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Automated Insulin Delivery Systems: Hopes and Expectations of Family Members

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Abstract

Background: This study examines the hopes and expectations that children, adolescents, and adults with type 1 diabetes and their families have for new automated insulin delivery systems. The study also aims to examine how the automated insulin delivery system may impact family functioning and individual members' psychosocial adjustment.

Methods: Forty-eight semistructured focus groups ($n=195$) and 89 individual interviews were conducted with children, adolescents, and adults with type 1 diabetes and parents and partners. Coders reviewed results in key themes most likely to contain references to the family system. Clusters were analyzed using thematic analysis to identify participants' salient hopes and expectations of how new technology may impact family relationships and individual psychosocial functioning.

Results: Three main themes emerged for participants' hopes and expectations for implementation of the automated insulin delivery system. First, there is an expectation that this diabetes technology will alleviate diabetes-specific worry and burden for the people with diabetes and other family members. Second, there is also hope that this system may reduce day-to-day stress and, third, improve family relationships.

Conclusions: The unique perspective of a broad age group provides insight into how individuals and families creatively address the multiple tasks required in daily diabetes management. Study findings elucidate the very high hopes and expectations held by those managing type 1 diabetes and the impact this new technology may have on family relationships. Awareness of these hopes and expectations is important for developers and clinicians in addressing potential challenges to uptake and to ensure that expectations are set appropriately.

Keywords: Type 1 diabetes, Technology, Family systems.

Introduction

RECENT DEVELOPMENTS IN DIABETES TECHNOLOGY (e.g., automated insulin delivery systems) and increased use of continuous glucose monitors (CGMs) and continuous subcutaneous insulin infusion systems (CSIs or pumps) are changing type 1 diabetes (T1D) management for many. Technology advancements provide opportunities to improve glycemic control (e.g., reduced fluctuations in blood

glucose values and fewer incidents of hypo- or hyperglycemia) among persons with diabetes (PWD).^{1,2}

Use of more advanced diabetes technology may improve quality of life among families of youth and adults with T1D.^{3,4} Thus, these technologies have the potential to positively change the ways in which T1D impacts family functioning and psychosocial adjustment.⁴⁻⁷ Understanding these relationships is important, as family cohesion, relationship quality, and psychosocial functioning are associated with

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improved adherence and glycemic control in PWD across the lifespan.^{8–10}

Family cohesion is important as it may impact diabetes management and health outcomes at each developmental stage.^{8–10} The emotional connectedness between family members is strongly associated with improved adherence,¹⁰ psychosocial functioning,^{11,12} and glycemic control.^{9,13}

In adolescence, a developmental period in which glycemic control often declines, a cohesive family environment, with fewer conflicts and more support, can protect against worsening glycemic control.⁸ However, as diabetes management transitions from parent to adolescent, family conflict often increases. This conflict often centers around blood glucose monitoring and can have a negative impact on glycemic control, as well as increase adolescent anxiety.^{14,15} Thus, family communication and cohesion are important during this time of transition. Parental support continues to be predictive of increased self-care and better psychological well-being throughout emerging adulthood.¹⁶

Similarly, among married adults, research shows a positive association between relationship satisfaction and improved diabetes-specific self-care.^{17,18} Relationship quality is also associated with increased satisfaction with the diabetes care regimen and has a significant impact on perceived stress.^{18,19} However, diabetes-specific conflict can arise when the PWD is unwilling to collaborate with their partner in managing daily diabetes care, leaving their partner feeling helpless in assisting with their care.³

The ways in which families function and relate to each other are highly influenced by how individual family members respond to, and cope with, diabetes-specific worries and stress, and can strengthen or weaken family cohesion.^{13,20–22} Although stress, in some cases, can positively impact diabetes management, resulting in more frequent blood glucose monitoring and better regimen adherence, it can also lead to decreased monitoring and adherence.²⁰ Within the family system, stress experienced by one individual can affect other family members.⁶ Parenting stress, in particular, is related to how children manage their diabetes and can impact communication and collaboration within the family system.²³

The impact of existing technologies such as CSII and CGMs on family functioning is mixed, impacted by methodological limitations,^{4,24} and in the case of CGMs, on-going technological improvements²⁵ and frequency of use.^{4,5} Although technology users have same or higher quality of life than nontechnology users,^{4,5} recent studies found no relationship between CGM use and psychosocial functioning among youth with T1D and their parents,²⁶ or CGM use and diabetes distress in adults with T1D.⁵ However, lower levels of stress are reported by parents whose children use advanced diabetes technology, namely CSII, than by parents whose children use injections.^{6,7}

Despite the extensive literature on diabetes, family cohesion, and psychosocial functioning, exploration of the expectations and hopes for how diabetes technologies will affect family relationships is required. This qualitative study examines the expectations PWD and their loved ones have for how automated insulin delivery systems may impact family functioning and individual members' psychosocial adjustment.

Materials and Methods

The INSPIRE study (Insulin Delivery Systems: Perceptions, Ideas, Reflections and Expectations) was conducted at the Ann & Robert H. Lurie Children's Hospital of Chicago, Stanford University, Joslin Diabetes Center, and Bournemouth University in the United Kingdom.²⁷ Recruitment of participants ($N=284$) took place through informational flyers posted in the clinics and hospitals at each research site, as well as online through diabetes blogs for adults and families with diabetes. Families of children receiving diabetes care at each of the four research sites were also reached through direct mail with study information and requests to participate.

PWD who were 8 years or older, and their parent(s) or partners, were invited to participate if they had been diagnosed with diabetes for at least a year, and had no other chronic diseases. Children (age 9–11; $n=16$), adolescents (age 12–20; $n=35$), and adults (age 21 and older; $n=113$) with T1D, and parents ($n=65$) and partners ($n=55$) of individuals with T1D participated in 1 of 48 focus groups ($n=195$) or in semistructured interviews ($n=89$) (Table 1). Focus groups were facilitated separately for each age group to encourage participation and ranged in size from two participants to eight participants.

A series of standard questions was used in focus groups and interviews, across all age groups. The standard questions fell into nine specific categories: (1) general understanding of the system, (2) hopes (and expectations) of the system, (3) physical experiences of the system, (4) benefits to use, (5) barriers to use, (6) cost/benefit analysis of using the system, (7) trusting the system, (8) impact on loved ones/relationships, and (9) wrap up/additional information added by participants. A general definition of the automated insulin delivery system was not provided, as it was a study aim to determine what individuals thought/expected of this new technology. Rather, initial questions asked participants to describe the system and its components that allowed interviewers to clarify misperceptions or guide participants in identifying the basic components of an automated insulin delivery system (e.g., CSII, CGM, and receiver/algorithm working together).

The Institutional Review Boards of each institution approved the protocol, and all participants provided informed consent/assent as required by their respective institutions. Results from the INSPIRE study informed the development of age- and role-specific psychosocial questionnaires assessing barriers to uptake of these systems.

Verbatim transcripts of focus group and interview audio recordings were created by an independent, HIPAA compliant, service provider (Medikin, Inc., New York, NY). Deidentified transcripts were entered into NVivo 11.2 qualitative software (QSR International, Victoria, Australia) and coded by a team of 9 coders using a standardized scheme of 24 a priori codes that were condensed to 12 thematic clusters²⁷ (refer to Naranjo et al. for a detailed explanation of this process). These thematic clusters represented closely related codes grouped under the headings: human versus system, technology, glycemic control, trust and control, nighttime, relationships, context (the context of living with T1D), quality of life, features, concerns, burden, and financial impact.²⁷

Family systems data analysis

Clusters were analyzed using thematic analysis to identify participants' salient hopes and expectations of how these

TABLE 1. CHARACTERISTICS OF PARTICIPANTS AND QUALITATIVE DATA SOURCES

<i>Descriptive characteristics of participants and data sources</i>	<i>Means or percentages with ranges</i>
Overall number of focus groups	48
Overall number of semistructured interviews	89
Total number of participants, <i>n</i>	284
Adults with type 1 diabetes, <i>n</i>	113
Data from semistructured interview	31.0%
Age, years	39.5 (18–77)
Female	70.8%
Race/ethnicity	
Black/African American	1.8%
Hispanic/Latino	0.9%
Asian/Pacific Islander	3.5%
American	
White, non-Hispanic	92.0%
Other	0.9%
Bachelor's degree or higher education	73.5%
Current pump use	72.6%
Current CGM use	54.5%
Hemoglobin A1c	58 mmol/mol, 31–105 mmol/mol (7.5%, 5.0%–11.8%)
Adolescents/young adults with type 1 diabetes, <i>n</i>	35
Data from semistructured interview	45.7%
Age, years	14.7 (12–20)
Children with type 1 diabetes, <i>n</i>	16
Data from semistructured interview	43.8%
Age, years	10.3 (9–11)
Parents of children with type 1 diabetes, <i>n</i>	65
Data from semistructured interview	25.1%
Relationship with child	
Mother	79.7%
Father	17.2%
Other	1.5%
Child's race/ethnicity	
Black/African American	1.5%
Hispanic/Latino	5.3%
Asian/Pacific Islander	0.0%
American	
White, non-Hispanic	89.9%
Other	3.3%
Child's current pump use	71.8%
Child's current CGM use	53.8%
Child's hemoglobin A1c	65 mmol/mol, 46–119 mmol/mol (8.1%, 6.4%–13.0%)
Partners of people with type 1 diabetes, <i>n</i>	55
Data from semistructured interview	20.0%

Adapted from Naranjo et al.²⁷ Adapted with permission. CGMs, continuous glucose monitors.

systems may impact family relationships.²⁸ Coders (K.P.G., A.J.) independently reviewed all data within the 12 thematic clusters, and selected the 4 clusters that most often captured participant discussions about the system's expected impact on family relationships: burden, context, quality of life, and relationships. The remaining clusters did not contain direct references to family relationships.

Each of the four thematic clusters included five source documents, one source document from each of the five participant groups (child, adolescent, and adult with T1D, parents of PWD, and partners of PWD). By analyzing the data separately for each of these five subgroups, coders were able to identify any salient developmental or role-related differences between respondents (e.g., adults vs. child; parent vs. partner). Coders (K.P.G., A.J.) developed a set of secondary a priori and emergent codes based on existing literature examining the impact of T1D on the family system and salient themes found in the 20 source documents.

Each of the 20 source documents was individually coded by K.P.G., A.J., and L.E.G.W. Coders met after coding the same 3 source documents and again after each individual coded an additional 10 source documents to discuss consensus and refine coding definitions. For example, the Burden and Worry codes were merged into one code due to large overlap in data and participants' interchangeable use of the terms.

The final six secondary codes included relationship quality, conflict, burden and worry, collaboration, stress, and cohesion. All codes were specific to how participants believed these systems would affect family interactions. For example, burden and worry included comments on how the automated delivery system would change diabetes care and how that would decrease the burden the individual and other family members experienced. At coding completion, areas of disagreement were discussed, and coders chose whether to recode the data. The final unweighted Cohen's Kappa coefficient for each set of coders (K.P.G.–L.E.G.W., K.P.G.–A.J., A.J.–L.E.G.W.) was 0.93, 0.82, and 0.83, respectively. Data analyses were conducted using NVivo 11.2 (QSR International).

Results

The coding team identified three emerging themes at the group level (children, adolescents, and adults with T1D, and parents and partners of PWD): an automated insulin delivery system may relieve the constant burden and worry about diabetes, lives may become less stressful with this new technology, and an automated insulin delivery system may improve family relationships.

Theme 1: An automated insulin delivery system may relieve constant burden and worry

Universally, participants discussed how diabetes played a dominant role in family relationships due to the amount of attention and care required in managing the day-to-day tasks. With new systems removing some of the burden through automation of many of these tasks, participants believed/anticipated that life would become less about diabetes and more about life.

- [Teen] Honestly, it's one of the things that bugs me the most about it. I'm a burden to my parents obviously. Obviously, I'm not but I always worry about that, because they're having to get up all the time. So, if I can

have it where I did all the work in the day and then during the night it was absolutely fine...I can't tell you how much that would make a difference for me, really.

- [Parent] Perhaps it can bring back some spontaneity and not having to think ahead and too much planning and organizing and more freedom, I think, and sleep at night.
- [Adult] My parents live across the country...and I know that it is incredibly stressful to them. I know my mom still checks in on me and if she hasn't heard from me in a day and is texting "Are you okay" and I don't think other parents worry like that...I definitely think that [the automated insulin delivery system] would improve my parents' stress level and our relationship...could be more about us and things in the world other than diabetes and then worrying about my livelihood on a daily basis. That would be phenomenal.
- [Partner] It would enact a little bit of freedom. I think that's probably what it would do, is it [would give] more freedom [to] our family and more time to relax.

Adult participants with T1D and their partners expressed hope that an automated insulin delivery system would improve glycemic control and reduce the number of incidents in which hypoglycemic events disrupt daily activities and responsibilities, which often results in shifting daily responsibilities to their partners.

- [Adult] If it is going to mitigate the highs and take the high "grumpies" away and the lows away, the panicky feeling when I'm with my kids and have to say "Mommy comes first right now, you have to wait until I'm done being low," if it is going to eliminate a lot of that then I think the benefit would be huge.
- [Partner] I try to be very sympathetic. I'd like to say I am, but there are those times where I will come home in the afternoon from work, and she'll be in bed...And she'll say "What time is it?" And I'll say "it's 5:30?" And she'll say "Oh my God, I've been sleeping for two and a half hours." That will get me annoyed. And I won't say anything to her, but internally it will bother me, because I can't understand what this disease is doing to her. And I try to [be] sympathetic and I try to be caring. We'll have to take the kids somewhere, and she'll say "I can't drive right now, I'm feeling shaky." And I'll have to take the kids somewhere. So, I think that it would certainly help our relationship.

Parent participants expressed hope that by decreasing the number and frequency of daily diabetes tasks, while simultaneously keeping blood glucoses in range, an automated insulin delivery system would decrease the need for parental interference, reminders, and "nagging." Keenly aware of their children's frustration with interruptions, parents reported that this frustration led to tension and animosity between caregivers and children.

- [Parent] People for the study came over and asked what was the worst about having type 1 diabetes and he said "The worst is that my mom calls me all the time when I am at the skate park to ask what my blood sugar is" and I said "There is some good news that this new technology is coming out and I only have to call you when you are high or low."

- [Parent] If there was a system that my son didn't have to constantly think about all day and wasn't nagged and every time he saw his parents they didn't...say to him have you done this, have you done that, whatever. That would be an enormous help.

Many participants and their family members shared worries about maintaining in-range glucose values and the possibility of short- and long-term complications. This theme was especially prevalent in conversations with parents and partners, expressing fears of being unable to wake their children or partners in the morning, and concerns of the PWD being unable to get the help they need to treat hypoglycemia when alone. Partners also expressed apprehension about diabetes complications hindering their ability to grow old together.

- [Adult] I think for my husband, [this system] would bring him peace of mind...it would be extra assurance that I am doing everything possible to live a long life and will make it into retirement along with him...and be able to say "I've got the best tools possible, my A1C is in range because of [this technology]." For me that would be huge, that would be really big and an expectation.
- [Parent] She's going to be more of a normal kid and get to cause me worry about other things not diabetes related there are all kinds of worries. There's the short term: "How's tonight going to go? Am I going to get any sleep?" But there's the long term: "What's going to happen in college? Are our daughters going to be able to have normal pregnancies? Yes, but it takes a lot of work. How is that going to go? Are my grandchildren going to have Type 1?" All of those things are things that I think parents worry about, and the easier we make this disease to manage, the less of an issue all of those things are.
- [Partner] It would just take a huge worry off her mind, my mind, her son's mind. We wouldn't be as worried as to what her day-to-day blood sugars are. I probably wouldn't be as worried about what her longevity is going to be like...Longevity has improved but there are still people in their 20s and 30s ending up on dialysis...I just think this would, again, take that constant anxiety away.

Theme 2: An automated delivery system may lead to decreased family stress

Many participants reported that a decrease in burden and worry would likely relieve stress. Diabetes-specific stress is not only experienced by the PWD and those supporting the individual; parents often reported that stress can permeate relationships with other individuals in the family. Parents felt that if these systems could relieve burden on the PWD, levels of stress may decrease more broadly across other family members.

- [Parent] When your child's been diagnosed, your immediate thoughts are for them. But in fact, diabetes doesn't just impact the child that's diagnosed. It impacts the whole family. And so, if there is a way of managing the treatment better, then it would impact the

whole family. It's not just mom and dad. It's the other siblings as well.

- [Parent] We think about [diabetes]...from when we get up to when we go to bed and all throughout the day and we love the guy so much and we just want him to have a good healthy quality of life and if this has any aid in doing so it would be a big relief off of us....I think it is just going to help us relieve some of the stress if [the automated insulin delivery system] does some of the things we are hoping it is going to do, what it is capable of doing.

It is perhaps unsurprising that participants reported stress often arising for families around food. Parent participants expressed hope that these systems might alleviate some of the stress associated with counting carbohydrates and bolusing, as both tasks can impact social activities and relationships.

- [Parent] So, we don't have to sit there and check her blood sugars and then do all the math calculations, do a correction and then cover for carbs...When we have people over or she has friends over, she is just sitting down to eat while everyone else is like up and gone, and they are off playing, and she is just still sitting there like with a pout face. But she has to eat those carbs because she just covered...And it is kind of a nuisance for her friends and some of our family members actually, it's kind of sad to say, but people don't consider what she has to go through, what she has to do before we eat meals.
- [Parent] Food is so central to this problem [general overall stress]. But the overall stress on the family, not just the immediate nuclear family, but the extended family at family events and whatever. It sort of emanates out, and so issues around food...lead to a lot of stress as well.

Theme 3: An automated insulin delivery system may improve the quality of relationships within the family

Participants discussed the conflict they experience when loved ones believe their child or partner are hypoglycemic and want them to check their blood glucose. Participants within all age groups expressed hope that these systems would decrease conflict around daily self-care tasks by providing constant monitoring and accessibility of blood glucose information.

- [Adolescent] I'm guessing with my mom it would be easier, because that's the only thing we argue about: diabetes. That's the only thing we fall out about. That might stop us falling out completely.
- [Adult] With a low for me, I sometimes get quite sharp and I snap, and that's not me...and that will make him say "Have you tested your blood lately?" which I absolutely hate. With [this new system] he could literally just pick up the machine and look at it and go "Maybe you want to have about four jelly babies about now?"
- [Parent] It would make a really, really big difference to him not to have to be inputting it all the time...We have fights about his lunch at school, because he doesn't dose ever for lunch at school...Because he says he

forgets...Wouldn't it be great if—for him, if he didn't have to remember to finger prick? And for his and my relationship so that I didn't spend—I mean, we have fights for lack of a better word...He and I might have a slightly different relationship, at least in that regard, if he didn't have to remember that.

Participants expressed the hope that improved blood glucose control due to an automated insulin delivery system would decrease negative moods associated with low and/or high blood glucose. Adults and parents reported that improved mood would have a direct and positive impact on relationships with family members and significant others.

- [Adult] I get a little short tempered with my children if my blood sugar is low...maybe [this system] would smooth my moods out a bit if it really kept me more in range.
- [Parent] If her levels are better, her mood is better. No emotional outbursts would be better. I think it would be great.
- [Adult] When I have a low I just tend to be kind of negative and to have something that takes that away, I don't know, I think you could even see it like changing people's personalities and their relationships with other people.
- [Parent] It's the levels again, as I said before. If her levels are better, her mood is better. No emotional outbursts would be better. I think it would be great.

Partner and parent participants expressed hope that by decreasing the amount of planning and forethought that diabetes management requires, these systems could restore family-level spontaneity and flexibility.

- [Partner] [An automated insulin delivery system] would enact a little bit of freedom. I think that's probably what it would do is it gives more freedom in our family and more time to relax, and...being [able to be] in control of the diabetes rather than the diabetes being in control of the day's events.
- [Parent] [If] everybody is moving together it would make it a little bit easier since she is the only one [with diabetes]. And sometimes it is a hang up if we forget something if we are at a restaurant, or we want to do this and we don't have this, or something like that.

Diabetes management can require parents to be present for activities and therefore may limit time without parental supervision in attempts to protect children from hypo- or hyperglycemia. Although youth understood the reasons for parental monitoring, they expressed feelings of being over-monitored or unable to engage in developmentally appropriate activities that promote independence, such as spending time with friends, overnight school trips, or sleepovers. Parents' constant involvement in their children's activities is often seen as intrusive and annoying, contributing to frustration and tension in parent-child relationships.

- [Child] I think I would just be able to do more things with my friends and...[more] opportunity to do stuff, and go places without the annoyingness of your blood sugar had to be perfect when you leave so [mom] knows it's all okay.
- [Adolescent] The whole crowd was going [to a charity match]...I asked my parents and they're like "No, a

football match is too rowdy.”...that’s always their reason for it. But I think I know really that they didn’t really want me to go into the middle of Manchester with my diabetes. So, I think if I had [this system], then it would take away my concerns and also—because...they’re worried about my safety—their concerns. It would really be great for me, because...sometimes I want to do something, but I just say no...because I don’t want to put my parents into...a position of guilt...So, I don’t want to have to ask them, and then they have to say no, because...they feel bad about that. So if I felt...there was no reason for them to be worried, then I think I would ask to do a lot more stuff and to be able to do a lot more stuff. So, I think...it would be amazing.

- [Parent] He is just really frustrated with when we have to intervene for the diabetes when he is in the middle of doing something. So if the [automated insulin delivery] system would decrease those points of contact where a parent really has to interact with what the kid is doing and do some sort of diabetes task, then that would be a huge thing developmentally for him as a second grader.

Discussion

Findings from this study highlight the hopes and expectations of what an automated insulin delivery system may offer families. The qualitative data resulted in three major themes pertaining to the impact these systems may have on families: reducing the constant concerns about diabetes, relieving family stress, and improving overall family relationships.

Extensive literature has examined the ways in which chronic conditions affect the family system. Cohesive family environments are conducive to lower rates of conflict,²⁹ and improved psychosocial functioning^{11,12} in youth. In addition, being involved in supportive and positive partnerships is associated with improved self-care^{17,18} and lower incidence of diabetes-specific conflict.³ Although CGMs and insulin pumps have improved families’ ability to monitor glucose and administer insulin, research has yet to examine families’ hopes and expectations for new diabetes technology, such as automated insulin delivery systems.

The age range of the participants in the INSPIRE project provided a lifespan perspective on the lived experience of diabetes. We found similar struggles, burdens, and stressors across the lifespan, although discussions of these topics were expressed differently based on age and care role. Overall, results from this study highlight a clear hope that automated insulin delivery technologies may help alleviate family systems burdens. Specifically, many participants from each age group believed that the new automated insulin delivery technologies will help with both managing blood glucose and reducing the cognitive and physical burden of diabetes management. Through improved management of glucose levels facilitated by the devices, many predicted less stress within the family system and reduced diabetes-specific family conflict due to automation of self-care tasks and improved glucose control.

The only theme that was specific to solely one group was parents’ hope that the automated insulin delivery system would decrease family stress. Parents expressed a direct expectation that by using an automated insulin delivery

system, there would be a decrease in stress felt about the daily diabetes care including carbohydrate counting, which would directly impact the stress felt in the family. As parents are those who are most often responsible for care of children and adolescents transitioning into adulthood, this is not surprising.

This study is not without limitations. The data used in this analysis were from semistructured interviews and focus groups examining the expectations and hopes for the new automated insulin delivery systems. Questions were not specifically framed to capture how these systems might impact the family. As most of the PWD who participated in this study were users of CSII or CSII+CGM, the hopes and expectations expressed were likely skewed by their technology experience, and thus may not accurately reflect the views of PWD who do not use technology. Furthermore, most participants identified as white, non-Hispanic; future work should include a broader and more diverse sample. Lastly, due to the open-ended nature of the interview questions, discussion regarding the role siblings, fathers, and children of PWD play in diabetes management within the family system was limited. Future work should specifically explore these roles and relationships in the family system.

Despite these limitations, this research is valuable to those who work with PWD and their families. Our findings provide a unique perspective of the family as they live with and support a loved one with diabetes, and how the struggles and challenges faced by family members may contribute to poor adherence to the diabetes regimen. Qualitative analysis offers an opportunity to delve into these lived experiences and highlight the voices of families. As automated insulin delivery systems are new technology and therefore new to the literature, qualitative analysis plays an essential role in elucidating potential challenges and barriers to patient uptake, as well as potential benefits to the technology.

More broadly, this work provides clinical care providers with a unique insight into the strengths and challenges of families living with diabetes from a lifespan perspective. This provides a base from which providers can work with families to focus on individual and family strengths, while working to find solutions to the challenges inherent in living with diabetes. Likewise, this work provides an understanding of family expectations for technology. These expectations can be addressed when new technology is introduced to mitigate any unrealistic expectations. This work provides a foundation from which future studies can expand upon through recruitment of more generalizable samples. Finally, these findings are important for developers of automated insulin delivery technologies and may increase awareness of the very high hopes and expectations that families hold for technological developments.

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