.²³

Nevertheless, this study has several limitations. First, the nurses self-evaluated themselves, which might increase the degree of ambiguity in their answers. Another limitation was that the nurses working in different healthcare settings were not compared, as primary care settings have an increased proportion of diabetic patients, thus affecting the generalizability of the results. Furthermore, insulin pen devices were not commonly used in the study setting, which also limits the assessment of knowledge, practices, and attitudes regarding the use of insulin pen devices among nurses.

The success of diabetes mellitus treatment depends not only on the dosage and type of insulin administered but also on the methods and types of techniques used to manage diabetic patients. For this purpose, health

care professionals should have prompt knowledge of instruments and devices that are used in managing diabetes. Within the domain of Dow University of Health Sciences, the use of pen devices is not very frequent, but the overall practices of managing diabetic patients are efficient enough among nurses. Therefore, more training sessions and education should be provided to allied health care professionals, such as nurses. Clinical practice guidelines should be given to every health care provider regarding the use of insulin pen devices for better management of diabetes.

DECLARATIONS

Ethics approval and consent to participate: The study was approved by the Dow University of Health Sciences' Institutional Review Board (IRB-2378/DUHS/approval/2022/825). The study was performed under Helsinki's ethical principle. To preserve confidentiality, we coded each interaction and removed their original identifications. Informed consent was taken from nurses.

Consent for publication: No applicable.

Availability of data and materials: All the data generated or analysed during this study are included in this article. Further inquiries can be directed to the corresponding author.

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Authors' Contributions:

ZK: Conceptualized, supervised and also contributed to the methodology and preparation of the original draft.

AAB: Responsible for data curation and formal analysis and contributed to the review and editing of the manuscript.

ZB: Carried out the investigation, data collection, and project administration.

NF: Contributed to validation, provided resources, and participated in the review and editing of the manuscript.

KS: Assisted with formal analysis, data visualization, and manuscript review and editing.

NT: Conducted the literature review, managed data entry, and supported the writing of the original draft.