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Exploring the Determinants of User Acceptance for the Digital Diary Application in Type 1 Diabetes Management: A Structural Equation Modeling Approach

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Abstract

Effective management of Type 1 Diabetes (T1D), especially in children, requires continuous monitoring and care. Digital health applications have become vital in supporting routine T1D management, including insulin delivery, glucose monitoring, nutrition, and physical activity tracking. This study investigates factors influencing user acceptance of a digital diary app designed for children with T1D and their families. Using an extended Technology Acceptance Model incorporating Trust, Perceived Risk, Perceived Enjoyment, and Social Influence, a survey was conducted with 114 participants, including parents, physicians, and dietitians. Data were analyzed using Partial Least Squares Structural Equation Modeling. Findings indicate that perceived usefulness, trust, and social influence significantly affect users' attitudes and intentions to use the app, through the accepted hypothesis that considered path coefficients and p-values. Conversely, hypothesis that shows relation between perceived ease of use, enjoyment, and risk toward intention were rejected, showing unsignificant relations toward user intention to use. Furthermore, this study recommends prioritizing robust security features, fostering user trust, and engaging social networks to enhance digital health adoption in pediatric care. Future research should further explore the roles of perceived risk and enjoyment in sustaining long-term engagement.

Keywords: Type 1 Diabetes, Digital Health Application, User Acceptance, Trust, Social Influence

1. Introduction

The management of T1D in children is inherently complex, requiring continuous monitoring and individualized care to effectively manage glycemic control and improve overall quality of life [1], [2], [3]. Self-management for pediatric patients extends beyond pharmacological treatments, involving regular blood glucose monitoring, insulin administration, and lifestyle modifications, such as dietary adjustments and physical activity [4]. The challenges specific to children and adolescents, including developmental needs and psychosocial factors, highlight the importance of personalized interventions that support their unique circumstances [1]. Digital health apps are essential for diabetes self-management, offering features to track blood sugar, insulin, diet, and activity, aiding informed decisions [5]. Mobile-based digital solutions are particularly advantageous for pediatric populations, as they offer seamless integration into daily routines, reducing clinical inertia and enhancing self-care capabilities [6]. These applications often include evidence-based behavior change techniques and real-time data feedback, which support behavioral modifications necessary for effective diabetes management [2], [5]. Additionally, digital health platforms are frequently aligned with clinical guidelines such as those from the International Society for Pediatric and Adolescent Diabetes (ISPAD), ensuring that technology supports the best practices in pediatric diabetes care [2].

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Research indicates that virtual care platforms in pediatric T1D, often including peer support and personalized educational resources, lead to better glycemic control and increased self-efficacy among children and their caregivers [7]. Adolescents, in particular, have shown a preference for digital tools that offer tailored health literacy content and social support, indicating that these technologies can supplement traditional face-to-face consultations [4]. This comprehensive approach reflects the growing trend toward integrated care models, where digital health solutions play a pivotal role in promoting long-term adherence and sustained engagement with self-management strategies. The ongoing management of T1D in children is significantly improved through the use of digital health applications. These tools assist in essential areas of self-management, including blood sugar monitoring, insulin dosing, nutritional guidance, and physical activity tracking, while addressing the specific developmental and psychosocial needs of pediatric patients [1], [2]. As these technologies continue to evolve, incorporating user feedback and ensuring compatibility with clinical systems will be essential for optimizing diabetes care and improving long-term outcomes for children living with T1D [3], [4], [6].

The Digital Diary app for children with T1D, using User-Centered Design, aids self-management. It features real-time blood sugar monitoring, insulin tracking, personalized meal planning, and activity logging. User-friendly and tailored for pediatric patients, parents, and healthcare providers, it integrates with medical devices like glucometers to improve data accuracy and reduce errors. A user-centered design process is critical for developing an application that truly meets the needs of children and their families. Involving stakeholders from the early stages of conceptualization and continuing through iterative testing enables developers to integrate essential aspects, such as ease of use, data accuracy, and content relevance [6]. Previous study indicates that acceptability is influenced by both intrinsic and extrinsic factors. Intrinsic factors include a clear user interface, the ease of navigating data entries (such as logging blood sugar readings or meals), and the perceived personal benefit of managing one's health [9]. Extrinsic factors, such as support from healthcare professionals, the integration of the application into existing care pathways, and overall trust in digital platforms, also significantly shape user perceptions [6], [8].

Qualitative studies have demonstrated that while digital diaries require consistent effort, they offer valuable insights into self-management practices when integrated with clinician oversight [8]. This balance of patient independence and clinical support is particularly important in pediatric diabetes care, where family involvement and continuous monitoring are essential for effective disease management [6]. The Real-time data integration and customized feedback are two essential components of the Digital Diary app that promote ongoing diabetic self-management. These features were created using a modular system design that enables manual entry of insulin and food data and links Bluetooth-enabled glucometers. Iterative coding sprints were used in the development process, and a heterogeneous team of engineers and medical experts combined clinical logic with interface feedback loops.

Despite advancements in diabetes management technology, research on the acceptability of digital diaries in pediatric contexts remains limited. Most existing studies focus primarily on adult populations or on app functionality, rather than the specific needs of children and their caregivers [6]. Therefore, there is a pressing need for further mixed-methods research that combines quantitative usability assessments with qualitative insights from in-depth interviews or focus groups. Such research should account for age-specific cognitive and emotional needs, caregiver stress, and the technical competencies of younger users to understand how these factors interact to affect both the acceptance and sustained use of the technology [6], [8], [9], [10]. While digital self-management tools show promise for improving diabetes care, the successful development and adoption of a Digital Diary application for pediatric T1D must rely on rigorous, user-centered design methodologies. Addressing the limited research on user acceptance by considering both technical functionalities and the broader psychosocial context is essential for creating an intervention that effectively supports daily disease management and integrates seamlessly into the lives of children and their families [6], [8].

The primary objective of this research was to develop and validate an integrated model that assesses the determinants of user acceptance of the Digital Diary application for managing T1D. This model aimed to incorporate various factors that influence the adoption of the application, focusing on understanding how different determinants interact to shape user perceptions and intentions. The study specifically aimed to explore the relationships between several key variables: PU, PEOU, TR, SI, PR, PE, and AT. By examining these variables, the research sought to determine how each one contributes to the user's AT toward the application. Furthermore, the research aimed to investigate how AT influences BI to use the Digital Diary, providing insights into the factors that drive users, particularly children and their caregivers,

to adopt and continue using the application for diabetes management. The research aimed to address several key questions regarding the adoption of the Digital Diary application for T1D management. Specifically, it sought to understand the effects of different factors on users' AT toward using the application. The first research question explored: What are the effects of PU, PEOU, TR, SI, PR, and PE on AT towards using the Digital Diary application? This question aimed to determine how these individual factors influence users' perceptions of the application. The second research question examined: How does AT influence BI to use the application? This question was designed to understand the role of AT in shaping users' intention to adopt and consistently use the application.

2. Literature Review

2.1. The Influence of Perceived Usefulness (PU) on User Acceptance of Digital Diary App

PU is a key construct that reflects the extent to which users believe that a digital system will enhance their ability to effectively manage T1D. In the context of diabetes self-management, PU involves the tangible benefits that applications provide, such as improving the efficiency of daily activities, including blood glucose monitoring, insulin administration, dietary planning, and tracking physical activity. Several studies in digital health have explored the role of PU within established models like TAM. For instance, [15] presented a model that demonstrated how PU positively influenced the continued use of digital health wearables among elderly diabetic patients. Similarly, [17] examined the use of patient portals among young adults with T1D. Their study found that these users valued digital tools for their ability to provide reliable, real-time data, helping them make more informed decisions about their care. This illustrates the significant role of PU in user adoption and sustained engagement with digital health applications.

Further extending the TAM framework, previous studies have highlighted that PU does not operate in isolation but interacts with other factors, such as technical efficacy, external benefits, and PEOU. Research [18] used structural equation modeling to show that PU is closely related to external benefits, which further enhance the likelihood of adopting health management tools. Research [19] conducted a survey of individuals with T1D in Europe and found that over 60% of participants viewed digital tools as useful, emphasizing their role in simplifying daily disease management. Additionally, a study by [20], although focused on Type 2 Diabetes, confirmed that PU is a significant predictor of the intention to adopt and consistently use digital interventions for diabetes management.

2.2. The Role of Perceived Ease of Use (PEOU) in Adoption of the Digital Diary App

PEOU refers to the extent to which users believe that using a digital health application for managing T1D will be free of effort and uncomplicated. In the context of healthcare applications, PEOU is a crucial construct from the TAM, capturing how the design and usability of an application minimize the cognitive and physical effort required to operate it. This concept is particularly relevant in healthcare settings, where user engagement is essential for effective disease management and adherence to treatment regimens. By reducing the barriers to using technology, PEOU encourages users to integrate digital tools into their daily routines, ultimately improving self-care practices.

Previous studies on healthcare and telemonitoring tools have highlighted the importance of PEOU in shaping user satisfaction and adherence [21]. In the specific context of diabetes management applications, qualitative analyses have found that both young patients and their caregivers' value digital tools that are easy to learn and use. For pediatric populations, where usability is critical for user engagement and sustained use, design elements supporting PEOU, such as user-friendly interfaces and intuitive navigation, are especially important [23]. However, the evidence surrounding the impact of PEOU on BI remains complex. Some studies indicate that the effect of PEOU may be moderated by other factors, such as prior experience with smartphones or the quality of the relationship with healthcare providers [22], [24].

2.3. How Perceived Enjoyment (PE) Impacts Engagement with the Digital Diary App

PE refers to the degree to which users find an application enjoyable to use, independent of any functional utility it may offer. In the context of digital health technologies, especially those designed for managing chronic conditions such as T1D, PE is a crucial factor that serves as an intrinsic motivator. It enhances user engagement and promotes sustained adherence to self-management regimens [25]. When an application is perceived as enjoyable, users, including pediatric

patients and their families, are more likely to interact with it regularly. This increased interaction can reinforce positive health behaviors, which are essential for achieving better disease management outcomes [25].

Several studies, particularly those focused on health applications, have identified PE as a significant predictor of continued use and user satisfaction. Research [25] demonstrated that incorporating hedonic elements into health app design enhances users' overall intention to use such applications. These enjoyable aspects help reduce the perceived burdens associated with managing chronic diseases, making the experience more pleasant for users. This effect is particularly important in pediatric settings, where the engagement of young users is directly influenced by the fun and interactive components of an application. Studies in related fields, such as [26], further emphasize that when users find an app enjoyable, their overall satisfaction improves. This, in turn, positively impacts their BI to continue using the technology. The synergy between PE and other acceptance constructs—such as PU and PEOU—highlights the importance of designing digital health interventions that are not only functionally effective but also engaging from a user-experience perspective [25], [26].

2.4. The Critical Role of Trust (TR) in Digital Diary App

TR refers to the confidence users have in a digital health application's ability to protect their personal data and provide accurate health information. In the context of diabetes management, this confidence is particularly crucial as these applications handle sensitive medical details and serve as sources of health-related guidance. TR is a critical determinant in the adoption and continued use of mobile health technologies, especially in managing chronic conditions like T1D. Research has consistently highlighted the role of TR in influencing users' willingness to rely on these digital platforms for managing their health [27].

Empirical studies suggest that TR can be broken down into several elements that contribute to a positive user experience. For example, [28] findings show that TR can alleviate concerns related to data privacy and the accuracy of the information provided by these applications. Additionally, [29] focused on the initial trust-building process, showing that establishing a strong foundation of TR—often through endorsements from trusted health authorities or transparent data-handling practices—is essential for encouraging early adoption of health apps. These findings underscore that users' perceptions of security and credibility are critical when personal medical histories are involved.

In the case of diabetes self-management, TR is further reinforced by the application's design attributes, such as functionality, usability, and the delivery of accurate, evidence-based health information. Research [30] investigated TR factors among diabetes patients and identified that accurate health data, reliable performance, and user-friendly interfaces are key elements that enhance TR. Their study found that when an application consistently meets these criteria, users develop stronger confidence in its ability to support effective self-management. Moreover, systematic reviews of mobile health application acceptance, such as the one conducted by [27], position TR as a central factor impacting adoption and influencing other constructs like PR and PEOU. This comprehensive approach to digital health behavior change highlights the integral role TR plays in technology adoption.

2.5. Perceived Risk (PR) and Its Effect on User Acceptance of Digital Diary App

PR refers to the potential harm or loss that users associate with using a digital health application. This includes concerns about privacy, security, the accuracy of health information, and the potential misuse of personal data. In the context of health applications, especially those designed for managing chronic conditions like T1D, PR plays a significant role in influencing user acceptance and engagement. Users, particularly parents and caregivers of pediatric patients, may be hesitant to adopt such technologies if they perceive the risk of disclosing sensitive health information or relying on potentially unreliable feedback as high [31].

Empirical studies in mobile health applications have shown that increased PR, such as concerns about privacy breaches, unauthorized access to data, or inaccuracies in health monitoring, can substantially reduce the likelihood of technology adoption. For example, [31] highlighted that older adult often express significant concerns about privacy and data protection, which hinder their acceptance of mobile health innovations. Although their study primarily focused on a different demographic, the concerns about data privacy and security are equally pertinent in pediatric diabetes care, where caregivers are responsible for safeguarding their children's sensitive health information. Additionally, [33] developed an integrated framework that highlighted the role of PR as a mediator between TR and users' AT toward

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IoT-based healthcare applications. Their research emphasizes that if risks, particularly those related to privacy and security, are not effectively addressed, both user TR and positive AT toward the technology are likely to suffer.

2.6. The Role of Perceived Ease of Use (PEOU) in Adoption of the Digital Diary App

SI refers to the impact that social factors—such as recommendations from family members, peers, and healthcare professionals—have on a user's intention to adopt and use a digital health application. In the context of diabetes management, SI plays a crucial role, as individuals often rely on the advice and experiences of trusted others when deciding whether to integrate a new technology into their routine care activities. Research has shown that when trusted sources, such as healthcare providers, endorse a digital tool, users are more inclined to perceive it as credible and beneficial, thereby increasing their BI to use the application [34], [35].

Previous studies employing models such as the TAM have frequently extended the framework to include SI as a significant predictor of usage intention. For instance, qualitative research conducted in Indonesia on individuals living with diabetes highlighted those recommendations from both professional and personal networks are influential in shaping patients' decisions about disease management strategies [34]. Furthermore, recommendations from healthcare professionals and social networks not only enhance the initial acceptance of digital health applications but also contribute to sustained usage over time. The endorsement by trusted individuals creates an environment of reassurance and support, mitigating concerns related to the complexities of managing a chronic condition like T1D. In the pediatric context, where parental acceptance is paramount, the influence of social circles becomes even more pronounced; caregivers are more likely to adopt digital tools for managing their child's health if they receive consistent, positive feedback from their immediate social environment and trusted healthcare experts [34]. Thus, incorporating strategies that leverage SI into the design and dissemination of digital health applications is essential for achieving high adoption rates and ensuring long-term engagement.

3. Methodology

3.1. Research Design and Data Collection

This study used a quantitative design to test hypotheses on factors influencing user acceptance of the Digital Diary app for T1D management. Developed with a UCD approach, the app helps children with T1D manage health by integrating features like blood sugar monitoring, insulin reminders, meal and activity logging, and medical device integration. It also offers personalized meal planning, automating caloric intake calculations and suggesting meals based on nutritional needs. These features aim to reduce the administrative burden on children and families and ensure accurate self-management. Quantitative research was chosen for its empirical, numerical data, analyzed using statistical methods. PLS-SEM was used to assess relationships between constructs like PU, PEOU, TR, SI, PR, PE, AT, and BI. This method allows testing complex models with multiple variables, providing insights into direct and indirect relationships.

The study used convenience sampling, a non-probability method selecting easily accessible participants willing to join. This was chosen due to challenges in recruiting individuals familiar with T1D and its management. However, due to the focus was targeting the participants that have experience managing the condition, either personally or as caregivers of T1D patients. Therefore, this study included parents, healthcare professionals, and nutritionists, who could offer insights into diabetes management technologies like the Digital Diary app [4]. The study aimed for 117 participants, with 114 completing the survey. This size was chosen for sufficient statistical power in PLS-SEM analysis, ensuring robust results. The analysis confirmed 114 respondents were adequate to detect significant effects in the structural model, allowing reliable estimation of path coefficients and evaluation of model fit indices to validate hypotheses. This was according to the ten-time rules to target the total of participants from the ten times of the factors investigated on this study [5].

The research targeted individuals managing and caring for children with T1D, mainly parents (71.1%), doctors (19.3%), and nutritionists (9.7%). While each participant groups represents practical involvement, the dominance of parents might cause generalization bias, affecting how the app is perceived by other professionals. However, parents or guardians are the primary decision-makers in pediatric healthcare settings, especially when it comes to selecting,

approving, or using digital tools related to their child's health. Therefore, any health technology designed for pediatric use must go through parental approval [4], [6]. The research design and data collection method were chosen to effectively address research questions and hypotheses, providing insights into factors influencing the adoption of digital health applications for T1D management.

3.2. Research Model and Hypothesis Development

The research model for this study is grounded in the TAM, which has long been used to understand user acceptance of technology, especially in the context of digital health applications. TAM identifies two primary constructs, PU and PEOU, which have been found to significantly influence AT toward technology. According to the model, the more useful a technology is perceived to be and the easier it is to use, the more positive an individual's AT will be toward adopting and using the technology. This, in turn, influences the BI to use the technology, which is a strong predictor of actual system use [37]. In this study, the model is extended by integrating additional constructs such as TR, SI, PR, and PE, which are particularly relevant when exploring user acceptance of health applications. The inclusion of these constructs aims to provide a more comprehensive understanding of the factors that shape AT and intentions toward using digital health tools in managing T1D, particularly in pediatric populations.

PU refers to the degree to which users believe that using a system enhances their performance in managing their condition. In the context of diabetes management, this can refer to how effectively an application helps users manage blood glucose levels, insulin dosing, meal planning, and physical activity. Studies have shown that when users perceive a technology as useful in improving disease management, they are more likely to develop a positive AT toward using it [15], [17]. In this case, it is hypothesized that the more users perceive the Digital Diary application as useful for managing T1D, the more positively they will view it, which can increase their likelihood of using it regularly. Therefore, from the explanation above, a hypothesis is proposed, specifically:

H1: PU has a positive effect on AT.

PU includes the observable advantages that apps offer, such as enhancing the effectiveness of everyday tasks including insulin administration, blood glucose monitoring, meal planning, and activity tracking. This factor is crucial in ensuring that an application is more likely to be adopted and used consistently by users when they believe it will help them better manage their health. Research has demonstrated that PU is a strong indicator of the desire to embrace and regularly employ digital diabetes management strategies [20]. This hypothesis implies that the simpler and more intuitive the Digital Diary application is to use, the more likely users are to form a positive AT toward using it, thus enhancing their engagement with the tool.

H2: PEOU has a positive effect on AT.

PEOU captures how easy users believe it is to use the technology without effort. This factor is crucial in ensuring that the technology is accessible, particularly for young children or caregivers who may not have high levels of technical expertise. Research has demonstrated that PEOU significantly influences user satisfaction and adoption [38]. This hypothesis implies that the simpler and more intuitive the Digital Diary application is to use, the more likely users are to form a positive AT toward using it, thus enhancing their engagement with the tool

H3: PE has a positive effect on AT.

PE refers to the degree to which using the application is perceived as enjoyable, independent of its functional utility. In the context of chronic disease management, especially in pediatric populations, enjoyment can be an important motivator for continued use. If users find the application fun or rewarding, they are more likely to engage with it regularly, which can lead to better disease management outcomes [25]. It is hypothesized that a more enjoyable experience will positively impact the user's AT toward the application, making them more likely to adopt it for sustained use. So, from the above explanation, a hypothesis is proposed.

H4: TR has a positive effect on AT.

TR is a key determinant of user acceptance, particularly when sensitive health data is involved. TR in the application's ability to protect personal health information and provide accurate data is crucial for user acceptance. In the context of diabetes management, parents and caregivers need to feel confident that the application will securely handle their

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child's medical data and offer reliable guidance [1], [7]. Previous studies have shown that TR in both the technology itself and healthcare providers is integral to user engagement and long-term use of health technologies [28]. Therefore, it is hypothesized that TR in the Digital Diary application will positively influence users' AT toward using the application, making them more likely to adopt it.

H5: PR has a positive effect on AT.

PR refers to users' concerns about potential harm or loss associated with using the application, such as privacy breaches or data security issues. Thus, although this construct related to TR, they operate on opposite psychological dimensions, where Trust promotes approach behavior, while Perceived Risk triggers avoidance [1], [8]. In health applications, especially those managing sensitive data like diabetes information, high PR can deter users from adopting or consistently using the technology. Studies have shown that users are less likely to use technologies they perceive as risky, especially in terms of data security and privacy [31], [32]. This hypothesis implies that higher PR may negatively impact users' AT toward the application, thus reducing their likelihood of using it regularly.

H6: SI has a positive effect on AT.

SI refers to the effect of social factors, such as recommendations from family, friends, or healthcare professionals, on an individual's intention to use technology. In healthcare settings, recommendations from trusted individuals, especially healthcare providers, play a significant role in shaping user AT. Previous studies have found that SI is a strong predictor of user adoption, particularly when the recommendations come from trusted sources such as doctors or caregivers [34], [36]. It is hypothesized that SI, particularly endorsements from healthcare providers and family members, will positively affect the user's AT toward the application, thus encouraging its adoption. So, from the above explanation, a hypothesis is proposed

H7: AT has a positive effect on BI.

According to the original TAM, AT toward a technology is a significant determinant of the BI to use it. A positive AT toward using the technology increases the likelihood that an individual will intend to use it regularly. In the context of the Digital Diary application, this hypothesis indicates that users who develop a positive AT about the app will be more likely to express a strong intention to use the application for managing T1D [37]. These hypotheses collectively form the basis for testing the relationships between various factors influencing user acceptance of the Digital Diary application, shown in figure 1.

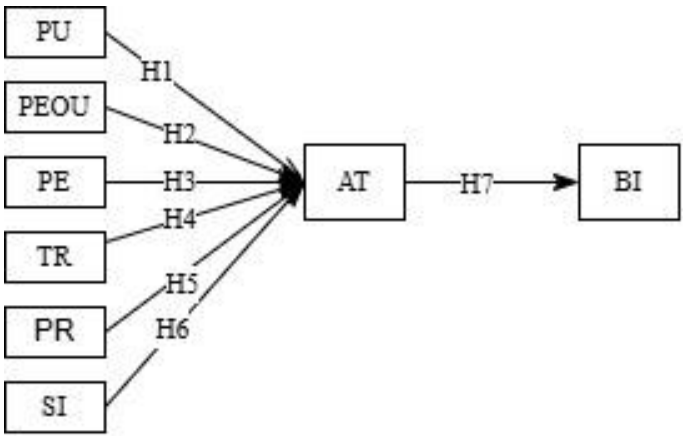

Figure 1. Research Framework

3.3. Measurement Instruments

The study's measurement instruments were adapted from existing scales to ensure reliability and validity. Constructs were chosen for their relevance to managing T1D and using the Digital Diary app. Table 1 lists the items for each construct, selected to accurately reflect their dimensions and suit the target population: parents, healthcare professionals, and caregivers of children with T1D. A five-point Likert scale, from "Strongly Disagree" (1) to "Strongly Agree" (5), was used for all items. This scale allows nuanced assessment of respondents' attitudes, with higher scores

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indicating stronger agreement. Commonly used in social science research, it measures constructs like PU, PEOU, PE, TR, PR, and SI in the Digital Diary context. This approach collects meaningful data on respondents' attitudes and behaviors, offering insights into their intentions and acceptance of the app.

Table 1. Questionnaire Items

Item*)		Questionnaire	Source
PU	PU1	Using the Digital Diary application improves my ability to manage my Type 1 Diabetes effectively.	[39]
	PU2	Using the Digital Diary application enhances my effectiveness in monitoring and controlling my diabetes.	
	PU3	Using the Digital Diary application makes it easier for me to manage my daily diabetes care routines.	
	PU4	I find the Digital Diary application useful for tracking my blood sugar levels, insulin dosage, and diet.	
	PU5	Using the Digital Diary application helps me make better decisions regarding my diabetes care and lifestyle.	
PEOU	PEOU1	Learning to use the Digital Diary application is easy for me.	[39]
	PEOU2	The interface of the Digital Diary application is clear and understandable.	
	PEOU3	It is easy for me to become skillful at using the Digital Diary application.	
	PEOU4	I find the Digital Diary application easy to use.	
PE	PE1	Using the Digital Diary application for diabetes management is pleasurable.	[40]
	PE2	I have fun using the Digital Diary application for managing my diabetes.	
	PE3	I find using the Digital Diary application to be interesting and engaging.	
	PE4	Using the Digital Diary application makes managing my diabetes feel more enjoyable and less burdensome.	
TR	TR1	I trust the Digital Diary application to securely handle my personal health data.	[41]
	TR2	I believe that the Digital Diary application will keep my health data secure and private.	
	TR3	I trust the information and recommendations provided by the Digital Diary application regarding my diabetes care.	
	TR4	I believe the Digital Diary application is committed to maintaining user data privacy and security.	
PR	PR1	It feels risky to share my personal health information with the Digital Diary application.	[42]
	PR2	There is uncertainty associated with providing personal health information to the Digital Diary application.	
	PR3	There is potential harm or loss if I provide my personal health information to the Digital Diary application.	
	PR4	I worry that my personal health data might be misused or accessed without my consent through the Digital Diary application.	
SI	SI1	People who are important to me think that I should use the Digital Diary application to manage my Type 1 Diabetes.	[43]
	SI2	People who influence my behavior think that I should use the Digital Diary application for my diabetes care.	
	SI3	People whose opinions I value prefer that I use the Digital Diary application for diabetes management.	
	SI4	Healthcare professionals recommend using the Digital Diary application to help manage my Type 1 Diabetes.	
AT	AT1	I believe I do not need assistance from others to use the Digital Diary application.	[44]
	AT2	I think the step-by-step guidance within the Digital Diary application is easy to understand.	
	AT3	I believe learning to use the Digital Diary application is easy.	
	AT4	I like the fact that the Digital Diary application makes diabetes management require minimal effort.	
BI	BI1	I intend to continue using the Digital Diary application rather than discontinue its use.	[39]
	BI2	I am more likely to continue using the Digital Diary application than try other similar diabetes management apps.	
	BI3	I will recommend others, especially those with Type 1 Diabetes, to use the Digital Diary application.	

*) PU: Perceived Usefulness, PEOU: Perceived Ease of Use, PE: Perceived Enjoyment, TR: Trust, PR: Perceived Risk, SI: Social Influence, AT: Attitude, BI: Behavioral Intention.

3.4. Data Analysis

The data analysis for this study used SmartPLS to perform PLS-SEM, a sophisticated statistical technique for social sciences and management research. PLS-SEM is ideal for complex latent variable relationships and multiple constructs. It explores both the measurement model (item-construct representation) and the structural model (hypothesized construct relationships). This method suits smaller sample sizes which robust to normality violations, and provides direct and indirect effects, making it suitable for studying user acceptance of the Digital Diary application for managing T1D. The first step was assessing the measurement model's reliability and validity. Reliability was measured using Cronbach's Alpha and Composite Reliability. Cronbach's Alpha assesses internal consistency, with a value over 0.7

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indicating reliability. Composite Reliability, considering factor loadings, also requires a value above 0.7 for satisfactory reliability.

After reliability tests, convergent validity was tested using the Average Variance Extracted (AVE), which measures the variance a construct captures from its items with threshold above 0.5. Discriminant Validity was assessed using the Fornell-Larcker Criterion and the Heterotrait-Monotrait Ratio (HTMT) to ensure that the constructs are distinct and reliably measured. After establishing the measurement model, the structural model was evaluated, focusing on hypothesis testing based on hypothesized paths in the theoretical framework, using path coefficients and t-values of path coefficients. After that, R^2 values were calculated to assess how well independent variables explain the dependent variable's variance in the model. In social sciences research, R^2 with 0.67 value is substantial, 0.33 is moderate, and 0.19 is weak. This study's R^2 values show how factors like PU, TR, and AT explain BI for the Digital Diary application.

Effect size (f^2) was also calculated to determine each construct's influence magnitude, with a small effect below 0.02, medium between 0.02 and 0.15, and large above 0.15. This helps identify the most influential constructs on BI, aiding in the application's design and improvement. The study rigorously tested relationships between key constructs, providing insights into how PU, PEOU, TR, SI, PR, and PE impact AT, and how AT influences BI. This methodical data analysis using SmartPLS ensured statistically sound and theoretically grounded findings, offering a reliable basis for hypothesis testing and insights for future digital health interventions in T1D management.

4. Results and Discussion

4.1. Descriptive Statistics

In this study, data were collected using a survey, and 114 valid responses were analyzed out of an initial 117 participants. The demographic data provided valuable insights into the composition of the sample. The gender distribution showed that 64.9% (74 participants) of the respondents were female, while 35.1% (40 participants) were male. This indicates a greater representation of female respondents, which could suggest that women, particularly parents, are more involved in the diabetes management process in households. Regarding the professional background of the respondents, 19.3% (22 participants) were doctors, 71.1% (81 participants) were parents, and 9.7% (11 participants) were nutritionists. The large proportion of parents as respondents reflects the pivotal role parents play in managing the health of children with T1D. In terms of the descriptive statistics for each variable, the mean scores across all variables were consistently high, as shown in table 2, indicating a positive perception of the Digital Diary application.

Table 2. Descriptive Statistic Results

Construct	Item	Mean	Std. Deviation	Variance	Skewness	Kurtosis
PU	PU1	4.31	0.874	0.763	-1.698	3.800
	PU2	4.48	0.627	0.393	-0.809	-0.34
	PU3	4.50	0.628	0.394	-0.875	-0.246
	PU4	4.60	0.544	0.296	-0.897	-0.264
	PU5	4.18	0.826	0.683	-0.836	0.198
PEOU	PEOU1	4.20	0.789	0.623	-0.596	-0.485
	PEOU2	3.94	0.989	0.978	-0.601	-0.424
	PEOU3	4.12	0.789	0.622	-0.663	0.666
	PEOU4	4.18	0.707	0.500	-0.264	-0.963
PE	PE1	4.32	0.710	0.504	-0.714	-0.125
	PE2	4.26	0.852	0.727	-1.235	1.598
	PE3	4.45	0.666	0.444	-0.991	0.630
	PE4	4.51	0.655	0.429	-0.994	-0.132
TR	TR1	4.14	0.727	0.529	-0.644	0.467

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Construct	Item	Mean	Std. Deviation	Variance	Skewness	Kurtosis
	TR2	4.29	0.806	0.650	-1.092	0.870
	TR3	4.30	0.703	0.494	-0.804	0.595
	TR4	4.25	0.711	0.506	-0.546	-0.295
PR	PR1	4.13	0.793	0.629	-0.891	1.348
	PR2	4.33	0.687	0.472	-0.543	-0.773
	PR3	4.50	0.584	0.341	-0.679	-0.499
	PR4	4.17	0.786	0.618	-0.416	-0.925
SI	SI1	4.54	0.668	0.446	-1.129	0.066
	SI2	4.18	0.707	0.500	-0.264	-0.963
	SI3	4.32	0.720	0.519	-0.702	-0.219
	SI4	4.48	0.655	0.429	-1.089	0.909
AT	AT1	4.47	0.641	0.411	-0.824	-0.350
	AT2	4.35	0.665	0.442	-0.537	-0.697
	AT3	4.41	0.702	0.492	-1.403	3.685
	AT4	4.48	0.668	0.447	-0.931	-0.280
BI	BI1	4.42	0.664	0.441	-0.906	0.523
	BI2	4.40	0.661	0.438	-0.664	-0.589
	BI3	4.37	0.801	0.642	-1.294	1.352

The mean scores indicated clear trends across constructs. PU was high (M = 4.18–4.60), with the highest score for usefulness in managing diabetes. PEOU ranged from 3.94 to 4.32, indicating good usability. PE scored 4.13–4.51, showing the app was enjoyable. TR was moderately high (4.14–4.29), while PR was low to moderate (4.13–4.50), suggesting minimal privacy concerns. SI showed strong influence (4.18–4.54), especially from social support. Whereas, the standard deviation values showed some variability in responses across the different constructs. For PU, the standard deviations ranged from 0.544 to 0.874, suggesting that while most respondents rated the application highly in terms of usefulness, there was some variation, with PU4 showing the least variation. PEOU had standard deviations ranging from 0.707 to 0.989, indicating some differences in how easy the app was perceived to be. PE also showed moderate variation in responses, with standard deviations ranging from 0.655 to 0.852, reflecting diverse levels of enjoyment. TR had standard deviations ranging from 0.703 to 0.806, suggesting a moderate level of agreement across respondents about their TR in the application. For PR, the standard deviations ranged from 0.584 to 0.793, indicating diversity in perceived risk associated with the application. Finally, SI had standard deviations ranging from 0.655 to 0.747, showing that while respondents generally agreed on the influence of social factors, there was some variation in how influential these factors were in their decision-making process.

The skewness values for most variables were negative, indicating that the distributions were left-skewed. This suggests that a larger proportion of respondents gave higher ratings for the constructs, particularly on items like SI and PE. For instance, the skewness for SI1 was -1.129, which indicates a higher frequency of positive responses compared to neutral or negative ones. Similarly, PE items showed a negative skewness, with PE1 having a skewness value of -0.714, suggesting that respondents were generally satisfied with the enjoyment aspects of the application. The kurtosis values revealed that some constructs had relatively high kurtosis, indicating a sharp peak in the responses, while others were flatter, suggesting a wider distribution. For instance, PU had a kurtosis value of 3.8 for PU1, indicating a distribution with a sharp peak, meaning that most respondents had similar opinions regarding the usefulness of the app. On the other hand, PR had kurtosis values between -0.499 and 1.348, indicating some variation in how respondents viewed the risks associated with using the app, but not extreme differences in responses.

The descriptive statistics reveal that the Digital Diary application was generally well-received, with most respondents providing positive feedback across the various constructs. However, the variability in standard deviation, skewness, and kurtosis values indicates that there were differing perceptions among participants. These variations are important for understanding the diverse experiences and expectations users have with the application [9], [10].

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4.2. Measurement Model Evaluation

The measurement model evaluation used to assess reliability of the constructs using cronbach's alpha, composite reliability, and convergent validity, as shown in table 3. Whereas, discriminant validity was evaluated through HTMT and the Fornell-Larcker Criterion as shown in table 4.

Table 3. Reliability Analysis and Convergent Validity

Construct	Item	Factor Loading	AVE	Composite Reliability	Cronbach's Alpha
PU	PU1	0.723	0.5588	0.8190	0.9250
	PU2	0.764			
	PU3	0.788			
	PU4	0.768			
	PU5	0.692			
PEOU	PEOU1	0.808	0.6925	0.8480	0.9070
	PEOU2	0.784			
	PEOU3	0.853			
	PEOU4	0.881			
PE	PE1	0.631	0.6348	0.7590	0.8700
	PE2	0.853			
	PE3	0.829			
	PE4	0.852			
TR	TR1	0.832	0.6337	0.8728	0.9648
	TR2	0.825			
	TR3	0.85			
	TR4	0.663			
PR	PR1	0.817	0.6641	0.8877	0.9693
	PR2	0.856			
	PR3	0.782			
	PR4	0.803			
SI	SI1	0.747	0.6601	0.8853	0.9686
	SI2	0.811			
	SI3	0.917			
	SI4	0.764			
AT	AT1	0.884	0.6940	0.6940	0.8460
	AT2	0.852			
	AT3	0.851			
	AT4	0.738			
BI	BI1	0.831	0.7130	0.7130	0.8510
	BI2	0.893			
	BI3	0.806			

Factor loading refers to the strength of the relationship between each indicator and the corresponding latent construct. In this study, factor loadings for the constructs are generally high, indicating that the indicators strongly represent the latent variables they are intended to measure. For example, PU items have loadings ranging from 0.692 to 0.788, with PU3 showing the highest factor loading at 0.788, suggesting that it is a strong indicator of PU. The PEOU construct also exhibits strong loadings, particularly with PEOU4 (0.881) and PEOU3 (0.853), highlighting their high relevance in measuring the PEOU of the Digital Diary application.

In contrast, the PE construct has a slightly lower loading for PE1 (0.631), indicating that it may be a weaker indicator, although still acceptable. The insignificant influence of perceived enjoyment might stem from a measurement bias. In

health-related contexts, terms like 'enjoyment' or 'fun' may be perceived as incompatible or inappropriate, especially when the task is serious. Prior studies [9] have highlighted that semantic mismatches in questionnaire items can lead respondents to underreport emotional responses, not due to the absence of enjoyment, but due to discomfort or misunderstanding of item intent. TR items show consistent loadings around 0.825 to 0.850, with TR4 being the lowest (0.663), suggesting some variation in how respondents perceive TR in the application. Overall, the factor loadings indicate that the items used in this study are strong indicators of their respective constructs, ensuring the reliability of the measurement model.

For reliability, both Cronbach's Alpha and Composite Reliability were utilized. A Cronbach's Alpha value greater than 0.7 is considered acceptable, and in this study, all constructs exceeded this threshold, indicating strong internal consistency across the items within each construct. For instance, the AT construct had a Cronbach's Alpha value of 0.846, while the PU construct achieved 0.925, and other constructs such as PEOU reached 0.907, TR is 0.9648, PR is 0.9693, and SI is 0.9686. These values suggest that the items used to measure each construct were consistently aligned with the underlying concept they were intended to measure. The Composite Reliability values further support the reliability of the constructs, with AT having a value of 0.901, PU is 0.819, PEOU is 0.848, TR is 0.8728, PR is 0.8877, and SI is 0.8853, all exceeding the recommended threshold of 0.7, confirming the robustness of the measurement scales.

Convergent validity was assessed using Average Variance Extracted (AVE), where a value above 0.5 indicates that more than 50% of the variance in the indicators is explained by the latent construct. All constructs in this study showed satisfactory AVE values, which further supports the validity of the measurement model. Specifically, the AVE values for the constructs ranged from 0.5588 (PU) to 0.694 (AT), demonstrating that the constructs effectively capture the variance in their respective indicators. These findings suggest that the measurement model is both reliable and valid, making it suitable for further analysis and hypothesis testing in the study.

Table 4. HTMT Ratio

	AT	BI	PEOU	PE	PR	PU	SI	TR
AT								
BI	0.934							
PEOU	0.676	0.796						
PE	0.92	0.947	0.694					
PR	0.945	0.92	0.854	0.903				
PU	0.854	0.827	0.808	0.784	0.86			
SI	0.902	0.825	0.748	0.871	0.971	0.731		
TR	0.967	0.992	0.809	0.977	1.025	0.83	0.897	

In this study, as depicted on table 4, it is known that most of the HTMT values were below 0.85, indicating that the constructs were distinct from each other. For example, the HTMT value between AT and PU was 0.854, which is slightly above the threshold, suggesting that these two constructs may have some overlap but are still distinguishable. The HTMT value between TR and PR was 1.025, which exceeds the 0.85 threshold, indicating a significant overlap between these two constructs, and suggesting that further clarification is needed to differentiate them more clearly in future research [5]. Despite this, other pairs, such as AT and PEOU, PU and PE, and SI and PU had HTMT values well below 0.85, confirming good discriminant validity for these constructs. Additionally, the Fornell-Larcker Criterion, which requires the square root of AVE for each construct to be greater than the correlations between constructs, was met for all constructs, further supporting their distinctiveness.

4.3. Structural Model Evaluation and Hypothesis Testing Results

The structural model evaluations measures the relationships between latent variables and their influence on each other in the proposed model. In PLS-SEM, key metrics such as path coefficients, R^2 values, and effect size (f^2) are used to assess the strength and significance of the relationships between the variables, showed in table 5. This section delves into the results of hypothesis testing, which focus on understanding how well the independent variables—PU, PEOU, TR, PR, SI, and PE—predict the dependent variables, namely AT and BI.

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Table 5. Inner Model Results (Summary)

Hypothesis	Path	Coefficient	P-Value	Conclusion
H1	PU → AT	0.243	0.001	Accepted
H2	PEOU → AT	-0.151	0.064	Rejected
H3	PE → AT	0.181	0.052	Rejected
H4	TR → AT	0.262	0.020	Accepted
H5	PR → AT	0.185	0.135	Rejected
H6	SI → AT	0.242	0.015	Accepted
H7	AT → BI	0.771	0.000	Accepted

Table 5 illustrated the inner model results for each hypothesis, as well as decision to accept or reject the hypothesis. The first hypothesis tested was whether PU has a positive effect on AT. The relationship between these two variables yielded β of 0.243, which is positive, suggesting that as users perceive the application to be more useful, their AT toward using it becomes more favorable. The p-value for this relationship was 0.001, which is well below the 0.05 significance threshold, confirming that the relationship is statistically significant. As a result, H1 is accepted. In contrast, the relationship between PEOU and AT was found to be negative. The β was -0.151, indicating that as the PEOU of the application increases, users' AT toward using it may not necessarily become more positive. The p-value for this relationship was 0.064, which is above the threshold of 0.05, indicating that this relationship is not statistically significant. Consequently, H2 is rejected. This result is somewhat counterintuitive, as in the traditional TAM, PEOU is expected to have a positive relationship with AT. The negative relationship in this study suggests that users who perceive the system as too easy to use may not find it engaging or challenging enough, potentially leading to a less positive AT. External factors such as prior experience with similar technologies or personal preferences might also influence this result.

The third hypothesis, which posited that PE would have a positive effect on AT, yielded a β of 0.181, suggesting a positive relationship (see figure 2). However, the p-value for this path was 0.052, slightly above the 0.05 threshold for statistical significance. This suggests that although there is a positive relationship, it is not strong enough to be considered significant at the conventional level, and therefore, H3 is rejected. For TR, the relationship with AT showed β of 0.262, indicating a significant positive effect. The p-value for this relationship was 0.020, which is less than the significance threshold of 0.05, confirming that TR positively influences AT toward using the application. This supports H4, which is thus accepted. TR plays a crucial role in digital health applications, particularly in sensitive contexts such as diabetes management, where users need assurance that their data is secure and the information provided is accurate.

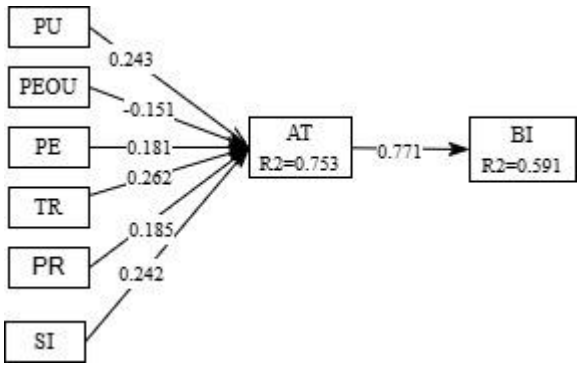

Figure 2. Structural Model Results Framework

In examining the relationship between PR and AT, β of 0.185 was obtained, suggesting that PR may have a positive effect on AT. However, the p-value for this relationship was 0.135, which is greater than the 0.05 threshold, indicating that this relationship is not statistically significant. This suggests that while users might be aware of risks such as privacy concerns, these concerns may be perceived as managed risks. Similarly shown that in high-trust or high-utility environments, perceived risk does not significantly shape attitude formation, thereby supporting the rejection of [1]. The relationship between SI and AT revealed β of 0.242, indicating a positive influence. The p-value for this

relationship was 0.015, which is smaller than the 0.05 significance threshold, making it statistically significant. This result supports H6, showing that social factors, including recommendations from healthcare providers and family members, positively influence users' AT toward using the digital diary application. Finally, the relationship between AT and BI yielded β of 0.771, indicating a strong positive influence. The p-value for this path was 0.000, which is highly significant and supports H7, indicating that a more positive AT toward the application significantly increases the likelihood of users intending to adopt and use it.

The R^2 values provide an indication of the explanatory power of the model. For AT, the R^2 value was 0.753, meaning that 75.3% of the variability in AT can be explained by the independent variables in the model. This indicates a strong explanatory power and suggests that the model is effective in predicting users' AT. For BI, the R^2 value was 0.591, indicating that 59.1% of the variability in BI is explained by AT. While this is a moderate level of explanatory power, it still highlights the importance of AT in influencing BI. The f^2 value for AT was 1.468, which indicates a very large effect size, suggesting that the independent variables in the model have a significant impact on AT. This large effect size underscores the importance of factors such as PU, TR, and SI in shaping users' AT, and subsequently their intentions to use the application. The structural model evaluation shows that several hypotheses were supported, including the significant effects of PU, TR, SI, and AT on users' intentions to use the digital diary application. However, PEOU and PE did not show significant effects, which suggests that further research is needed to explore the complexities of these variables and their impact on adoption in the context of digital health applications. The model demonstrates strong predictive ability, particularly in understanding the role of AT as a mediator between the independent variables and BI to use the application.

4.4. Discussion

This study explores the key factors influencing the adoption of a Digital Diary application for managing T1D in children, integrating several psychological and social constructs into a TAM framework. The findings revealed that PU, TR, SI, and AT positively influenced the BI to use the application, while PEOU, PE, and PR had less impact or no significant effect. These results were consistent with some previous studies while also offering new insights into the specific dynamics of pediatric diabetes management. The acceptance of H1 (PU influences AT) aligns with numerous studies demonstrating the central role of PU in influencing the adoption of health technologies. Research consistently shows that when users believe that a digital tool will enhance their disease management, they are more likely to adopt and continue using it [15]. Similarly, H4 (TR influences AT) received strong support, with TR in the application's ability to safeguard sensitive health data and provide accurate information found to be a critical factor. This aligns with findings from [27], [28], which emphasize that TR is a key determinant for user acceptance, especially in applications involving personal and medical data.

H6 (SI influences AT) was also confirmed, which is in line with the existing literature. SI has long been recognized as a significant factor in technology adoption, particularly in healthcare contexts [34]. This finding underlines the importance of recommendations from trusted sources such as healthcare providers and family members in encouraging technology adoption. It also highlights the role of social networks in promoting sustained engagement with the application, particularly in pediatric care, where caregivers' decisions are heavily influenced by professional advice and peer support. The acceptance of H7 (AT influences BI) further reinforces the importance of AT in determining users' intentions to use the technology. This is consistent with TAM, where a positive AT toward technology has been shown to significantly predict the BI to adopt digital health tools [45]. These findings underscore the necessity of fostering a positive AT towards digital health applications, which can be achieved by improving perceptions of usefulness, trustworthiness, and social support.

However, the rejection of H2 (PEOU influences AT) diverges from the traditional TAM, where PEOU typically has a positive effect on AT. Previous studies have often highlighted that PEOU is a fundamental determinant in the adoption of technology, as users are more likely to embrace systems that require minimal effort to use [37]. However, in this study, PEOU had a negative beta of -0.151, suggesting that for users already familiar with digital tools, the PEOU may become less significant over time. This result supports the findings of [22], who found that the effect of PEOU diminishes when users are already comfortable with technology. This suggests that once users become adept at using

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a system, the PEOU may no longer be a priority, and other factors such as the tool's utility and reliability might take precedence [11], [12].

The rejection of H3 (PE influences AT) also provides insight into the specific needs of the pediatric diabetes management context. Although PE has been found to enhance engagement in other contexts [25], its impact in healthcare applications may be weaker, particularly in medical settings where the primary focus is on functionality and health outcomes rather than enjoyment. This aligns with research by [46], who suggested that the effect of PE is often weaker than that of PU and PEOU. In diabetes management, where the stakes are high and users prioritize health benefits, the motivating role of enjoyment might not be as significant, especially when the application is seen as a tool for managing a serious chronic condition. Similarly, the rejection of H5 (PR influences AT) aligns with findings from previous studies which suggest that the impact of PR tends to decrease over time. As noted in research by [31], [32], while concerns about privacy and data security are crucial during the initial stages of technology adoption, these concerns may diminish once users gain confidence in the system's reliability and security. This is particularly true when users have positive prior experiences with digital health applications or when the application is supported by robust security measures.

The findings of this study make a significant contribution to the understanding of user acceptance of digital health tools for pediatric T1D management. The results emphasize the critical importance of TR and SI in driving the adoption of these applications. In the context of pediatric diabetes, where managing the condition requires continuous monitoring and collaboration between healthcare providers and caregivers, the role of TR—both in the technology and in the professionals who endorse it—cannot be overstated. Previous research [47] has highlighted that TR, especially when supported by SI, is vital for encouraging users to engage with health applications. This study extends those findings by showing that TR and SI are key factors in the acceptance of digital health applications in pediatric care, where both security concerns and social support networks play an integral role in users' decision-making processes.

This study supports and extends existing research on the factors influencing the acceptance of digital health applications for managing T1D. By highlighting the critical roles of TR and SI, alongside PU, this research contributes to a more nuanced understanding of the determinants of technology adoption in pediatric chronic disease management. The findings suggest that while factors such as PEOU, PE, and PR may have weaker or non-significant effects, the combination of TR, SI, and AT remains essential in promoting both the adoption and sustained use of these tools. This study underscores the importance of incorporating user feedback, security measures, and social support into the design and dissemination of digital health solutions to optimize diabetes management and improve patient outcomes.

5. Conclusion

The results of this study demonstrating that the integration of the TAM with additional constructs such as TR, SI, and PR can effectively explain the behavioral intention to use a digital diary application for managing T1D in children. Specifically, the findings indicate that PU, TR, and SI significantly affect AT, which in turn influences the BI to adopt and use the application. This confirms that the user's AT towards the system is crucial in driving the adoption of digital health tools, in line with the hypothesis set forth at the beginning of the study. However, researchers found that PEOU and PE were found to have negative impacts on attitude in using the system, which contradicts traditional expectations from the Technology Acceptance Model. These results suggest that while PEOU and PE may influence the adoption of some technologies, in the context of pediatric diabetes management, their role were be secondary to more critical factors such as TR and SI.

Furthermore, PR did not significantly affect AT, indicating that users, particularly those already familiar with similar technologies, may place less emphasis on the risks over time, a finding consistent with previous research that suggests the influence of PR decreases with greater familiarity and positive past experiences. Looking forward, these findings open several avenues for further research and application development. Future studies could explore the long-term effects of TR and SI on the continued use of digital health applications, especially in pediatric contexts. Additionally, further research could delve deeper into the interplay between PEOU and PE in technology acceptance, particularly in environments where users are already familiar with the technology. Developers can use these insights to create more

user-centered and context-specific applications that cater to the unique needs of children with T1D and their families, ensuring that these tools remain effective, engaging, and trustworthy over time.

6. Declarations

6.1. Author Contributions

Conceptualization: E.T., P.A.G.P.; Methodology: E.T., S.H., D.K.; Software: P.A.G.P., S.H.; Validation: D.K., Y.P.; Formal Analysis: E.T., R.K.P.; Investigation: S.H., Y.H.; Resources: D.K., N.R.; Data Curation: P.A.G.P., M.F.; Writing – Original Draft Preparation: E.T.; Writing – Review and Editing: S.H., Y.P., R.K.P., Y.H., N.R., M.F.; Visualization: E.T., P.A.G.P.; All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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6.4. Institutional Review Board Statement

Not applicable.

6.5. Informed Consent Statement

Not applicable.

6.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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