



A Comparative Evaluation of Insulin Syringe and Prefilled Pen Usability and Preference among the Population with Diabetes in Pakistan

Sameen Abbas¹ Areej Javed¹ Mamoona Khalid¹ Syed Muhammad Talha¹ Pakeeza Zainab¹
Anum Bibi¹ Sidra Bibi¹ Aliza Yaseen¹

¹ Department of Pharmacy, Quaid-i-Azam University, Islamabad, Pakistan

Address for correspondence Sameen Abbas, PhD, Department of Pharmacy, Quaid-i-Azam University, Islamabad 45320, Pakistan (e-mail: sameenabbas@bs.qau.edu.pk).

J Diabetes Endocrine Practice

Abstract

Background Diabetes management often requires insulin administration, and the choice of delivery method—vials/syringes or prefilled pens—significantly impacts patient adherence, satisfaction, and outcomes. While prefilled pens offer convenience and ease of use, their higher cost may limit accessibility in resource-constrained settings like Pakistan. This study evaluates the usability and patient preferences for these devices in Pakistan

Methodology A cross-sectional observational study was conducted at the Federal Government Polyclinic Hospital Islamabad, from February 2024 to June 2024. The data were collected from the medical ward, orthopaedic ward, intensive care unit (ICU), medical ICU, and urology ward. A self-structured validated questionnaire was used to collect the demographics and knowledge assessment about the usability and preference of using an insulin pen or vial and syringe (VaS) system. Filled questionnaires were analyzed through SPSS version 26. A p -value ≤ 0.05 was considered significant.

Results The study found that patients preferred insulin pens for their ease of use, convenience, and reduced risk of pain. Safety concerns, such as pain and bruising at injection sites, were reported less frequently with pens. However, traditional VaS system remained more widely used due to their affordability and accessibility. Patients expressed a willingness to switch to pens if cost barriers were addressed, highlighting the significant role of economic factors in influencing device choice.

Conclusion This study highlights important insights into the usability and patient preferences for insulin delivery methods among diabetic patients in Pakistan. Prefilled insulin pens were generally favored for their ease of use, convenience, and potential to improve adherence, while traditional syringes were more commonly used due to affordability and accessibility. Addressing economic and systemic barriers through policy interventions, cost reduction strategies, and patient education results in optimized diabetes management.

Keywords

- ▶ diabetes
- ▶ insulin
- ▶ prefilled pens
- ▶ syringes
- ▶ preference
- ▶ Islamabad

DOI <https://doi.org/10.1055/s-0045-1802356>.
ISSN 2772-7653.

© 2025. The Author(s).

This is an open access article published by Thieme under the terms of the Creative Commons Attribution License, permitting unrestricted use, distribution, and reproduction so long as the original work is properly cited. (<https://creativecommons.org/licenses/by/4.0/>)

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

Introduction

Diabetes is a chronic metabolic condition characterized by elevated blood glucose levels, causing damage to various organs over time. Globally, there is a projected increase in diabetes prevalence from 382 million in 2013 to 592 million by 2035.¹ According to another study, it has been projected that the number of diabetes patients will rise to 693 million by 2045 from 451 million in 2017.² It is also estimated that 49.7% of people living with type II diabetes are undiagnosed. In developing countries, the majority of diabetes patients are younger than 64 years, and diabetes in the adult population is expected to increase by 69% from 2010 to 2030 in developing countries as compared to 20% for developed countries.³

The management of diabetes often requires insulin administration, which is a potent and cost-effective substitute for oral hypoglycemic agents to attain normoglycemia. It is generally started 10 to 15 years later, but insulin therapy at the early stages of diabetes has proven to be a better agent for prolonged glycemic remission.⁴ Insulin can be delivered through various devices, including traditional vials and syringes (VaS) system and prefilled pens. The choice between these options can significantly impact patients' experience, adherence, and overall outcomes. While insulin syringes have been the conventional method, requiring users to draw insulin from a vial, advancements in technology have made prefilled insulin pens increasingly popular due to their ease of use, convenience, and accurate dosing. Insulin pens or pumps offer solutions to some disadvantages for individuals who find syringes problematic.⁵ Prefilled pens offer a more user-friendly alternative, potentially enhancing adherence to insulin therapy by reducing the burden associated with daily injections. Understanding the usability and patient preference for these devices is critical for optimizing diabetes management and improving patient quality of life (QoL).

In Pakistan, diabetes has become a significant public health challenge, with a rapidly rising prevalence due to factors such as urbanization, sedentary lifestyles, and dietary changes.⁶ Insulin therapy is a cornerstone in the management of type I and advanced type II diabetes. Yet, its administration remains a barrier for many patients, often due to a lack of access to user-friendly devices and educational resources. Insulin syringes are commonly used because they are relatively affordable and widely available. However, the manual process of drawing insulin from a vial can be daunting, particularly for patients with limited health literacy, physical disabilities, or those living in rural areas with minimal health care support. Consequently, adherence to insulin therapy may be suboptimal, leading to poor glycemic control and an increased risk of diabetes-related complications.

In recent years, prefilled insulin pens have emerged in the Pakistani market as an alternative to traditional syringes, offering potential advantages such as ease of use, convenience, and more precise dosing.⁵ However, these devices are often more expensive, which can be a barrier to widespread adoption in a country where a significant portion of the population has limited financial means. Additionally, cultural factors,

including patient perceptions of technology and the role of health care providers in influencing treatment choices, play a role in the acceptance of new insulin delivery methods. So, this study aimed to assess the usability and patient preference for insulin syringes versus prefilled pens in Pakistan, taking into account local socioeconomic, cultural, and health care system factors.

Methodology

A prospective cross-sectional investigation was conducted at Polyclinic Hospital in Islamabad over 6 months from February to June 2024. Ethical approval for the study was obtained from the institutional ethical review board of Quaid-i-Azam University and Federal Government Polyclinic Hospital, ensuring adherence to ethical standards in research conduct. The research was carried out in various wards, including the medical, orthopaedic, intensive care unit (ICU), medical ICU, and urology ward, as well as outdoor patients to capture a diverse patient population who were either self-administering insulin or receiving assistance from family members in terms of insulin administration.

The inclusion criteria targeted patients with type I or type II diabetes from both genders who used insulin at home via self-injection or with help from family members. Patients on insulin therapy during hospitalization were excluded if they received injections only from health care professionals, had a language barrier, or were those who did not consent or manage their diabetes solely with oral hypoglycemic agents. Using a convenient sampling method, data were collected from 50 patients. Data confidentiality and anonymity were maintained throughout the study.

The study included two sections of a well-structured adapted questionnaire⁷ that was used to collect data targeting traditional VaS system and insulin pen users. There were three components in each section. In both sections, the first two components were identical. Thirteen general questions on the patient's demographics, diabetes type, length of insulin use, fasting blood glucose and HbA1c monitoring, concurrent use of oral hypoglycemics, and other comorbidities made up the first component. Nine questions that outlined the administration methods were included in the second component. Either insulin pen users or traditional VaS users were the focus of the final component.

The administration method included questions about the awareness of each technique in terms of proper storage (in the fridge before opening and at room temperature or fridge after opening), angle of administration (answered as 45 or 90 degrees as a correct method according to the body mass index), examining the suspension before use, the process of shaking (rubbing as a proper method), cleaning the site of administration, rotating the site of injection (rotating within the same region for morning dose and another region for evening dose or rotating between sites from one injection to another), releasing trapped air from the vial/syringe (for conventional device) or hearing the click (for pen), using a new needle for every injection and throwing away needles directly after injection. The responses were converted to

either “incorrect” (0) or “correct” (1). “Safety and simplicity” included information about pain perception, bruises, hypoglycemia, ease of use, and comfort on using a device for which answers were converted to either “0” as a more negative impact or “1” as a less negative impact on patients.

The primary endpoints included the safety, simplicity, patient preference, and convenience of insulin administration. Safety considerations covered pain, hypoglycemic episodes, and bruising at injection sites. Simplicity was assessed through questions on ease of use and comfort using a device (pen/VaS) without guidance. Patient preferences and convenience were gauged by asking pen users about the ease of shifting to the pen and VaS users if they would switch to a pen if it were equally priced. The secondary endpoint was the awareness of the method of administration as mentioned earlier.

The collected data were analyzed using SPSS version 26, employing descriptive statistics and one-way analysis of variance (ANOVA) tests, *t*-tests, and logistic regression analysis. A *p*-value of ≤ 0.05 was considered statistically significant in evaluating the results.

Results

In this study, 52 patients were surveyed, of whom 29 (56%) were VaS users, while the remaining patients (44%) used an insulin pen. ►Table 1 compares the respondents' demographic, clinical, and treatment characteristics. VaS users predominantly have type II diabetes (79%), while type I diabetes was more common among pen users (65%). Age distribution showed a higher proportion of older individuals (>58 years) in the VaS group (59%). Body mass index (BMI) indicated a higher prevalence of obesity in pen users (35%). Insulin use was similar, with most requiring 10 to 20 units daily and using it for 1 to 5 years. Combination oral hypoglycemic therapy was more common in VaS users (83%). HbA1c monitoring every 3 months was frequent in both groups, while comorbidities like hypertension (41%) and renal disease (41%) were more prevalent in VaS users.

Safety and simplicity domains were classified, including the following five factors: pain, hypoglycemic episodes,

Table 1 Demographic and clinical characteristics of respondents (*n* = 52)

Variables	VaS user, N (%)	Pen user, N (%)
Female	16 (55)	13 (57)
Male	13 (45)	10 (43)
Age (y)		
18.0–28.0	10 (34)	12 (52)
28.1–38.0	15 (52)	13 (57)
38.1–48.0	13 (45)	09 (39)
48.1–58.0	16 (55)	14 (61)
>58	17 (59)	09 (39)

(Continued)

Table 1 (Continued)

Variables	VaS user, N (%)	Pen user, N (%)
BMI		
Normal	12 (41)	07 (30)
Overweight	10 (34)	08 (35)
Obese	07 (24)	08 (35)
Diabetes type		
Type 1	06 (21)	15 (65)
Type 2	23 (79)	08 (35)
Diabetes duration (y)		
1–5	12 (41)	07 (30)
6–10	10 (34)	10 (43)
11–20	05 (17)	04 (17)
>20	02 (7)	02 (9)
Insulin use duration (y)		
1–5	16 (55)	12 (52)
6–10	09 (31)	08 (35)
11–20	04 (14)	03 (13)
>20	02 (7)	01 (4)
Insulin units per day		
10–20	14 (48)	10 (43)
21–30	09 (31)	08 (35)
31–40	04 (14)	02 (9)
41–50	03 (10)	02 (9)
>50	02 (7)	01 (4)
Oral hypoglycemic		
Single drug	05 (17)	10 (43)
Combination therapy	24 (83)	13 (57)
Insulin injection frequency per day		
Once	14 (48)	10 (43)
Twice	11 (38)	13 (57)
Other	04 (14)	01 (4)
HbA1c monitoring frequency		
Every 3 mo	18 (62)	15 (65)
Every 6 mo	07 (24)	06 (26)
>6 mo	04 (14)	02 (9)
Comorbidities		
Heart failure	03 (10)	02 (9)
Dyslipidemia	11 (38)	08 (35)
Stroke	02 (7)	01 (4)
Hypertension	12 (41)	06 (26)
Glaucoma	07 (24)	08 (35)
Renal disease	12 (41)	09 (39)
No comorbidity	05 (17)	04 (17)

Abbreviations: BMI, body mass index; VaS, vial and syringe system.

Table 2 Percentage of safety and simplicity variables

Safety and simplicity variables	VaS user (%)	Pen user (%)
Pain		
Yes	69	22
No	31	78 ^a
Hypoglycemic episodes		
1 in 3 mo	10	09
>1 in 3 mo	03	00
Bruising		
Yes	55	43
No	45	57
Ease of use		
Easy	76 ^a	57
Intermediate	17	30
Hard	07	13
Comfortable using the device		
Very uncomfortable	21	17
Uncomfortable	17	22
Comfortable	48	52
Very comfortable	14	09

Abbreviation: VaS, vial and syringe system.

^aSignificant at $p \leq 0.05$.

bruising at injection sites, ease of use, and comfort using a device (pen/VaS) without guidance (►Table 2). Pain perception is a major barrier to accepting insulin therapy. A statistically significant higher percentage (78%) of pen users reported no pain during injection compared to only 31% of the conventional users. No statistically significant difference was seen between the groups in the incidence of hypoglycemia. Another safety outcome addressed in our study was the percentage of bruises at the administration site. More

patients among the conventional users developed bruises at the site of administration (55%) compared to 43% of the pen users but with no significant levels ($p = 0.154$). As for reading the scale, 76% of VaS users could read the scale easily versus 57% of pen users ($p = 0.045$). When asked how comfortable they would feel using a syringe or a pen without a guide, 61% of insulin pen users answered they were “comfortable” and “very comfortable.” Moving to another primary endpoint, which studied patients’ preference and convenience, 78% of pen users found it more convenient when shifting to a pen. However, only 69% of conventional users would want to shift to the pen if it were the same cost as the traditional VaS system.

The percentages of correctness for all administration procedures are calculated in ►Table 3, and a *t*-test was conducted to test the significant level of difference in administration procedures between pen and traditional VaS users. Pen users, as compared to conventional users, had a significantly lower percentage of correctness on shaking (18 vs. 55%), on examining the suspension (40 vs. 52%), and on changing the needle on every attempt (0 vs. 12%). Surprisingly none of the users in either category practice throwing needles after the injection.

A logistic regression, as shown in ►Table 4, was conducted to test how the safety and simplicity variables, together with administration factors, influence diabetic patients’ preference for the VaS system over insulin pens. Surprisingly, the results showed that pain was the only significant parameter that influenced the decision in the category of safety, whereas no administration procedure was a significant factor at the 5% level.

Discussion

Diabetes is a chronic disease that impacts patients’ lives a lot, and thus, patients need special attention and care in order to manage their lives through frequent glucose monitoring, daily monitoring of carbohydrate intake, and lifestyle modifications.¹ Insulin therapy is made more difficult for patients

Table 3 Percentage of correct administration procedures

Administration procedure	VaS user (%)	Pen user (%)	<i>p</i> -value
Storage	100	95	1.0
Angle of administration	38	40	0.18
Examining the suspension before use	52	40	0.22
Shaking before use	55	18	0.013 ^a
Cleaning the site of administration	24	30	0.31
Rotating the site of injection	40	55	0.07
Releasing trapped air from the vial/syringe (for conventional device) or hearing the click (for pen)	65	57	0.05 ^a
Using a new needle for every injection	12	0	0.05
Throwing away needles directly after injection	0	0	–

Abbreviation: VaS, vial and syringe system.

^aSignificant at $p \leq 0.05$.

Table 4 Logistic regression analysis of safety, simplicity, and administration variables in the study population

Variables	Coefficient	Standard error	p-value
Pain	3.51	0.56	0.004 ^a
Hypoglycemic episodes	-2.20	0.029	0.12
Bruising	0.97	1.10	1.94
Ease of use	5.23	2.38	0.12
Storage	-26.12	1.42	0.957
Angle of administration	-0.38	0.029	0.380
Examining the suspension before use	-0.91	2.23	0.086
Shaking before use	12.6	2.38	0.51
Cleaning the site of administration	-38.42	5.85	0.99
Rotating the site of injection	4.20	0.39	0.176
Releasing trapped air from the vial/syringe (for conventional device) or hearing the click (for pen)	-0.91	1.53	0.278
Using a new needle for every injection	-0.53	1.52	0.744
Throwing away needles directly after injection	-15.03	3.35	1.0

^aSignificant at $p \leq 0.05$.

by a number of social and financial obstacles they must overcome before starting it. This study provides valuable insights into the usability and patient preferences for insulin delivery methods among a cohort of diabetic patients in Pakistan, revealing critical factors that influence the choice and satisfaction with these devices. The findings indicate that prefilled insulin pens are generally perceived as more user-friendly, offering convenience and ease of use, especially for patients with limited dexterity or visual impairments. The results parallel those of Korytkowski et al in which 74% of patients indicated a preference for the pen over the VaS system, compared with 20% who preferred the VaS system.⁸ It was also researched that 74% considered the pen easier to use overall, compared with 21% for the VaS system, and 85% of insulin pen users found reading the scale easy to use compared to only 10% of the conventional users who believe that reading the scale is easy to read.⁷

Insulin pens are perceived as less painful when compared to a conventional VaS system. In fact, needle phobia has been studied in many clinical trials. A study about the needle gauge and its association with pain was conducted on 30 healthy volunteers; 40.3% reported that a large size needle was significantly more likely to cause pain compared with a lesser outer diameter needle.⁹ Another open-label, crossover study comparing patient preference and pain perception between different insulin pens showed that the pen with a 33-gauge lubricant-coated needle had a significantly superior ($p < 0.001$) overall patient satisfaction score with less fear and less bleeding tendency.¹⁰ These attributes align with global trends showing that user-friendly devices enhance adherence to insulin therapy. However, the higher cost of prefilled pens compared to traditional syringes emerged as a significant barrier, particularly in a resource-constrained setting like Pakistan, where affordability often dictates health care choices.

The results of this study dictate a need for insulin technique awareness for the diabetic population of Islamabad. The majority of patients under study did not clean the site of injection before injecting insulin, did not rotate the site of administration, did not use a new needle for every injection, and did not throw away the needle directly after injections. However, those are the key factors for proper insulin administration in order to avoid infections. Patients should be instructed on the correct injection depth, site, and technique. Insulin depth should be sufficient to avoid intramuscular injections that lead to rapid absorption and a higher risk of hypoglycemia.^{9,11}

This study has several potential limitations. First, using a convenient sampling method may limit the generalizability of the findings to the broader diabetic population in Pakistan. Additionally, the reliance on self-reported data for preferences and convenience introduces the possibility of recall bias. The study's cross-sectional design captures patient experiences at a single point in time, which may not reflect long-term usability or adherence outcomes. Finally, since the survey was conducted in a single health care setting targeting only a specific number of patients, the findings may not fully represent patients in other regions or health care environments across Pakistan.

Future studies could incorporate objective measures such as continuous glucose monitoring (CGM) or glucometer records to minimize bias to validate episodes. Limiting recall periods to recent events (e.g., 2 weeks) and using standardized definitions of hypoglycemia can improve the consistency and accuracy of patient responses. Structured and validated questionnaires and training interviewers to avoid leading questions can further reduce recall and interviewer bias. Cross-verifying patient reports with caregivers or medical records and ensuring participants are not overly focused on the study's primary objective can minimize response bias.

Conclusion

This study highlights important insights into the usability and patient preferences for insulin delivery methods among diabetic patients in Pakistan. Prefilled insulin pens were generally favored for their ease of use, convenience, and potential to improve adherence. At the same time, traditional VaS systems were more commonly used due to affordability and accessibility. The findings suggest that while prefilled pens may enhance patient satisfaction and simplify insulin administration, economic and systemic barriers remain significant factors influencing their adoption. Patients in both groups need more awareness about the method of administration, aseptic injection techniques, and proper disposal of needles/syringes. Understanding these factors is crucial for optimizing diabetes treatment strategies and enhancing patient satisfaction and adherence. Future research directions include investigating long-term adherence rates and clinical outcomes associated with different insulin delivery methods, which could further inform clinical practice and improve diabetes care protocols in the whole country. Studies on larger and more diverse populations are also recommended to validate these findings and explore long-term outcomes of device preferences on glycemic control and QoL.

Author Confirmation

It is hereby confirmed that the manuscript has been read and approved by all named authors and that no other persons have satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

Data Availability Statement

The original contributions presented in the study are included in the article. Further inquiries can be directed to the corresponding author.

Ethics Statement

The research was deemed low risk and, as such, was reviewed by the Ethical Review Board of Polyclinic Hospital Islamabad and the Institutional Ethical Review Board of Quaid-i-Azam University, Islamabad.

Funding

None.

Conflict of Interest

None declared.

Acknowledgments

The authors acknowledge all patients who gave consent to participate in this project, including the staff of Polyclinic Hospital Islamabad and the Department of Pharmacy, Quaid-i-Azam University, Islamabad, Pakistan.

References

- Patil SR, Chavan AB, Patel AM, Chavan PD, Bhopale JV. A review on diabetes mellitus its types, pathophysiology, epidemiology and its global burden. *J Res Appl Sci Biotechnol* 2023;2(04):73–79
- Ogurtsova K, da Rocha Fernandes JD, Huang Y, et al. IDF diabetes atlas: global estimates for the prevalence of diabetes for 2015 and 2040. *Diabetes Res Clin Pract* 2017;128:40–50
- Akhtar S, Nasir JA, Abbas T, Sarwar A. Diabetes in Pakistan: a systematic review and meta-analysis. *Pak J Med Sci* 2019;35(04):1173–1178
- Wallia A, Molitch ME. Insulin therapy for type 2 diabetes mellitus. *JAMA* 2014;311(22):2315–2325
- Kesavadev J, Saboo B, Krishna MB, Krishnan G. Evolution of insulin delivery devices: from syringes, pens, and pumps to DIY artificial pancreas. *Diabetes Ther* 2020;11(06):1251–1269
- Sharif S, Sharif H, Rehman J, Fatima Z. Is a sedentary lifestyle a leading causal factor of obesity and distress in type 2 diabetes? A cross-sectional study in low-socioeconomic areas of Karachi, Pakistan. *BMJ Public Health* 2023;1(01):e000149
- Ramadan WH, Khreis NA, Kabbara WK. Simplicity, safety, and acceptability of insulin pen use versus the conventional vial/syringe device in patients with type 1 and type 2 diabetes mellitus in Lebanon. *Patient Prefer Adherence* 2015;9:517–528
- Korytkowski M, Bell D, Jacobsen C, Suwannasari R. FlexPen Study Team. A multicenter, randomized, open-label, comparative, two-period crossover trial of preference, efficacy, and safety profiles of a prefilled, disposable pen and conventional vial/syringe for insulin injection in patients with type 1 or 2 diabetes mellitus. *Clin Ther* 2003;25(11):2836–2848
- Hansen B, Matytsina I. Insulin administration: selecting the appropriate needle and individualizing the injection technique. *Expert Opin Drug Deliv* 2011;8(10):1395–1406
- Al Hayek A, Al Dawish M. Patient-reported preference and clinical efficacy of insulin pen devices with safety needles in adolescents and young adults with type 1 diabetes: a prospective study. *Cureus* 2021;13(04):e14555
- Pledger J, Hicks D, Kirkland F, Down S. Importance of injection technique in diabetes. *Diabetes & Primary Care* 2012;14(01):53–58