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ORIGINAL RESEARCH

Qualitative Assessment of Experiences and Challenges Faced by Mothers of Children Using an Insulin Pump in the United Arab Emirates

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Background: Various benefits and challenges influence insulin pump use by diabetic patients, especially children. Mothers, as the primary caregivers, can provide valuable feedback on their children's health-related issues. This study aimed to explore the experiences and challenges faced by mothers of children using an insulin pump.

Methods: This qualitative exploratory research involved in-depth interviews of eight mothers in the United Arab Emirates selected purposively during March 2025, whose children had type 1 diabetes and used an insulin pump up to the age of 12 years old. A validated interview guide was used.

Results: The use of an insulin pump positively impacted the mothers' and children's quality of life. The main identified themes were mothers' knowledge and perception of insulin pump use, the impact of insulin pump use clinically, psychologically, and socially, the challenges faced, and recommendations. All participants preferred the use of an insulin pump due to its positive properties. Yet, mothers mentioned some concerns, including sudden device malfunction, wrong placement of the cannula, financial burden and the lack of awareness of the needs of insulin pump users.

Conclusion: Insulin pump therapy has significant advantages and disadvantages, but in the opinion of the mothers interviewed, the advantages outweigh the drawbacks.

Keywords: challenges, children, insulin pump, mothers, perspective, type 1 diabetes, United Arab Emirates

Background

Type 1 diabetes mellitus (T1DM) is estimated to affect 652, 000 children worldwide,[1] among which 109,000 are in the Middle East and North Africa.[2] These alarming numbers call for immediate action to manage this disease among children. Patients with T1DM suffer from destruction of the β-cells in the pancreas, leading to a complete deficiency of insulin.[3] Managing the disease is crucial, especially in children, to support healthy growth and reduce the risk of complications. This is done by lifelong insulin administration; the two approaches are multiple daily injections (MDI) and continuous subcutaneous insulin infusion (CSII). The insulin pump therapy employs CSII and is a well-known approach in pediatric diabetes management. Compared to the MDI therapy, it offers multiple benefits including reduced injection frequency, better glycemic control, improved quality of life for children and caregivers, flexibility in their meals and overall daily routine.[4–10] There is a reduction in HbA1c level in children with CSII treatment compared with the MDI group.[11] Despite all benefits, certain challenges could affect the use of an insulin pump. The high cost that often causes a financial burden for the caregiver, social challenges such as the use of technology in school and other settings, complexity of the process, the continuous need of education, adverse effects like the occurrence of dermatological problems and displacement of the needle in addition to device malfunction may reduce uptake of the device.[7,12–18]

https://doi.org/10.2147/PPA.S574827
Received: 16 October 2025
Accepted: 18 February 2026
Published: 9 April 2026

Mothers are the primary caregivers for their children. They play a key role in managing their children using insulin pump. Their responsibilities include, but are not limited to, managing daily insulin administration, monitoring blood glucose levels, ensuring proper pump maintenance, educating their children about pump usage, and providing essential emotional and psychological support.[19–21] Their continuous engagement, vigilance, and encouragement significantly influence the child's confidence, independence, and long-term health outcomes. It is thus important to understand and support mothers' roles in this process to achieve a lifelong healthier journey for their children.

A systematic review identified six studies conducted in the United States, the United Kingdom, and Sweden, all of which explored parents' and/or children's perspectives on the use of insulin pumps.[22] Overall, parents expressed positive attitudes toward transitioning from MDI to insulin pump therapy, although some challenges related to pump use were also reported.[23–25]

This qualitative research aims to get a more comprehensive understanding of the mothers' perspectives on the use of insulin pump among their T1DM children, covering every aspect of life that the child and the mother go through including psychological, clinical, difficulties, social challenges, and their recommendations. In Gulf Cooperation Council (GCC) countries, this topic is not widely researched, as reviewing the literature revealed only one study conducted in Kuwait to explore adult patients' experience regarding insulin pump.[26] In the United Arab Emirates (UAE), there is an absence of publications in this area. This scarcity shows the need to conduct research to explore the mothers' perspectives on insulin pump use among their children. The authors conducted a qualitative research study to understand the mothers' perspectives, experiences, and challenges faced while managing their children. This study aims to provide a deep insight and rich information from mothers, which could lead to more effective support for children and their families.

Methods

Study Design

This was a qualitative study involving mothers with diabetic children (≤12 years old) who were using the insulin pump to explore their perspectives on the pump use. The Consolidated Criteria for Reporting Qualitative Research (COREQ) was followed in this manuscript (Appendix 1).

Study Setting

Mothers of type 1 diabetic children using insulin pump participated in this study from different Emirates across the United Arab Emirates (UAE). The distribution was Sharjah (3), Abu Dhabi (3), Ras Al Khaima (1) and Umm Al Quwain (1) to establish diversity and obtain a broader spectrum of experiences. For the convenience and satisfaction of the participants, a hybrid approach was followed in this study, allowing both face-to-face interviews and online interviews.

Study Timeline

This study started toward the end of February 2025 and continued until mid-April 2025. Obtaining informed consent, developing the interview guide, conducting the interviews, producing the transcript, analysis and literature review were all completed during this period of time.

Sampling

A purposive sampling technique was followed to select the participants. The participants were approached through personal contacts in addition to the mothers' support groups. Participating mothers referred other mothers whose child met the inclusion criteria. All contacts were made through WhatsApp and phone calls.

Inclusion and Exclusion Criteria

This study included mothers of children up to the age of 12 years who are using an insulin pump for at least 6 months, living in the United Arab Emirates (UAE), and who were willing to participate. Mothers were excluded if their children

were above the age of 12, had type 1 diabetes but were not using an insulin pump, and were living outside of the UAE. Mothers were also excluded if they did not give consent to audio record the interview.

Developing the Interview Guide

All authors participated in developing the interview guide. Open-ended questions were used in developing the interview guide to obtain rich and relevant answers. Content validity was checked by sending the interview guide to three experts, and their feedback was considered in finalizing the guide. After that, a pilot interview was conducted, and eight questions were modified as shown in Table 1. Appendix 2 shows the finalized interview guide.

Interview Process

Face to face / online interviews were done to obtain comprehensive insights from mothers whose children met the study inclusion criteria. The interview started with collecting the children's demographic and medical details, including the last HbA1c level, height, weight, co-morbidities, and the type of insulin pump used.

Pre-interview stage: Before conducting the interview, the participants were contacted by the first author through WhatsApp or a phone call to schedule the interview and ascertain the preferred interview mode (face-to-face or online).

Table 1 Customization of the Interview Guide

Question Used in Pilot-Tested Interview Guide	Modified Question in Finalized Interview Guide	Comment
—	What type of insulin pump does your child use?	This question was added to the interview guide after the pilot interview was conducted.
How should you manage your child's insulin pump when they are sick?	—	This question was removed from the interview guide after the pilot interview. It was not understood by the participant.
What approach do you use for enhancing your knowledge about the use of insulin pump?	—	This question was removed from the interview guide after the pilot interview. The answer was repeated from a previous question.
—	How do the UAE government and healthcare organizations support insulin pump users?	This question was added to the interview guide after the pilot interview was conducted.
Describe your overall perception on the use of insulin pump?	___	This question was removed from the interview guide after the pilot interview. The answer was repeated from another question.
What is the impact of using an insulin pump on your child's overall health? What was your child's experience before using an Insulin pump and after using it?	How does using an insulin pump affected your child's health and experience compared to before?	These two questions were replaced with one question that combines both.
Describe the overall quality of life of your child after using an insulin pump.	—	This question was removed from the interview guide because the answer was repeated, and it is very similar to another question.
Describe a challenging event that happened with your child while using the insulin pump. What were the difficulties your child faced and stated when he used the insulin pump?	Describe a challenging experience your child had while using the insulin pump and the difficulties they faced.	These two questions were combined as one question.

https://doi.org/10.2147/PPA.S574827

At this stage, the first author explained all details, including the audio recording and provided the consent form for those who were willing to participate.

Interview stage: Interviews were conducted in a quiet, private setting to ensure confidentiality and encourage open conversation. The first author began by greeting the participants and briefly introducing herself, building a rapport with them. Additionally, the participants were reminded about their voluntary participation and their right to withdraw at any stage of the interview. Then, the demographic and medical details were collected, and the interview was conducted. The pilot interview was conducted face-to-face, while all others were done virtually using online platforms. At the end of the interview, participants were given the opportunity to share any further thoughts or experiences that had not been discussed. The researcher thanked the participants for their valuable time and for sharing their experiences. The interview lasted between 18 to 50 minutes and all interviews were conducted in Arabic language.

Data Saturation

Data transcription and analysis were done concurrently. The data was coded and compared with the previous codes of other participants. Regular discussions among the researchers were conducted to review the coding framework and evaluate whether further interviews were needed. After the sixth interview, researchers noticed that multiple codes were being repeated and proposed that saturation had been reached, as no new themes or codes emerged. To confirm this, two more interviews were conducted, and their codes compared with the previous ones. At this stage, researchers reached a consensus to stop the interviews as no new codes could be found, and saturation may have been achieved.

Ethical Approval and Informed Consent

The study was conducted in accordance with the Declaration of Helsinki and the ethical approval was obtained from the Ethical Review Board of Ajman university, on February 18th, 2025 (Ref Number: P-F-H-18-Feb). Agreement of participants were confirmed before collecting the responses and that was considered as written consent. All methods applied were performed in accordance with the relevant guidelines and regulations.

Data Analysis

Data was analyzed using a thematic analysis approach and followed the six phases mentioned by Braun and Clarke.[27] All interviews were audiotaped and transcribed verbatim and reviewed multiple times by three researchers (LAF, NM, AF) to ensure accuracy. The researchers were assisted by"TurboScrib" software to transcribe the interviews. They listened to each recording and verified the transcript accordingly. To ensure the accuracy and equivalence of the translation, a back-translation process was conducted and verified by an external person. The English-translated transcripts were independently translated back into Arabic and compared with the original Arabic transcripts to verify consistency and preserve meaning.

The verified transcripts were then sent to the mothers for review and to get their confirmation. Manual coding was performed by three researchers and transferred to an Excel spreadsheet. Further, the software ATLAS.ti was also used and compared with the manual coding to confirm that no codes were missing. All researchers were involved in deciding the themes, subthemes, and coding that emerged and reaching a consensus. Figure 1 demonstrates steps of data analysis.

The main identified themes were: mothers' knowledge and perception on insulin pump use; the impact on the clinical, psychological, and social life of insulin pump use; challenges faced and mothers' recommendations.

Results

Demographic Characteristics of Participants

Eight mothers participated in this study, with half of them holding a bachelor's degree. One mother had two children of different genders and ages who used an insulin pump. The mean age of the children was 8.8±3.05 years, while the mean age at diagnosis was 4.1±2.1 years. Table 2 shows the details related to the demographic characteristics of the children.

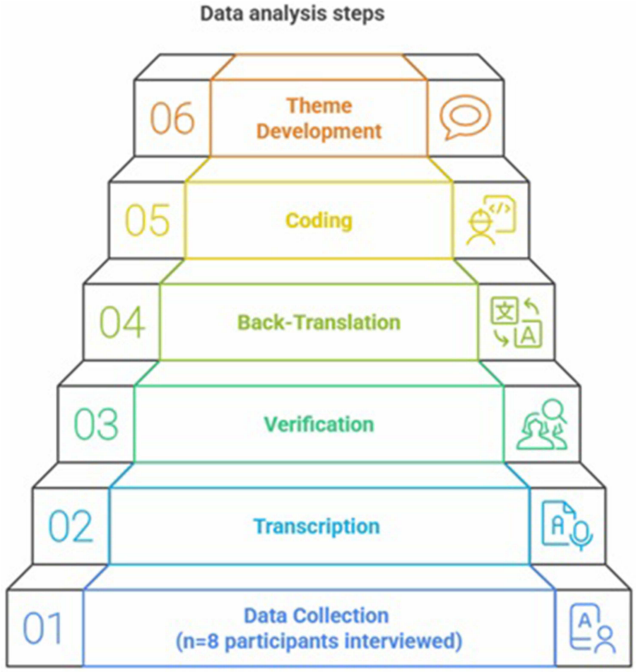

Figure 1 Steps followed during data analysis.

Themes

Eight mothers were interviewed. There were three main themes: mothers' knowledge and perception on insulin pump use; the clinical, psychological, and social life impact of insulin pump use; challenges faced and mothers' recommendations. Tables 3–5 show all themes, subthemes, and codes that emerged.

Theme 1: Mothers' Knowledge and Perception of Insulin Pump Use

The overall knowledge of mothers on insulin pump use was adequate, with all participants having a positive perception. As the use of insulin pumps changed their children's lives positively, mothers perceived this technology as a "blessing". Table 3 shows more details on mothers' knowledge and perception of insulin pump use.

Table 2 Demographic Characteristics of Participants' Children

Characteristics	Frequency, n (%)	Mean ±SD
Gender		
Male	5	–
Female	4	
Age (years)		
5–8	3	8.8± 3.05 (5–12)
9–12	6	
Nationality		
Locals	5	-
Arabs Non-locals	4	

(*Continued*)

https://doi.org/10.2147/PPA.S574827

Table 2 (Continued).

Characteristics	Frequency, n (%)	Mean ±SD
Emirates		
Abu Dhabi	3	-
Dubai	0	
Sharjah	3	
Ajman	0	
Fujairah	0	
Ras Al Khaima	2	
Umm Al Quwain	1	
Children's Height (cm)		
101–120	3	133.1± 17.77
121–140	3	
141–160	3	
Children's Weight (kg)		
16–30	3	35.1± 10.30 (20–55)
31–45	5	
46–60	1	
HbA1c level (%)		
<7.0%	4	7.2± 0.85 (6.4–9)
7.0–8.9%	4	
≥9.0%	1	
Going to school (Yes/No)		
Yes	9	-
No	0	
Age at diagnosis (years)		
0–3	3	4.1± 2.1 (1.3–8)
3–6	5	
6–9	1	
Family history of diabetes		
Yes	0	-
No	9	
Other comorbidities		
Yes	1	-
No	8	

(*Continued*)

Table 2 (Continued).

Characteristics	Frequency, n (%)	Mean ±SD
Duration of use of insulin pump (years)		
≤1 year	4	2.1±1.4 (9moths-1year)
1–2 years	1	
2–3 years	3	
3–4 years	0	
4–5 years	1	
Name of insulin pump used		
Medtronic	5	-
Omnipod DASH	4	
Previous usage of insulin pens		
Yes	9	-
No	0	
Mothers educational level		
High school	2	-
Diploma	1	
Bachelor's degree	4	
Doctorate*	1	

Note: *This mother had two children who met the inclusion criteria and the interview was related to both of them.

Initial Knowledge and Perception About the Use of an Insulin Pump

The participants' initial feelings were mixed between fear and unfamiliarity from the use of new technology, and excitement for the positive change that this technology will bring to their child's life and its quality. For example, a mother said:

> For example, something like this. You take insulin alone. How do you inject insulin? It changes every three days. How does it change? How does it not bother you? I was worried about this; how do you sleep? How do you wake up? How do you take a shower? I didn't imagine it like this. P8.

According to the mothers, the children showed initial resistance because it is a device that should stay in their bodies all the time. However, with time, this was accepted by the children, and they expressed no desire to return to the use of an insulin pen. A mother said:

> She didn't want to use it at first, she was annoyed, then I asked her you want the old 15 injections per day or this and she chose this, and she accepted it. P5.

Results showed that children's initial knowledge of the concept of the pump was very basic and simple, and it improved with time. The knowledge came mainly from their mothers, who simplified it as something beneficial to their bodies. As they grew up, their level of understanding improved, and they became more self-dependent.

Many mothers described their initial thought of the pump as an artificial pancreas "outsider pancreas" with limited knowledge reported. A mother stated:

Table 3 Mothers' Knowledge and Perception of Insulin Pump Use

Subtheme	Codes	Quotes
Initial knowledge and perception about the use of an insulin pump	Initial discomfort and rejection	"Honestly, the first time I installed it, there was something strange on her body, so I was not used to it at first…she did not accept the pump's sensor, it hurt a lot when I used it. " P2
	Initial fear and uncertainty	"At first, I was very scared and nervous…"because I had never tried it before. But, it took me a maximum of a month to change the settings, I was scared because it was new…but when I installed it, because it was new, and I was afraid of the pain" P3 "I was scared. Of course, at first, I was scared. I couldn't imagine how this thing would work….I couldn't imagine how this thing would work. How would it get into the stomach? Where would it be? How would I inject it? I couldn't imagine how it would work" P8
	Availability concern	"Among the things that I noticed is that there is no Omnipod 5 in UAE. What was available is the big one Metronic. Which is recommended by the physician but I refused to buy it" P5
	Happy and comfortable	"Honestly, I was very happy to use it. I do not want to tell you how happy I was…My daughter will be completely cured" P1 "I think it's better Since the child is comfortable with it, It's more comfortable for the mother and the child" P2
	Ease of use and flexibility	"This type will automatically dispense insulin…eating is more flexible with this device, as when we were using the insulin pen, we had to wait 3 hours at least before eating again, which excited me to get it…and its very easy to use so its easy." P6
	Acceptance and adaptation	"In the last month, I consulted a doctor. The doctor convinced him…until the child was convinced to use the pump, we used it… Thank God, he accepts it.insulin pump is a blessing…I was afraid in the beginning, but now I am used to it" P1 "I don't even know how we convinced her, and after continuous convincing, until finally convinced…then I asked her you want the old 15 injections per day or this and she choose this, and she accepted it" P5
	Initial knowledge and thought (a. mothers)	"I heard that there are pumps that have been developed, I searched on YouTube." P1 "Before that, I did not know about it, but when I read about it, I googled it and discovered all the information. I looked at all the data about diabetes, what works and what does not, and so on. " P5
	Initial knowledge and thought (b. mother's perception of their children's knowledge)	"He grew up and understood it…he learns by himself…he told me that I am old enough to calculate my carbs. He reads and calculates the calories and insulin doses by himself. " P1 "She still does not know how to use it, but she knows that this is a diabetes device that has medication. "P5

https://doi.org/10.2147/PPA.S574827

Knowledge improvement with the use of different resources	Diabetes educator role	"The diabetes educators taught me" P1, P2, P4, P5, P7 "The doctor showed me how to install it. Then I started to install it. I had no information until I tried it" P3
	Other healthcare providers role	"And there's also a nutritionist. I go to the nutritionist, and I tell him what my problem is. He gives me the solution, and I go back to the doctor to make sure" P3
	Hospital role	"Yes, we do not receive it until they make sure we know how to use it. " P1, P2 "and the hospital" P4 "There were seminars in the hospital and they trained us for three months. Every month there was one or two seminars." P6
	Self-learning	"I am a teacher at the school, I used to watch on YouTube" P1 "Honestly, I was in groups on Facebook. They were talking about this pump…I kept reading about it…I learned how to use it on my own. I told you about it on Facebook. I used to watch it on YouTube." P2
	Mothers' support groups	"We have a group of mothers. So, we learn from each other" P1 "and the mothers experience from the mothers' group" P4
	Suppling company	"I learned it from a company before taking insulin pump, the session with the company itself" P4 "They taught me, the hospital and the company both were part of the teaching." P5
Diet and insulin management approaches	Device dependent	"I have a device that only reads, it reads on the phone. I use a link to send me notifications, but regarding the carbs, I have apps, but I don't rely on them." P1 "We monitor sugar using a Freestyle sensor" P3
	Applications dependent	"through the application…at the beginning through the diabetic educator and some diabetes calories catalog" P7
	Online platform	"For example, if there is a new meal, my child open Google. Google is the easiest thing for a child. For example, when he is at school, he can directly open Google and see how much carbs he has." P1
	Reliance on Personal experience	"I use the pump itself. There are 24 hours in a day, the pump distributes insulin every hour so that I can control the sugar level. With my experience, I know when there is a drop or increase in sugar level so I do adjustments accordingly. This is my personal experience. Thank God, the doctor supported me with this idea" P2

https://doi.org/10.2147/PPA.S574827

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Table 4 The Clinical, Psychological, and Social Life Impact of Insulin Pump Use

Subtheme	Codes	Quotes
Impact of insulin pump use on children's clinical outcomes	Improved management	"Before using the pump, HbA1c used to be 13–15. Thank God, within 3 months, it has lowered to 7.2, then to 6.5. And now, we're at 6.6" P3 "Glucose level went down…her health got better, her life changed a lot after using the insulin pump." P6
	Dose flexibility	"When we were in the hospital, we had to wait maximum between the first meal and the second, maximum 2.5 to 3 hours. The difference is between the insulin dose and the insulin dose" P2. "now it's more flexible it doesn't have to be very 2 hours it can give doses anytime." P5
	Improved adherence	"he is now very adherent to his medication unlike before. He takes his medication on time because of the easiness of use, while before he used to delay his medicine multiple times." P1 "My daughter is adhered she do not forget however my son he is in another world he often forgets, basically it depends also on the awareness of the child. The pump let me tell you has a huge contribution in improving the situation but if the person is lazy and lacks discipline the pump will not help." P7
	Diet flexibility	"Because he can monitor his food more and he doesn't have to worry about how much he eats. When he was using the insulin pen, he used to hide when he eats something he is not supposed to…it's easier even if he eats a small amount, he can calculate it" P4
	Hospital visits	"Didn't change, we do regular visits every 3 months and we continue to do the same." P1 "Honestly, it did not affect. " P2, P6 "stayed the same. Also being a mother that notices everything, like at night my child will have a raise in his blood sugar, so being aware of these details will prevent you going to the doctor" P3
	Self-management	"he is capable of using it on his own." P1
	Weight impact	"As for her weight, it increased time to time, but that's because she was weak…No, she was full, but when she took insulin, she suddenly gained weight" P2
Impact of the use of insulin pump on mothers' and children's mental health **Children as reported by the mothers**	Improved acceptance	"Now, she is more accepting. Even if she didn't go to nurse, she takes her insulin automatically and eats" P6
	Easy life	"Life became easier for him. When he used to take Insulin pen in school time he used to go to the school nurse during break time, but now he does not have to go to the nurse. So, you can say easiness of use. "P1 "She didn't want to eat, she didn't want to take the insulin pen, because It hurt her. So now the situation has changed 180 degrees, thank God. Thank God." P7
	Mental improvement	"For him, it was like he was a superhero. Thank God, his mental state improved a lot" P3 "No difference, no mental health issues nothing still the same" P7
	Reduced pain stress	"Because the pain was reduced, he felt more comfortable, so he accepted the situation much more than before" P3
Impact of the use of insulin pump on mothers' and children's mental health **Mothers**	Relieved and comfortable	"There is no stress, it is easy to live, it is true that we face some difficulties, in terms of carbs, the body accepts it, but it is very easy, there is no pain, there is no insulin, it is just the pump…psychologically it is comfortable, when you feel comfortable, there is no stress, your mental health becomes perfect, you accept the situation" P3 "Thanks god of course better, the least is that I can sleep comfortably at night, at the beginning from my worries I couldn't sleep at night" P7
	Easier daily routine	"I used to reschedule my plans and outings according to medication timings while now he can take the medication himself." P1 "its like my right hand" P6
	Grateful	"I hope whoever invented the insulin pump goes to heaven." P5
Social impact of the use of insulin pumps on children and their mothers	Daily activities impact	"He plays football; while travelling we take report from the doctor before travelling, every problem has solution " P1 "Now Swimming, exercise He used to like swimming, but we stopped him because their issue with the tape and the pod will be destroyed If he swam…but if he did normal exercise, it would have been possible." P4

Table 5 Challenges Encountered by Mothers and Their Children in the Use of Insulin Pumps

Subtheme	Codes	Quotes
Challenges and concerns faced while using the insulin pump.	Positive feedback	"There is nothing strange about it. There is nothing that worries me… as soon as the doctor tells you, you can use the insulin pump, you don't hesitate. You don't sit like me. I was in a financial situation, to be honest. You don't wait like me…" P8 "On the contrary, it made my son's life much easier. He practices his life very naturally. He plays all the games, all the sports, and there are no problems. No, we travelled with it and everything was fine the facilities at the airport were excellent. My son did not have a scan. Everything was normal. On the contrary, it was very easy"P3
	Skin reactions	"…there was a skin reaction problem. The first time he put it on, he refused to change the place. There was an injury. It lasted three days, but I don't know what happened to the boy. It was like a second degree burn under the Omnipod." P1
	Safety concerns	"But before my child started to use it when we just opened it, the insulin pump was not working… For example, one time we installed the insulin pump, and he went to school, he entered the classroom, and the door hit the pump and it was removed from its place. That day, we were giving him medicine and the sugar was getting higher and higher. We did not know that the device was coming out of its place, but later we found out that the device came out of its place and the insulin did not get into the body…" P1 "When we use the pump, and it doesn't give insulin. For example, if there's an error, it causes the sugar to rise…That it doesn't have specific timings to dispense the medicine, this is the thing that worries me the most." P4
	Daily routine concerns	"When I travel with my family, I keep thinking that it will break and something bad will happen. I'm afraid of that." P2
	Financial experience	The problem is when I buy these as medical equipment's and I have the limit of 5000 dirhams, but they sometimes count it as medicines and they make me pay 30% of the amount, I pay every 3 months 400 dirhams. The insurance company does not know what to categorize it as medical equipment or medicine, so I pay 30% of the price, and honestly, the expenses are high" P2 "We don't pay for anything; the government provides everything for us" P6
Management approaches to the challenges and the need for extra support	Overcoming concerns	"Honestly, one of the things that made me learn and look for myself because I cannot go to the doctor every now and then and you do not find appointments, so I had to do it all on my own… to learn, to look, to try. And sugar is always an experiment, you either succeed or fail"P3 "Yes, I go back directly to the insulin pump company, even if at night they have emergency number that we contact." P6
	Management approach	"There was an issue that the pump leaves mark on the skin that need time to go from the skin plus the use of creams so that it goes" P2 "If something like this happens, we either change it or we use the external insulin pen… We used creams and spray to remove the tape because it's an adhesive and it lasts for a long time So we have to use creams…P4
	Support needed	"Honestly, I speak from my field. As a teacher in the school, I have support…In schools, they do Diabetes day, they celebrate on this day. We share awareness videos. For them too. Thank God." P1 "As a family, you need more support, not only financial support, more awareness. All the children who are in a private or public hospital should have an awareness and training workshop, there are young children who do not understand this. There should be events like this organized by the state" P8
Recommendations to other mothers	Advice to mothers	"I advise everyone who has not tried the pump. I really advise them. Yes, from an early age. When my son was 3.5 or 3.7 years old, before he was 4 years old, I gave him a pump. It does not have a specific time. I wish I had not tortured my son in the insulin pen before I started with the pump" P3 "It will be your right hand. It will change your life before your child's life, even in school it is so much easier" P6
	Reflection on pump use	" If I went back in time, I would use it, but as I said, the age. But I judge for my child, As I said, they are twins. On that basis, I would refuse. But maybe as if they are single. No, on the contrary. The mother sees the nature of her child." P1 "If I went back in time, I would have learned how to calculate the carbs from the start, I would go directly to the use of insulin pump, would not have waited. I made my child follow a low carb diet for a period of time until the Doctor advised me to stop this diet as she is a child that is still growing, I even was mentally tired when I made her follow the low carb diet" P2

> Honestly, I thought it was an outsider pancreas. I thought it was an artificial pancreas. P2

Knowledge Improvement Using Different Resources

Over time, the knowledge becomes adequate with positive perception as it was supplemented and expanded by various sources, including a diabetes educator, self-learning from online resources, and mothers' support groups. Mothers searched about the insulin pump and its benefits over the insulin pens and decided to switch, aiming to reduce the suffering experienced by their child while injecting insulin using a pen multiple times a day. This decision was further encouraged by the physicians and supported by the diabetes educator in the hospital.

6 out the 8 Mothers appreciated the role of the healthcare providers, mainly the physicians and diabetes educators, who supported them. As they mentioned:

> The diabetes educators taught me P1, P2, P4, P5, P7 and The doctor showed me how to install it. Then I started to install it. I had no information until I tried it P3.

The role of the pharmacist was addressed by one mother as a primary, reliable, constant source of information in case she had a question. Another mother appraised the nurses' role in providing one-to-one educational sessions.

Diet and Insulin Management Approaches

Mothers showed different approaches to measuring the blood sugar and managing their children's diet. Some used sensors for monitoring blood sugar, while others did regular blood checks due to the high expense of the sensor and its noise. For the diet, few mothers used carb-counting applications, whereas others sought aid from the nutritionist, and the majority considered themselves experts and stated self-dependency and referred to Google or the leaflets on the package of the food supplements. One mother even showed that her 12-year-old child started to be self-dependent in counting the carbs, she stated:

> For example, if there is a new meal, my child opens Google. Google is the easiest thing for a child. For example, when he is at school, he can directly open Google and see how many carbs he has. P1

Theme 2: The Clinical, Psychological, and Social Impact of Insulin Pump Use

In general, the impact of insulin pump use on mothers and their children was positive. Mothers mentioned that using the insulin pump affected their lives positively as "everything changed after using the pump", reducing stress, allowing for flexibility in diet, and improving their children's quality of life. Table 4 illustrates the impact of insulin pump use on different aspects of children's and their mothers' lives.

Advantages of Insulin Pump Use on Children's Clinical Outcomes

All participants agreed that the use of an insulin pump provided an adequate management of the blood glucose levels and a visible improvement in the HbA1c level compared with the previous insulin pen treatment. A mother said:

> Thank God, the sugar level improved, as you can see in HbA1c, the sugar level decreased a lot. P1

Mothers mostly mentioned that the use of an insulin pump improved their child's adherence due to the ease of use, being easily portable, and fewer injections required than the insulin pen. In contrast, one mother believed there should be no effect whether it is an insulin pen or pump, as the adherence of the child to the medication falls within the mother's responsibility. She said:

> I made her adhere, it is my responsibility, so I give her all the medications on time.P5.

Additionally, the use of an insulin pump reduced frequent hospital visits, as stated by most mothers. Mothers' responses to their children's ability to manage and control their sugar levels varied depending on their children's age. Younger children who are 5 years old cannot have full control by themselves, and they need their mothers' assistance.

However, mothers mentioned that those children were fully aware of their condition, and when the sugar level is high or low. In contrast, older children were more self-dependent and could deal with their conditions independently.

One mother addressed the importance of having a sensor for younger children, as it will ring an alarm when the sugar level is irregular. She said:

> If there was a sensor, for a younger child, this sensor is important for them. For me, I have an older son, so I don't need it. But for young children, this sensor is important. Because it's a warning signal P8

The mothers mentioned that their children's food intake has improved with the use of the insulin pump, their appetite increased, and they wanted to try new food, having freedom in their food choices with no restrictions, less stress, and more organized eating habits.

Impact of the Use of Insulin Pump on Mothers' and Children's Mental Health

Mothers explained that initially their children were afraid and nervous when they started using the pump. Some stated that their children refused to go to school while wearing the pump. With time, they adapted, and the fear shifted to acceptance and happiness as they experienced less pain, more engagement with their friends at school, and an easier and more comfortable life than before. A mother said:

> For him, it was like he was a superhero. Thank God, his mental state improved a lot. Because the pain was reduced, he felt more comfortable, so he accepted the situation much more than before. P3.

Two mothers illustrated the noticeable positive shift in their son's mental health during school time after using the pump. They explained how their sons isolated themselves from their classmates and preferred to eat privately to avoid drawing attention or questions when they were using the insulin pen. one said:

> Before, he was nervous, he was upset, he would go to the nurse and say, I'm not playing with the children. He used to say, I don't want to eat, I don't want to eat. He would go to the nurse and eat in front of her, this affected him a lot. Especially in the first two years, he didn't enjoy school at all. He hated school. After using the insulin pump… he would go to school and enjoy his break with the children and the adults who were playing. He used to say now I don't worry about them at all. P8

Mental health also improved among mothers after the introduction of an insulin pump in their children's lives.

Social Impact of the Use of Insulin Pumps on Children and Their Mothers

According to the mothers, there was little to no negative impact on their children's daily activities from using the insulin pump. Some restrictions and worries were reported from a few mothers during travelling, exercising, and swimming, whereas others described a normal, active lifestyle for their children.

However, other mothers stated "every problem has solution" showing their ability to overcome these restrictions. For example, during travelling, they prepare a medical report from the hospital to ensure safe travel "while travelling we take report from the doctor before travelling" P1.

Some mothers reported receiving support from the government and other institutions, which positively affected their social life. Local participants received full funding from the government. Additionally, non-local participants benefit from different sources of funding aimed at supporting children with diabetes. For example, one participant acknowledged the support from the charitable organizations that provided the pump for her child. All mothers were grateful for the role of the UAE government in supporting children with diabetes.

Theme 3: Challenges Faced and Mothers' Recommendations

Challenges and Concerns Faced While Using the Insulin Pump

Generally, the mothers appreciated the use of new technology in making their children's lives normal and easier. A mother said,

> On the contrary, it made my son's life much easier. He practices his life very naturally. He plays all the games, all the sports, and there are no problems.P3.

However, most mothers were concerned about the adverse events from the insulin pump, including sudden device malfunction and wrong placement of the cannula, leading to spikes in the blood sugar and an increase in ketone levels. They shared several stories about their children, where improper insulin pump placement led to complications and required immediate hospitalization, raising safety issues with the pump. A mother stated:

> We put a pump on her. Then she slept, keeping in mind that the pump was new, we kept it for three days, so when she woke up her blood sugar was high, to eventually find out that the pump needle was not fully entered inside the body so the insulin was not reaching her body, her ketone was 5 then went to the hospital and stayed there for 2 days, it was due to inappropriate placement. P2

Skin irritation and infection were also mentioned as adverse reactions caused by the use of the pump, leaving marks on the skin. There was a near consensus about the suitable age to use an insulin pump. They said it is better to start at a young age so they adapt to it more easily, while only one mother insisted on using it when the child is 11–12 years old.

Regardless of their financial category, all participants reported additional expenses for device accessories and maintenance, which could be an added burden. Some expressed concerns about the high costs and financial strain associated with insulin pump use.

> The financial impact is more, honestly…It's expensive P8

Addressing the Challenges and the Need for Extra Support

The mothers addressed these challenges by following the physicians' instructions, using Google, or their mothers' WhatsApp support groups. For skin reactions, they used creams, protective tissue, and rotated the locations while inserting the canula of the insulin pump. If the device broke for any reason, the participants used to replace it.

Two participants believed that no additional support was necessary, as comprehensive assistance was already available, including support in schools, awareness programs, activities, and parental guidance. The others addressed the need for more support and assistance in different ways. One participant reported the need for a faster response from the company that provides the pump, as they usually have a delay in their answers. Another participant suggested that companies should offer a one-month trial period before purchase, allowing children to determine whether they are comfortable using the device. Some mentioned that their children require more medical support and faster access to care, prioritizing their mental health. The need for more training for mothers, staff at schools and supportive society was also addressed,

> Yes, I need more learning, I applied for the new Insulin Pump even though I don't know what's the benefits of it, so I am waiting till I got the approval, and they train me on how to use it. P2.

> When a child sees a diabetic baby with a pump, he feels normal. He does not feel alone. Now he is the only child with diabetes. He always asks me why only me? When we go out as a group of mothers with diabetes, I feel like it supports my son. Or we have more diabetic meetings and activities. I wish there was more awareness regarding diabetes. P3

Recommendations to Other Mothers

All participants provided positive feedback, highly praising and recommending the use of the insulin pump. The mothers advised others not to fear starting insulin pump therapy, emphasizing the importance of starting at the right age, learning to count carbohydrates, and ensuring the child's acceptance of the device. They described the pump as life-changing, bringing peace of mind and a sense of relief for both the mother and the child.

50% of the mothers expressed regret over delaying the use of the insulin pump, wishing they had started sooner. Additionally, one participant wished she had learned carbohydrate counting earlier, as it would have made her experience much smoother. Another mother suggested that the decision to start the insulin pump should be based on the child's individual needs, as mothers know their children best.

Discussion

This study assessed the mothers' perspectives on various aspects of insulin pump usage among their children. A broader look at the results showed that mothers found the insulin pump device useful, while there were also multiple challenges. A more detailed discussion on specific themes analyzed in this research is provided below.

Theme 1: Initial Knowledge and Perception About the Use of an Insulin Pump

The initial perception among mothers fluctuated between fear and excitement regarding the use of new technology. Children also reported initial rejection of the use of the insulin pump. As another study mentioned, some parents heard positive things about diabetes technologies, yet some families had concerns about using the insulin pump, like child willingness and its cost.[28] However, over time, mothers and their children changed their perceptions of the insulin pump and accepted it, and even called it an outsider pancreas with no willingness to go back to insulin pens. In another study, the parents expressed their willingness to use the insulin pump and consider it the future of diabetes management.[29]

Knowledge Improvement Using Different Resources

Respondents obtained knowledge from different sources, including physicians and even self-learning. All parents obtained the information from direct resources such as physicians, but a good number also used technology to get the information needed.[28] The mothers praised the healthcare team, especially their physicians and diabetes educators. Almost all mothers received training session from the hospital or the device supplying company. Several factors including effective communication between the patient and the care provider, patient education about diabetes and emotional support, will enhance the patient's adherence to the insulin pump.[30]

Diet and Insulin Management Approaches

Different methods were followed by the mothers to measure and monitor their children's insulin and diet. Using an insulin pump, continuous glucose monitoring as well as following a nutritional strategy like advanced carbohydrate counting maximized the efficacy and enhanced the quality of life of T1DM.[31,32] Our findings are supported by other studies which reported dietary management was taught by a nutritionist through educational classes, and by learning from other parents, but also "self-taught" was how most parents described themselves.[33]

Theme 2: The Impact of Insulin Pump Use on the Clinical, Psychological, and Social Life

The current study's findings indicated that insulin pump therapy has a positive impact on children, including better glycemic control, improved adherence to insulin doses, improved HbA1c levels, and reduced frequency of hospital visits. These results are supported by other findings.[11] A multicenter study showed improved clinical outcomes of early initiation of insulin pump therapy in children.[34] Further, a German study concluded that the use of insulin pumps reduced long-term hospital stays among pediatric patients.[35]

Results of this study showed a flexibility in food choices with minimal restriction after using the pump, which lessened the stress on mothers and their children. Insulin pump therapy provides greater flexibility in meal timing and food choices for patients.[36]

Mental Health

Results of this study revealed initial fear and hesitation among children when they started using the pump due to concerns about wearing a device all the time and potential discomfort. Initially they were apprehensive to interact with their classmates but later they were more accepting of the device. A case-control study conducted in Egypt showed that children with CSII have better health-related quality of life and confidence in diabetes self-management scores than those on MDI,[11] and a cross-sectional study conducted in Saudi Arabia revealed the same.[37] However, a randomized control trial showed that CSII alone does not appear to significantly improve neuropsychological outcomes in children with T1DM.[38]

Social

Results of this research showed some restrictions while using the pump on certain children's activities, especially during swimming, traveling, and exercising. However, many mothers denied these restrictions, describing a normal, active lifestyle among their children. Insulin pumps can generally be disconnected for no more than an hour during activities like swimming, showering, or participating in high-contact sports.[39,40]

Theme 3: Challenges and Concerns Faced While Using the Insulin Pump

Adverse Events

Mothers generally did not encounter serious obstacles; quite the opposite, it offered them and their children comfort and a good quality of life with few restrictions. However, some mothers expressed concerns about the adverse effects of the pump, such as technical malfunction and skin reactions, based on past incidents their children had experienced. Their primary concern was that the pump might stop functioning or become dislodged without them noticing. The technical faults were mainly due to the dislodged cannula or sport-related incidents where the pump stopped releasing insulin, and the children experienced severe hyperglycaemia and diabetic ketoacidosis that required immediate hospitalization. Similar findings are reported in the literature.[39,41] A systematic review revealed that the increased use of insulin pump, dermatological concerns became more common. Mothers in the current study reported mild skin reactions as an adverse effect of pump use, which they managed by applying topical creams and regularly rotating the pump insertion sites. To avoid this, it is recommended to insert the pump to dry non-broken skin and to rotate the insertion site every three days.[42]

Moreover, to prevent the recurrence of such incidents, some mothers reported using protective tissues. Meser et al recommended various techniques to reduce the likelihood of hypersensitivity reactions, such as the use of a hydrocolloid patch that acts as a barrier between the adhesive and the skin.[42] Another study showed the advantage of the use of the corticosteroid medication, fluticasone propionate spray to the cutaneous lesions. The researchers demonstrated that applying two sprays to the skin prior the insertion of the sensor was beneficial in avoiding the incidence of contact dermatitis.[43]

The challenges encountered by mothers were mainly addressed by following guidance from healthcare providers, searching for information online, or seeking advice from experienced mothers through a WhatsApp group chat. Most mothers advised the early usage of the pump at a younger age. According to the International Society for Pediatric and Adolescent Diabetes (ISPAD) guidelines 2022, insulin pump therapy is the recommended insulin delivery method for young children under 7 years old with T1DM, provided it is accessible and affordable.[44]

In this study, our findings identified two major groups based on financial aspects related to insulin pump access. The first group consisted of UAE nationals fully covered by the government. The second group included non-nationals who either had insurance coverage or relied on charitable organizations for pump provision. Additionally, some of those non-nationals are without any financial assistance and depend solely on self-payment. All mothers agreed that the device accessories were not covered by insurance and they had to purchase them.[39]

The literature acknowledged the dramatic rise in insulin prices during recent years.[45,46] A qualitative study conducted in the United States to explore the views of parents with children with T1DM about the financial aspects and expenses revealed that supporting families requires an understanding of the financial challenges parents face and their impact on family well-being.[46]

Mothers' Recommendations and Advice

All participants recommended the use of insulin pump therapy, as it ensures proper growth for their child, manages their metabolic conditions, and reduces the risk of long-term complications. They stated that they regret not initiating the pump therapy earlier, as it would have saved them a lot of time and struggle. Some participants stated that the school staff lacked knowledge and were not able to handle the children correctly, which resulted in multiple incidents leading to hospitalization. Other findings suggest there is insufficiency in the training of school nurses regarding diabetes knowledge.[47–49] A study reveals that school nurses encountered obstacles in finding training on how to properly manage the pump use and the study suggested that there are currently no clear guidelines in paediatric diabetes management in

schools where they spend most of their weekdays, and recommended enhancing the teamwork based system between school nurses and healthcare providers to ensure effective diabetes management.[50]

A qualitative study explored the preferences of youth and their parents regarding an ideal artificial pancreas system. Participants suggested a variety of innovative features aimed at improving both ease of use and safety, such as ketone monitoring integration, voice command functionality, and location tracking.[51]

Study Strengths and Limitations

This study has several notable strengths. Its qualitative design enabled an in-depth exploration of mothers' perspectives on insulin pump use in their children, providing rich insights. Furthermore, the study included participants from diverse demographic backgrounds, enhancing the breadth and relevance of the findings. Importantly, this is the first study of its kind to be conducted in the UAE, contributing to a better understanding of diabetes management.

However, this study has some limitations. The sample did not include non-Arab participants, which may limit the diversity of perspectives captured. Additionally, mothers were recruited from only four of the seven emirates. Furthermore, the use of purposive sampling, while effective for reaching a specific population, may have introduced selection bias and limited the generalizability of the results. Another possible limitation of the study is the small sample size (n=8) of the study. Though we aimed to continue as much as sample, the study was stopped after authors confirmed that no new responses were being obtained by doing further interviews and the responses reached saturation. However, it is remotely possible that the respondents were relatively homogenous and this may have contributed to getting similar responses.

Recommendations

Based on the findings of this study, several recommendations can be proposed to improve insulin pump use and support for families managing childhood diabetes in the UAE. There is a clear need to strengthen educational and support systems for parents. Healthcare providers should offer comprehensive training and continuous education on insulin pump use, including troubleshooting common issues. Additionally, developing accessible, evidence-based resources in multiple languages could help reduce parents' reliance on informal sources such as social media or peer advice.

The study also highlighted the value of peer support, particularly through platforms like WhatsApp, where experienced mothers shared practical advice. Formalizing such support networks through healthcare institutions or patient organizations could provide structured, reliable guidance and emotional support for newly diagnosed families.

Furthermore, concerns about device-related issues, such as technical malfunctions, skin irritation, and accidental dislodgement, should be addressed by both healthcare providers and device manufacturers. Innovations like improved adhesives, waterproofing, and early alert systems could enhance safety and usability, particularly during physical activities or when parents are not present. The authors would also like to recommend future studies on specific themes generated by this research and on the children's perspective on the use of an insulin pump. A detailed quantitative study involving more mothers, preferably from a large pool across multiple countries, can help validate the qualitative findings and help associate them with demographics and other related parameters. This can further provide the opportunity to device interventions targeted at specific patient group.

Conclusions

Study findings clearly show the positive impact of technology on managing chronic diseases like diabetes. Mothers appreciated the technology, noticed better glycaemic control, and found their initially reluctant children were positive about insulin pump use. Though mothers found the benefits outweigh the drawbacks, they raised concerns about device failure, which in a type 1 diabetes child can be dangerous. Improved education to parents, involvement of the child as the end-user, and more failproof and patient-friendly insulin pumps can further add to the benefits of insulin pumps. More detailed analysis on glycaemic control, pharmacoeconomic evaluation, and quality of life studies can further enhance the widespread use of this novel technology, which can be a game-changer in diabetes management.

Acknowledgments

The authors are grateful to the participating mothers who spent their valuable time to provide their feedback. Their cooperation, openness, and the generous time they dedicated to discussing their journeys are deeply appreciated. Authors further wish to thank Dr. Ayat Ahmed Farajallah, Lecturer at College of Humanities and Sciences, Ajman University, who validated the two Arabic versions of each participant's transcript. The authors would also like to acknowledge Dr. Wasiq Ali Khan, RPh, Managing Director of Makkah Group of Pharmacies, United Arab Emirates, for facilitating the interviewing process. The authors would also like to thank Ajman University for paying the article processing fee.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

The authors received no funding for this study.

Disclosure

The authors declare that they have no conflict of interests.

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