



Nursing Management of Pediatric Diabetes: Current Challenges and Solutions

¹ Khaznh Hadi Madlool Aldefery, ² Bader Mahmoud Alamri, ³ Dalal Sawyed Alanzi, ⁴ Mohammed Ahmed Mohammed Muyidi, ⁵ Ayman Ali Makki Alqubby, ⁶ Taghreeg Hamed Ahmed Hakami, ⁷ Shaqraa Hsn Sufyani, ⁸ Manal Fayadh Alanazi, ⁹ Mansoor Abdullah Alohal, ¹⁰ Amani Abdullah Almutairi, ¹¹ Fatimah Jubran Salawi Email, ¹² Abdulmohsin Abdulrahman Almousa, ¹³ Fawzia Ali Attia Alzhrani, ¹⁴ Entesar Mohammed Alsaadi, ¹⁵ Hind Hassan Alhazmi,

¹ Ksa , ministry of health , Maternity and children hospital Hafr Al-Batin

² Ksa , ministry of health , Al Haram Hospital in Medina

³ Ksa , ministry of health , second health cluster

⁴ Ksa , ministry of health , Eradah Hospital for mental health
Jazan Health Cluster

⁵ Ksa , ministry of health , Irada Mental Health Hospital in Jazan
Jazan Health Cluster

⁶ Ksa , ministry of health , Prince Mohd bin Nasser Hospital
⁷ Ksa , ministry of health , al ardash hospital

⁸ Ksa , ministry of health , Aljazeera primary health care center
⁹ Ksa , ministry of health , The first health cluster

¹⁰ Ksa , ministry of health , AL Malaz primary health care center

¹¹ Ksa , ministry of health , R1 - king salman hospital in Riyadh

¹² Ksa , ministry of health , P.H.C.rawdat sudair

¹³ Ksa , ministry of health , Maternity And Children Hospital In Tabuk

¹⁴ Ksa , ministry of health , Tabuk - MCH

¹⁵ Ksa , ministry of health , Woman and child health care cilinc alqasser moll

Abstract

Background: The management of pediatric diabetes, particularly type 1 diabetes (T1D), presents substantial obstacles as a result of the intricate nature of the condition and the critical role of insulin in regulating blood sugar levels. The worldwide increase in T1D cases, maybe exacerbated by the COVID-19 pandemic, necessitates creative ways to enhance treatment for young patients. School nurses (SNs) are essential in assisting children with Type 1 Diabetes (T1D) in school environments, where technological integration has shown potential to improve treatment results.

Methods: This research looks at how SNs may manage T1D care for kids who use technology in classroom settings. Comprehensive searches in databases such as PubMed/Medline, Scopus, and CINAHL were performed using Boolean operators to integrate keywords associated with T1D, technology, and school nursing.

Results: The findings indicate substantial deficiencies in the existing assistance for children with Type 1 Diabetes at educational institutions across many countries, including Saudi Arabia, Italy, and Australia. Inadequate training of school staff restricted resources, and absence of organized care plans hinder effective treatment of Type 1 Diabetes in educational environments. Parents often assume the main duty of managing their child's diabetes, underscoring the need for more extensive support systems inside educational institutions.

Conclusion: The study emphasizes the pressing necessity for enhanced training and resources to be provided to educators and SNs to effectively manage T1D in educational settings. Improved cooperation among parents, educators, and healthcare professionals is crucial for the welfare of children with T1D. Implementing comprehensive care plans and incorporating technology solutions may significantly improve the quality of diabetes management in educational environments.

Keywords: school nurses, technology, type 1 diabetes, pediatric diabetes, and care management.

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1. Introduction

The World Health Organization (WHO) has identified type 1 diabetes (T1D) as one of the world's leading causes of death, making it a serious health problem [1,2]. It is an autoimmune disease that causes the pancreatic beta cells that produce insulin to be destroyed, leading to a severe lack of insulin, which is necessary to control blood sugar levels. T1D development is influenced by genetic predispositions, although environmental events may also cause it to start. The exact reasons are still unknown after a great deal of study. Although it mostly affects children and teenagers, T1D may appear at any age [3-5]. A concerning increase in T1D patients has been reported recently; this increase may be related to COVID-19 infections, which may worsen autoimmune reactions and accelerate beta cell death [6,7]. The treatment and metabolic control of type 1 diabetes and other diabetes types are greatly impacted by lifestyle variables, such as smoking, drinking alcohol, being sedentary, and making poor food choices [8-10].

With 1.52 million people afflicted globally, technological developments have shown promise in improving the treatment of T1D. While 39% of the approximately 300,000 individuals with T1D in Italy use Continuous Glucose Monitoring (CGM) devices, only 10% use Continuous Subcutaneous Insulin Infusion (CSII) [5,6]. The majority (51%) need many daily insulin shots to control their diabetes. There is a rising focus on incorporating technology into everyday treatment, which is backed by strong evidence, given the challenges of managing type 1 diabetes, particularly in younger populations [11-14]. Given this, school nurses (SNs) are in a position to manage T1D care in educational settings by adjusting to a variety of management techniques and resources [15] (Figure 1).



Figure 1. The school nurse's primary areas of expertise in type 1 diabetes management.

2. Methodology

The purpose of this study is to investigate how SNs may help juvenile T1D patients who use technology in the classroom. Three academic researchers oversaw the selection process, while a fourth helped to settle any disagreements. The study includes systematic searches in databases such as PubMed/Medline, Scopus, and CINAHL. Boolean operators were used to carefully mix terms associated with T1D, technology, and school nursing to create search strings.

3. T1D School Care and Parental Support

Parents of children ages 4 to 19 were given an online survey as part of research by Alaqeel [16] that evaluated the support services offered for kids with T1D in Saudi Arabian schools. Just 36 kids (8.8%) out of 411 responders utilized insulin pumps. The poll looked at several topics related to school care, such as peer relationships, glucagon availability, food sufficiency, and insulin administration. Remarkably, just 8.6% of school employees were certified to provide T1D treatment, and SNs were often left on the sidelines. Because of the lack of a defined treatment plan, 79 percent of respondents said that 8% of children did not get insulin during school hours, and many children turned to self-administering insulin. A considerable proportion of children (89.4%) had uncontrolled HbA1c levels despite frequent visits to endocrinologists (90.3%), suggesting a critical need for better community-based treatment.

In a similar vein, Pinelli L et al.'s qualitative research [17] investigated how Italian parents deal with their children's (ages 6–13) T1D while they are at school. In 2.9% of situations, a teacher was in charge of insulin control, but in only 3.6% of cases, an SN was present at the school. The majority of the time, kids either gave themselves insulin or had assistance from their parents. Remarkably, 55.9% of respondents said that the school where their kid was enrolled did not have the resources needed to manage T1D situations. Australian moms of young children with T1D were interviewed by Marks et al. [18] in similar research. With SNs mostly missing and parents alone responsible for management, their results demonstrated the shortcomings in the educational system regarding healthcare assistance for T1D. Parents stressed the need for competent social workers to help with T1D, especially when it comes to utilizing technology, and voiced worries about their kids' safety.

4. The Function of Teachers and Nurses

52 instructors participated in a qualitative study conducted by Pinelli et al. [17] in Italy, which revealed serious deficiencies in their knowledge and readiness for managing type 1 diabetes (T1D) in classrooms. Only 2.9% of teachers said that they would be prepared to assume responsibility for managing T1D in

school settings, despite 40.4% of them reporting having gotten some kind of training on the illness. Furthermore, just 23 percent of the instructors thought their schools had the necessary resources to deal with T1D-related problems. These results highlight the serious shortcomings in the training given to teachers on how to help students with long-term medical difficulties.

5. Assistance for Kids with Type 1 Diabetes in Educational Environments

Children with type 1 diabetes (T1D) have additional difficulties, especially in educational settings where appropriate care is essential to their health and welfare. The present status of school assistance for children with T1D is examined in this study, with particular attention paid to findings from research done in Saudi Arabia, Italy, Australia, and Poland. These studies emphasize the need for better training and resources while highlighting the responsibilities that educators, parents, and school nurses (SNs) have in treating type 1 diabetes.

Alaqeel [16] conducted cross-sectional research in which 411 parents of children ages 4 to 19 completed an online survey to evaluate the support services offered for children with T1D in Saudi Arabian schools. Only 8.8% of the youngsters utilized insulin pumps (IP), according to the data. The poll looked at several important topics, such as peer relationships, the availability of glucagon for emergencies, the quality of meals, and who gave insulin at school. Sadly, only 8.6% of school personnel were trained to treat T1D, therefore many kids had to self-administer insulin. Additionally, 8% of the children did not take insulin during school hours, mostly because there was no clear treatment plan in place—79% of respondents said that there was no such plan. A startling 89.4% of the children had uncontrolled HbA1c levels despite frequent visits to endocrinologists (90.3%), indicating that the present level of care provided in schools is insufficient and highlighting the urgent need for more community-based assistance.

Similarly, a semi-structured questionnaire was used in qualitative research by Pinelli L et al. [17] to investigate how Italian parents deal with their children's T1D between the ages of 6 and 13 during school hours. Only 2.9% of the 220 responders had a teacher in charge of giving insulin, and only 3.6% had a school nurse on hand to help with diabetes treatment. Children often depended on parental help or self-administered their insulin. Interestingly, 55.9% of parents said that their child's school had the necessary resources to manage diabetic situations, indicating a serious lack of support networks for these kids.

Furthermore, 14 Australian moms of children with T1D aged 6 to 7 participated in qualitative interviews with Marks et al. [18], 10 of whom were using insulin pumps. According to these interviews, children with T1D do not get enough healthcare assistance in the Australian educational system, and the school nurse's role is often lacking. Due to this absence, parents are solely responsible for managing their children's diabetes, and they have voiced serious worries about their safety at school. The moms underlined the urgent need for certified school nurses who can provide the right kind of support, especially for kids who use cutting-edge technology.

6. The Function of Teachers and School Nurses

52 instructors were surveyed as part of the Pinelli L et al. research [17] to gauge their readiness to help kids with T1D. The findings revealed that while 40.4% of instructors had undergone specialized training on T1D, just 2.9% were prepared to assume management responsibilities. Furthermore, just 23% of the educators thought their schools had the necessary resources to deal with crises involving diabetes. These results point to a serious deficiency in teacher preparation, especially concerning managing T1D in tech-using kids. The research indicates that thorough training sessions are required for school personnel who are eager to help SNs in managing T1D, even if no instances of carelessness or poor management were documented during crises.

March et al. [19] used a unidimensional measure in similar research to evaluate school nurses' understanding of diabetes treatment tools, such as insulin pumps. The scale, which originally included 50 questions, was trimmed to 25 and given to 310 Pennsylvania school nurses. The study's objectives were to assess SNs' level of competence with these tools, pinpoint areas in need of training, and adjust treatments appropriately. The findings showed that just 34% of the SNs had expertise with integrated care systems,

but 95% had experience with insulin pumps and 92% with continuous glucose monitoring (CGM). This demonstrates the critical need for focused instruction and policies on the use of cutting-edge diabetic care products in educational institutions.

A cross-sectional survey was administered to 132 nurses as part of a further study by March et al. [20], and 104 of them submitted enough replies for analysis. Only 23% of school nurses, according to this survey, had specialized knowledge of integrated technology-based care systems for kids with T1D. This disparity highlights the need for school-specific policies to make the most of these cutting-edge solutions, which will eventually help kids and teenagers with type 1 diabetes.

Additionally, 40 school nurses from public elementary and secondary schools in the United States participated in semi-structured interviews by March et al. [21]. According to the interviews, there is a great deal of promise for contemporary diabetes management tools, but there are also notable training gaps among SNs. The nurses underlined the value of working together with teachers and school personnel to improve assistance for impacted kids and voiced a strong need for additional specialized education about T1D.

Through cross-sectional research involving 230 school nurses from 17 primary schools, Kobos et al. [22] further examined the expertise of school nurses in Poland. Their overall understanding of diabetes, the administration of insulin and glucagon, problems related to diabetes, physical activity, stress, comorbidities, diet, and blood glucose monitoring were all evaluated. The understanding of technical equipment for T1D treatment (36.5%), nutrition (37.4%), and insulin and glucagon (37.9%) had the lowest results, with an average accurate answer rate of 46.7%. There was a modest association between perceived and real knowledge, suggesting that SNs with more education, personal ties to T1D, and previous training on certain subjects fared better.

Last but not least, the obstacles to implementing insulin pumps in the educational system were brought to light by a qualitative investigation that included 13 diabetes educators (DEs) who were responsible for teaching children with type 1 diabetes in Australian primary schools. To properly manage T1D with electronic gadgets, the interviewees emphasized the need to have supporting adults available during school hours and the urgent need for specific training for both SNs and DEs [23].

7. Discussion

Because of their main and secondary effects, chronic illnesses have become a major concern for healthcare policymakers [24-28]. Since diabetes is becoming more widely acknowledged as a global pandemic, attention must be paid to particular factors like food and exercise in light of the concerning national and worldwide trends in diabetes prevalence, which include both type 1 and type 2 diabetes [29-32]. For diabetes management at all levels of care, integrated care approaches that take the patient into account holistically—beyond merely the "diabetological" perspective—should be given priority [33-35]. To improve both qualitative and quantitative results in the treatment of chronic diseases, public health professionals must adopt a contemporary, multifaceted, and interdisciplinary approach [36-39].

Our findings highlight the critical need for better coordination in the treatment of chronic illnesses, especially for patients who require specialized therapeutic education, such as kids with type 1 diabetes (T1D) who use technology in the classroom. In integrated care systems, nurses play a critical role in promoting improved technical and emotional compliance. One research, for example, found that when school nurses (SNs) assisted with the administration of continuous subcutaneous insulin infusion (CSII), glycemic control was better throughout the school year than it was over the summer [34]. This result emphasizes how crucial regular SN engagement is to improving diabetic care. Further studies have shown that SN therapies are linked to better health outcomes and greater adherence to treatment procedures [40].

Furthermore, research from several nations, such as Saudi Arabia, Italy, and Australia, shows that children with T1D often do not get enough assistance, which is frequently linked to the sparse or nonexistent presence of SNs in schools [16, 18, 19]. Children often have to self-administer insulin as a result of this absence, which results in poor HbA1c levels and general insufficient diabetes control during school

hours. As a result, parents or the kids themselves are often left to handle T1D, which highlights serious structural and resource gaps in schools' ability to handle diabetes-related situations.

These difficulties are not unique to T1D; they often arise while managing other chronic illnesses that are common in kids, such as asthma. Adequate healthcare assistance, especially from skilled social workers, has been shown in international trials to considerably improve asthma control [41]. To avoid serious medical occurrences and guarantee student safety, school personnel must be trained to identify and handle asthma problems. As with T1D, schools, parents, and medical professionals must work together to create individualized treatment programs and provide continuing support for asthma [42].

To improve both the technical and emotional commitment to integrated care, nurses play a crucial role. Children need active assistance from schools and their employees, which may have significant positive social and societal effects. People of all ages are impacted by T1D, and its effects go beyond clinical issues to include mental health. Vulnerable people's psychological well-being may be greatly improved by establishing proper therapeutic pathways in appropriate care settings, especially in the early stages of the illness.

Globally, there is a noticeable lack of personal care in delicate settings like communities and schools, which is made worse by the management difficulties brought on by the COVID-19 epidemic [43-46]. This situation emphasizes how important it is for the scientific community to improve the support networks for those with long-term illnesses. Given their ability to successfully fill organizational gaps in primary care, nurses—especially family and community nurses—must be given the respect and accountability they deserve [47]. The community might gain a great deal by looking at ways that family and community nurses can advance their careers. Giving these professionals the tools and training they need may help manage chronic illnesses better and provide a welcoming and safe learning environment for all kids. These issues may be resolved quickly and practically by incorporating specialized skills into the duties of current nurses, which would eventually improve the quality of life for kids with T1D and other chronic illnesses [48].

8. Limitations

There are many restrictions on this research. Only a small number of research in the examined literature focused largely on the existence of SNs and the characteristics of technological equipment, and these aspects were not consistently organized. The significant variety in healthcare systems, timescales, outcomes taken into consideration, and research designs made it difficult to standardize therapies and study populations. As a result, it was not possible to aggregate the results for a summary meta-analysis. We also encountered issues with the included studies' varied reporting of insulin delivery techniques.

9. Conclusion

There are notable training and resource shortages among school nurses and educators when it comes to supporting children with T1D in school settings. Diabetes management is often entrusted to parents, which raises questions regarding the security and welfare of their kids. The results of several research points to the urgent need for thorough training programs for school employees, the development of precise protocols for the management of type 1 diabetes, and the inclusion of certified school nurses in the healthcare system at educational establishments. We can improve the care and support that children with T1D get by tackling these problems, which will eventually improve their quality of life and health outcomes.

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إدارة التمريض لمرض السكري لدى الأطفال: التحديات الحالية والحلول

الملخص

الخلفية: تمثل إدارة مرض السكري لدى الأطفال، وخاصةً مرض السكري من النوع الأول (T1D)، عقبات كبيرة نتيجة للطبيعة المعقدة للحالة والدور الحاسم للأنسولين في تنظيم مستويات السكر في الدم. إن الزيادة العالمية في حالات مرض السكري من النوع الأول، والتي قد تتفاقم بسبب جائحة COVID-19، تتطلب طرقاً مبتكرة لتعزيز العلاج للمرضى الشباب. تلعب الممرضات في المدارس (SNS) دوراً أساسياً في مساعدة الأطفال المصابين بمرض السكري من النوع الأول (T1D) في البيئات المدرسية، حيث أظهرت التكاملات التكنولوجية إمكانية تحسين نتائج العلاج.

الطرق: تبحث هذه الدراسة في كيفية إدارة الممرضات في المدارس لرعاية مرض السكري من النوع الأول للأطفال الذين يستخدمون التكنولوجيا في الفصول الدراسية. تم إجراء بحث شامل في قواعد البيانات مثل PubMed/Medline و Scopus و CINAHL باستخدام عوامل الربط لدمج الكلمات الرئيسية المتعلقة بمرض السكري من النوع الأول والتكنولوجيا والتمريض المدرسي.

النتائج: تشير النتائج إلى وجود نقص كبير في الدعم الحالي للأطفال المصابين بمرض السكري من النوع الأول في المؤسسات التعليمية عبر العديد من الدول، بما في ذلك السعودية وإيطاليا وأستراليا. إن التدريب غير الكافي للموظفين في المدارس، والموارد المحدودة، وغياب خطط الرعاية المنظمة تعيق العلاج الفعال لمرض السكري من النوع الأول في البيئات التعليمية. غالباً ما يتحمل الآباء المسؤولية الرئيسية عن إدارة مرض السكري لدى أطفالهم، مما يبرز الحاجة إلى أنظمة دعم أكثر شمولاً داخل المؤسسات التعليمية.

الخلاصة: تؤكد الدراسة على الحاجة الملحة إلى تعزيز التدريب والموارد المقدمة للمربين والممرضات في المدارس لإدارة مرض السكري من النوع الأول بشكل فعال في البيئات التعليمية. التعاون المحسن بين الآباء والمربين والمهنيين الصحيين أمر حاسم لرفاهية الأطفال المصابين بمرض السكري من النوع الأول. قد يؤدي تنفيذ خطط رعاية شاملة ودمج الحلول التكنولوجية إلى تحسين جودة إدارة مرض السكري في البيئات التعليمية بشكل كبير.

الكلمات المفتاحية: الممرضات في المدارس، التكنولوجيا، مرض السكري من النوع الأول، مرض السكري لدى الأطفال، وإدارة الرعاية.