



What nursing interventions and healthcare practices facilitate type 1 diabetes self-management in young adults? An integrative review

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Abstract

This integrative review aimed to explore how current nursing and healthcare practices can be designed to facilitate effective type 1 diabetes (T1D) self-management in young adults aged 16-25 years. The review explored relevant quantitative and qualitative literature published between 2017 and 2021. Five electronic databases were searched: CINAHL, Medline, Scopus, PubMed and PsycINFO. PRISMA reporting was used to show the flow of information through the different phases of the review. Articles that met the inclusion/exclusion criteria were critically appraised using the Mixed Methods Appraisal Tool. Four main themes emerged through thematic analysis: digital information systems; glucose monitoring and insulin devices; group and peer education and peer support; and diabetes care delivery style. Findings from the review identified that 1) platforms for text messaging, social media, email, and smartphone apps were innovative communication strategies that worked for this age group; 2) the use of continuous glucose monitoring and insulin devices were found to improve self-management routines and psychological well-being of young adults; 3) health service support and education needs to be flexible, dynamic and young adults want to be treated as partners in their own care; and, 4) young adults prefer to be socially engaged, interacting either in group educational settings or with peers through social media. This integrative review highlights the importance of adopting age-appropriate interventions to improve young adults' engagement in T1D self-management, requiring nurses and healthcare practitioners need to keep up to date with the rapid changes in digital technology and diabetes-related device technology. However, relational engagement remains an essential component integral to nurses supporting young adults living with T1D.

Keywords / Ngā kupu matua: adolescents / ngā taiohi; digital technology / hangarau matihiko; nursing / tapuhi; self-management / whakahaere i a ia anō; type 1 diabetes / mate huka momo 1; young adults / ngā pakeke taiohi

Te Reo Māori translation

He aha ngā ritenga āwhina a te tapuhi me ngā tikanga mahi taurima hauora hei whakangāwari i te whakahaere a te pakeke taiohi i te mate huka momo 1? He arotake tuitui

Ngā ariā matua

Ko te whāinga o tēnei arotake tuitui he tūhura me pēhea te hoahoa i ngā tikanga mahi tapuhi, taurima hauora hoki hei whakangāwari i te whakahaere whaihua a te pakeke taiohi i waenga i te 16-25 tau, i tōna anō mate huka momo 1 (T1D). I tūhuratia e te arotake ngā tuhinga ā-inerahi, ā-kounga hāngai i whakaputaina i waenga i te tau 2017 me 2021. E rima ngā pātengi raraunga matihiko i hāhauria. Ko CINAHL, ko Medline, ko Scopus, ko PubMed, ko PsycINFO hoki. I whakamahia ngā tikanga pūrongo PRISMA hei whakakite i te rerenga mōhiotanga, mā roto i ngā hipanga o te arotake. I arohaehaetia ngā tuhinga i eke ki ngā paearu tuku mai/aukati atu ki te Taputapu Arohaehae Tikanga Hanumi. E whā ngā



tāhuhu matua i puta mai mā roto i te tātaritanga tāhuhu: ko ngā pūnaha mōhiotanga matihiko; ko te aroturuki huka toto, me ngā pūrere taiaki huka; te akoranga me te tautoko ā-rōpū, ā-hoa mahi hoki, me te āhua o te hora taurimatanga mate huka. I tautohutia e ngā kitenga o te arotake 1) he rautaki whakapā auaha te whakamahi pūhara mō te karere kuputuhi, pāpāho pāpori, me ngā taupānga waea atamai mō tēnei reanga; 2) nā te whakamahinga aroturuki huka toto, me ngā taputapu taiaki huka i piki ake ai ngā hātepe whakahaere a te pakeke taiohi i a ia anō, me tōna hauora ā-hinengaro anō hoki; 3) he mea hira kia kakama, kia hihiri ngā tautoko ratonga hauora, akoranga hoki, ā, e hiahia ana ngā pakeke taiohi kia kīa he hoa kōtui i roto i tō rātou taurimatanga; ā, 4) he mea pai kē atu ki te pakeke taiohi kia hono ā-pāpori ki ōna hoa, mā te kōrerorero i roto i ngā horopaki ako ā-rōpū, mā te kōrero rānei ki ngā hoa mā ngā pāpāho pāpori. Nā tēnei arotake tuitui kua whakaūngia te hira o te whakamahi i ngā ritenga āwhina tika ā-reanga hei whakapiki i te whakaurunga mai o te pakeke taiohi ki ngā whakahaere i a ia anō mō T1D, e tika ai kia ako haere tonu ngā tapuhi me ngā kaimahi taurima i ngā hangarau matihiko hou, me ngā hangarau e pā ana ki ngā pūrere mō te mate huka. Ahakoa tērā, he mea tino nui te whakatata atu mō ngā tapuhi tautoko i ngā pakeke taiohi e noho tahi ana me te mate huka T1D.

Introduction and literature

Type 1 diabetes (T1D) is a chronic metabolic disorder characterised by high blood glucose levels (Banasik, 2021). The aetiology is a result of the autoimmune system destroying its own beta cells (β -cells) in the pancreas, leading to an absolute deficiency of insulin, the hormone responsible for regulating blood glucose levels (Banasik, 2021). In Aotearoa New Zealand T1D accounts for 5–8% of people with diabetes (Ministry of Health, 2015). Although T1D can occur at any age, the predominant occurrence and onset are found in children and young adults under the age of 15 years, with a marked increase between the ages of 10–14 years (Derraik et al., 2012). The prevalence of T1D in Aotearoa New Zealand is estimated at approximately 17.9 per 100 000 people. However, over time this number has steadily increased reflecting international trends (Derraik et al., 2012; Paul & Corbett, 2021). Although T1D predominantly affects those of European ethnicity others, including Māori, Pacific and Asian, have lower, but similar prevalence rates of 12.3% versus the national population of 17% (Derraik et al., 2012).

Young adults often struggle to self-manage glycaemic levels, resulting in acute and long-term poor health outcomes (Wong et al., 2020). International guidelines recommend a mean glycated haemoglobin (HbA1c) target of 53 mmol/mol for young adults with diabetes (International Society for Pediatric and Adolescent Diabetes (ISPAD), 2018). In Aotearoa New Zealand however, those with T1D aged between 15–29 years had a median HbA1c of 73 mmol/mol, which is significantly above the recommended standard (McClintock et al., 2022).

Unique developmental factors exist that influence these poor outcomes. Cognitively, young adults are still neurologically developing. This development includes the refinement of executive functioning skills. Young adults' working memory is still evolving. Physiologically, these skills depend on the pre-frontal cortex, which continues to mature until around age 25 years (Berg et al., 2018). Additionally, hormonal changes related to puberty have been linked to increased insulin resistance, further compounding the challenges of blood glucose regulation (Datye et al., 2016).

Psychosocially, increasing maturity means young people will experience more independence, decision-making, and personal responsibility. They may move from the parental home or begin to establish intimate relationships. Young adulthood is also a time of experimentation and exploration in sexual behaviour (Vasilenko et al., 2017). Acknowledgement of the young adult's sexuality regarding their chronic illness and the presence of new, intimate, or sexual relationships is also an important developmental consideration (Santos et al., 2020). Stressors also exist such as participating in risky health behaviours that affect carbohydrate intake, glucose metabolism and serum glucose levels, such as experimenting with tobacco, alcohol, and drugs. Positive stressors such as commencing a career or academic pursuit all require lifestyle changes that can also influence daily routines of diet, sleep, and exercise (Hynes et al., 2016).

There is mounting evidence that young adults living with T1D experience significant negative psychological outcomes, including high levels of diabetes distress. This concept of diabetes stress encapsulates the emotional burden of living with



T1D, with the results of lack of motivation, frustration, and anxiety (Wentzell et al., 2020; Wong et al., 2020). An evaluation of the psychological profile of young adults with T1D in Aotearoa New Zealand showed that low emotional wellbeing was apparent in one fifth of the participants, with 7.5% experiencing likely depression, almost a quarter with diabetes distress, and 30% with disordered eating. All these psychological problems can relate to negative diabetes health outcomes (McClintock et al., 2022).

Socio-political factors are also linked to poor glycaemic control in young adults with T1D. Indigenous populations, those who are socioeconomically deprived, and people in rural communities can experience higher HBA1C levels (Chepulis et al., 2021; Sandhu et al., 2020). Additionally, young adults often have deteriorating glycaemic control following the transition from paediatric diabetes services to adult diabetes services. Evidence indicates they are known to have infrequent clinic visits or disengage from clinical services as they devote less time to structured T1D self-management routines, focusing on other competing life priorities (McCarthy & Grey, 2018). Paul and Corbett (2021) have also highlighted that diabetes specialist services catering for young adults in the Aotearoa New Zealand health system do not offer enough support services due to under-resourcing and understaffing, thereby falling short of the International Society for Paediatric and Adolescent Diabetes (ISPAD) (2021) guidelines for diabetes care.

COVID-19 has been an additional stressor, with young people unable to attend routine follow-up visits in person. Virtual health care has become a normal way of interfacing with health professionals (Brenton et al., 2021). Diabetes technology has shown rapid growth such as continuous subcutaneous insulin infusion (CSII) and continuous glucose monitoring (CGM) diabetes delivery over the last decade (Dovc et al., 2020). This growth has expanded due to the COVID-19 pandemic and led to the rapid implementation of remote care delivery (Forde et al., 2022), which accelerated the implementation of platforms such a telemedicine (Wake et al., 2020).

Regardless of innovative technology, T1D self-management is a complex and involved undertaking, which requires balancing multiple variables to

maintain optimal blood glucose levels (Hendricks et al., 2013). Ongoing T1D self-management remains the cornerstone of diabetes control, given the chronic nature of T1D, complexity of disease progression and adverse health outcomes associated with T1D (O'Hara et al., 2017; Wong et al., 2020).

Although T1D is relatively rare, management is very intensive and requires many resources and specialised experts to reduce the risk of long-term serious complications. This integrative review aims to evaluate current nursing and healthcare practices found to be effective in facilitating T1D self-management in young adults.

Methodology

An integrative review was used to explore what works well and what engages young adults with T1D to improve self-management. Integrative reviews can build upon available or emerging knowledge, explore and evaluate possible new solutions, identify gaps in knowledge, and be a catalyst for future research recommendations (Torraco, 2016; Whittemore & Knafl, 2005).

Database search

The literature search took place from April 2021 to May 2021. Five electronic databases: Cumulative Index of Nursing and Allied Health Literature (CINAHL), Medline, Scopus, PubMed and PsycINFO were utilised in the search. Keywords were searched in subject headings and in-text. The search terms were grouped into four categories, with Boolean operators, as shown in Table 1.

Table 1: Search term categories

Category one	"Diabetes type 1" OR diabetes* OR "insulin-dependent diabetes" OR "juvenile diabetes" OR "childhood-onset diabetes"
Category two	young adult* OR "young adulthood" OR "emerging adult" OR "adolescence"
Category three	("self-management" OR "self-care" OR "glycaemic control") AND (interventions OR strategies)
Category four	(Facilitat* OR enabl* OR promot* OR encourag*)
Category five	("New Zealand" OR "Australia") AND indigenous*social determinants of health AND Māori)
Category six	("Nurse led" OR "Nurse" OR "Health professional" OR "Nurse facilitated" OR "diabetes nurse")

Inclusion Criteria: Only primary research published from 2017 to 2021 were considered for this review.

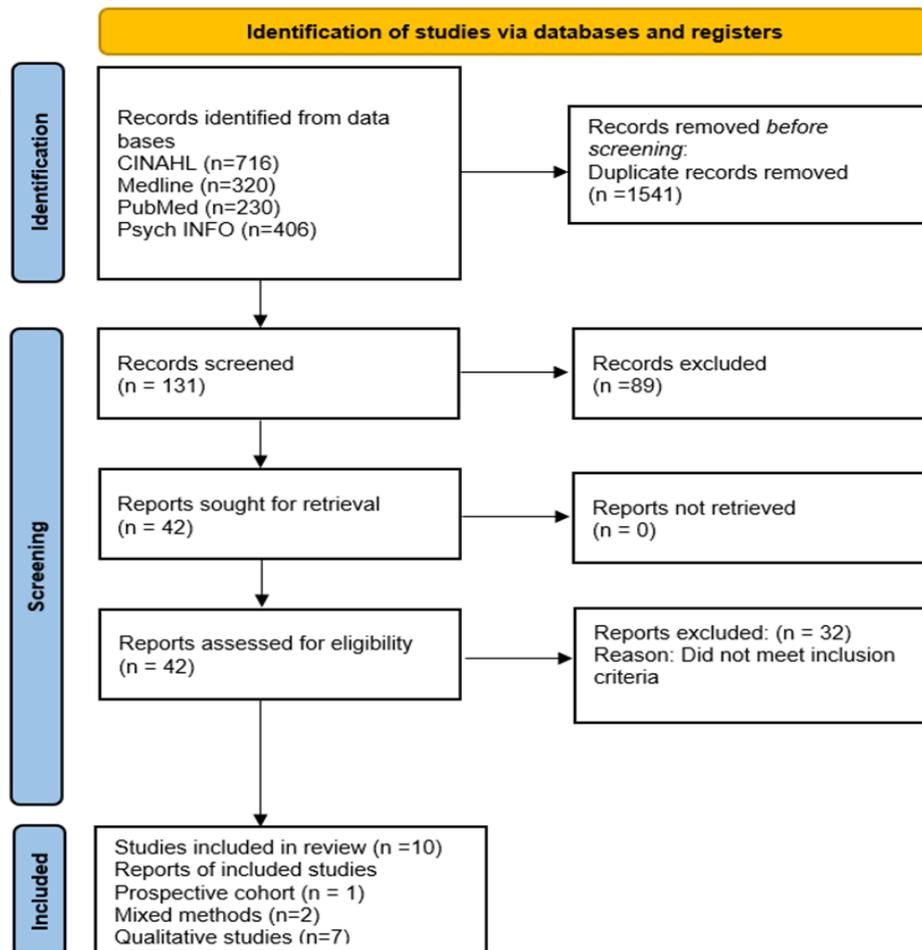


Articles were limited to publications in the English language and those aged 16 to 29 years old, who had T1D.

Exclusion Criteria: Those with Type 2 Diabetes were excluded and research where age-specific data was

not provided. Results of the search process used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Moher et al., 2009, see Figure 1)

Figure 1: PRISMA flow diagram



Data Evaluation

Methodological and data quality assessment used the Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018). Two researchers (TP & RM) independently appraised and evaluated the quality of the selected research. All articles met 90% or more of the quality criteria and were deemed suitable for analysis (see Table 2). The data used in this integrative review were analysed using thematic analysis approach (Braun & Clark, 2006). To understand the data the authors became familiar with the articles by reading them multiple times, applying codes to identify relevant features based on the research question, codes were checked between co-authors (RM and TP) until consensus was reached (Braun & Clarke, 2013).

As commonalities and recurrences occurred with the codes, themes could be identified that capture the essence and spread of meaning. Once theme categorisation was completed, again two authors reviewed the emerging themes to reduce potential researcher bias and provide additional insights. Early themes were reviewed for overlapping commonalities and redundancies until the following themes became increasingly apparent: Digital information systems; group education and peer support; diabetes care delivery style; and glucose monitoring and insulin devices.



Table 2. A review matrix summarising the primary data extracted from the selected articles

Authors. Country	Title	Research Aim	Methodology	Age group & Sample size	Main Results
Bakhach et al., 2019. USA	Home telemedicine (CoYoT1 clinic): A novel approach to improve psychosocial outcomes in young adults with diabetes.	To evaluate the impact of home telemedicine on T1D-related psychosocial and behavioral outcomes.	Prospective cohort pilot study; non-randomised, quantitative study. 42 participated, 39 in control group.	18-25 years; n=81	<ol style="list-style-type: none"> 1. Overall lower levels of diabetes distress, interpersonal distress, and physician-related distress (which relates to disappointment with your current healthcare professionals and can include nurses) 2. Improved self-efficacy, improved ability to communicate with others about T1D.
Agarwal et al., 2017. USA	An adult health care-based paediatric to adult transition program for emerging adults with type 1 diabetes.	To design a paediatric to adult-based health care-based transition program. From an existing adult service program.	Mixed methods; Interviews and demographic statistics.	18-25 years; n=72	<ol style="list-style-type: none"> 1. Improved HbA1c levels and blood glucose monitoring frequency. 2. Adult based health program was more developmentally appropriate and appropriate and acceptable to young adults.
Marsh et al., 2020. USA	Exploring perceptions and use of the patient portal by young adults with type 1 diabetes: A qualitative study.	To explore emerging adults' patient portal knowledge, perceived barriers, and successes in self-managing chronic conditions.	Qualitative; semi-structured survey.	18-26 years; n=27	<ol style="list-style-type: none"> 1. Portal use improves access to general information, appointments, lab results, prescription/supplies. 2. Young adults are interested in using technology to help manage T1D. 3. Health providers should take a more active role in offering T1D management technology and apps whilst giving specific education on how to use them.
Ramchandani et al., 2019. USA	Challenges to diabetes self-management in emerging adults with type 1 diabetes.	Exploring the perspectives of emerging adults on adopting a diabetes self-management (DSM) programme that supports transitional care.	Qualitative; descriptive study. Participants were split into four focus groups (according to age and gender).	18-29 years; n=21	<ol style="list-style-type: none"> 1. Virtual follow up visits can be useful and convenient for emergencies, busy schedules, and regular follow up care. 2. Young adults desire to have a therapeutic partnership /connection with their health care provider. 3. Use of CGMs and insulin pumps optimises glycaemic control and lowers incidence of hypoglycemia.
Johansen et al., 2020. Denmark	Positive facilitators of diabetes management in emerging adults with type 1 diabetes: A qualitative analysis of blogs.	To explore which strategies and supports facilitate T1D management for emerging adults.	Qualitative; analysis of blogs written by emerging adults with T1D.	18-29 years; n=15 blogs	<ol style="list-style-type: none"> 1. Blogs improve connectedness, peer support and information sharing and practical diabetes management strategies from peers. 2. Blogs offer a platform to communicate frustrations, anxieties, and reflections on the emotional tolls of diabetes management as a young adult.



Dobson et al., 2017. Aotearoa New Zealand	The use of mobile health to deliver self-management support to young people with type 1 diabetes: A cross-sectional survey.	To investigate the current and perceived roles of mobile health (mHealth) in supporting young people to manage T1D.	Qualitative; descriptive cross-sectional survey using non-randomised open-ended questions.	16-24 years; n= 57	1. mHealth and diabetes apps improves accessibility of information, facilitates record keeping and tracking of data, useful for carb counting and insulin dose calculation.
Sanders et al., 2018. UK	Experiences of self-management among young adults with type 1 diabetes in the context of a structured education programme.	To explore the experiences of young adults about self-management of T1D, using a structured diabetes education programme.	Qualitative. 15 interviews and 7 focus groups 12 weeks after each course	16-24 years; n= 57	1. Improved participation, reflection, and tacit learning from peers. 2. Increased social and emotional connectedness with peers. 3. Greater understanding of the complexity of diabetes control and associated health risks, whilst reinforcing effective self-management.
Davis et al., 2020. Canada	Moving beyond the rhetoric of shared decision-making: Designing personal health record technology with young adults with type 1 diabetes.	To investigate how personal health record (PHR) technology can be designed to enable shared-decision-making between health practitioner and patient; and how PHR can support self-management decision-making of young adults with T1D.	Mixed methods, survey and semi-structured interviews.	young adults 18-24 years (n=7) and providers (n=15) Total n=22	1. PHR Improves patient engagement, empowerment, access to personal health information, self-management & outcomes. 3. Emphasis on involving young adults in the design of PHR functions, because it is focused on their needs, keeps them engaged, allows them to keep their locus of control.
Farrrell et al., 2019. Australia	Self-management of sick days in young people with type 1 diabetes enhanced by phone support: A qualitative study.	To evaluate the impact of phone support on sick-day management of young people with T1D	Qualitative, exploratory study using semi-structured interviews	18-24 years; n=8	1. Phone services increase the availability and promptness of crisis or follow-up care and offers ongoing responsive advice through calls or text messaging. 2. Text messages are useful for reports on clinical progress. 3. Availability of tailored information from experts and competent health professionals providing the phone service.
Boucher et al., 2020. NZ	Initial experiences of adolescents and young adults with type 1 diabetes and high-risk glycemic control after starting flash glucose monitoring: A qualitative study.	To identify facilitators, challenges, and support needs for young adults, aspects that are vital for enabling providers to intervene and improve patient outcomes.	Qualitative study; semi-structured interviews	Adolescents 14-17 years (n=8) and young adults 18-19 years (n=7)	1. Flash glucose monitoring improves diabetes self-management, reducing glucose-monitoring burden, and increases insulin administration. 2. Facilitators for self-management include: i. Reminders to scan flash glucose meter; ii. Short term-goals; iii. Advice for common problems, tailored recommendations



Findings

Digital information platforms

Participant preference for using digital information platforms as a facilitator of T1D self-management was identified as a dominant theme across the studies reviewed. Digital platforms refer to multiple electronic technologies, including telephone, text messages, email, social media, patient portals and apps (Dobson et al., 2017; Marsh et al., 2020). Of the six studies that reported using technology, all found that using mobile phones and short message systems (SMS) were effective ways to communicate with young people (Bakhach et al., 2019; Boucher et al., 2020; Davis & MacKay, 2020; Dobson et al., 2017; Farrell et al., 2019; Ramchandani et al., 2019). These digital information platforms kept young adults engaged with diabetes services, providing accessible information, tips, motivation, and reminders about diabetes management (Bakhach et al., 2019; Boucher et al., 2020; Davis & MacKay, 2020; Dobson et al., 2017; Farrell et al., 2019; Ramchandani et al., 2019). Mobile phone apps for diabetes management were also an effective intervention (Marsh et al., 2020; Dobson et al., 2017).

Diabetes mobile phone applications provide a source of sharing information for decision-making around carbohydrate counting or insulin titration calculations and tracking and storing personal diabetes data (Dobson et al., 2017; Marsh et al., 2020). Young adults require innovative self-management strategies that address their specific psychosocial needs. The patient portal provides purpose-driven health information (Marsh et al., 2020). Similarly, using Personal Health Record (e-PHR) technology showed promise as an approach to diabetes self-management for young adults with T1D (Davis & MacKay, 2020). Finally, Bakhach et al. (2019) found that young adults attending a telemedicine clinic had better outcomes in self efficacy, communication, and depression reduction than those in the control group, receiving usual (in-person) diabetes care. It is thought that this positive effect using telemedicine was due to having an increased opportunity for education, support, care and increased engagement.

Glucose monitoring and insulin devices

Advances in glucose monitoring and insulin administration devices overall have made a positive impact on diabetes management for those with T1D.

Boucher et al. (2020) found that flash glucose monitoring devices led to increased glucose checks and better knowledge of longitudinal glucose data among young adults. Ramchandani et al.'s (2019) study also reported the positive effect of flash glucose monitoring. These authors identified that continuous glucose monitors (CGMs) and insulin pumps made diabetes management easier for young people. However, despite the benefits of using diabetes devices, some young adults reported annoyances with glucose devices due to inaccuracies, malfunctioning and devices sticking out of from under clothing (Ramchandani et al., 2019).

Health service delivery style

The findings of this integrative review demonstrated that the design of T1D self-management diabetes services influences success. Two studies suggested the need for nurses and the multidisciplinary team counterparts to offer age-appropriate support services that are developmentally appropriate, age-acceptable, useful, and thus relevant to young adults (Agarwal et al., 2017; Ramchandani et al., 2019). To make this service orientation possible, health professionals need to deliberately craft and implement strategies that accommodate young adults' social, physical, and developmental needs and preferences (Agarwal et al., 2017; Marsh et al., 2020; Sanders et al., 2018). Young adults preferred flexible clinic appointment times that extend access to diabetes providers during weekends or after business hours (Agarwal et al., 2017; Ramchandani et al., 2019).

The relationship between diabetes service providers and young adults with T1D is critical for successful diabetes self-management. Young adults value connecting with their diabetes service teams and being partners in their care planning and delivery (Ramchandani et al., 2019). Other studies corroborated this collaborative approach, identifying that young adult wanted supportive, individualised, and non-judgmental relationships with their healthcare providers (Agarwal et al., 2017; Davis & MacKay, 2020; Johansen et al., 2020). Providers' communication skills play a vital role. Building rapport and establishing therapeutic relationships are especially important when faced with a young adult's acute complications such as hypoglycaemia and diabetic ketoacidosis (Farrell et al., 2019). There was consensus that diabetes service providers must be sensitive, realistic, and treat young adults with a



person-centred approach, rather than a biomedical focus on their blood glucose readings (Johansen et al., 2020; Ramchandani et al., 2019; Sanders et al., 2018). Young adults wanted holistic care that came from having a connection with their diabetes providers who understood their day-to-day stresses. Their preference was for a co-ordinated multidisciplinary service, ranging from mental health input to the physical aspects of T1D self-management (Johansen et al., 2020; Ramchandani et al., 2019).

Group education and peer support

Diabetes education plays a pivotal role in enhancing T1D self-management and influencing positive self-care behaviours (Sanders et al., 2018). International exemplars of group delivery for diabetes education have been shown to improve participants' engagement and positively influence diabetes outcomes for young adults with T1D. The following are two examples of such programmes: Working with Insulin, Carbohydrates, Ketones and Exercise to Manage Diabetes (WICKED) offers a five-day intense programme (Sanders et al., 2018); and Colorado Young Adults with T1D Clinic "CoYoT1" (pronounced coyote) involves participant visits three monthly over a 12-month period (Bakhach et al., 2019). Contrary to findings that young adults prefer group education, Ramchandani et al. (2019) found that young adults experience diverse challenges requiring individually tailored advice, education, or support.

Social media can provide an avenue of peer support. For example, web-based social support through blogs facilitates relationship-building between young adults with T1D (Johansen et al., 2020). Likewise, young adults use these blogs to communicate their frustrations regarding blood glucose monitoring and other daily hassles and practicalities about exercise, insulin administration, and dietary decisions (Johansen et al., 2020). These findings are consistent with those found in Bakhach et al.'s (2019) study, which showed the psychological benefits of peer support when participating in a group home telemedicine model of care.

Discussion

This integrative review took place on cusp of the COVID-19 outbreak, so the data available at that time preceded the innovative management of how diabetes care has subsequently been delivered to young adults with T1D to date through the pandemic. However, this review found that effective, age-

appropriate communication methods using multiple technologies and relevant content are vital enablers of T1D self-management in young adults. Mobile phones and SMS use were the most prominent pieces of technology utilised (Bakhach et al., 2019; Boucher et al., 2020; Davis & MacKay, 2020; Dobson et al., 2017; Farrell et al., 2019; Ramchandani et al., 2019). Ng et al.'s study (2019) supports these findings and reports that mobile-based digital interventions (mHealth) better equip young adults to tap into reputable evidence-based information resources. Therefore, identifying and understanding the information models and communication technologies that are adaptable to young adult's developmental stage, such as blogs, social media, email, and SMS, will help nurses to advocate for fit-for-purpose services that further the interests of young adults (James et al., 2020; Whittaker et al., 2019).

Although in the studies that explored mobile devices and sites require internet access, the digital divide continues to impact young adults with T1D (Dobson et al., 2017). Financial constraints, limited computer literacy, and limited health literacy are factors driving these disparities. Further, young adults need to comprehend the diabetes-related information conveyed, which can be a barrier to someone with poor health literacy. These inequities may partially explain the variation in why some young adults view mobile technologies and smartphone apps as effective in aiding T1D self-management whilst others perceive the opposite (Dobson et al., 2017). Dobson et al. (2017) note that there was the potential for messages to be perceived as impersonal, unnecessary, and annoying.

The evolution of diabetes technology has reshaped the management of diabetes care (Forde et al., 2021). Young adults have shown improvement in diabetes self-care activities, along with an increased self-efficacy, confidence, and motivation when supported with diabetes devices such as continuous glucose monitors (CGMs) and insulin pumps/continuous subcutaneous insulin infusion (CSII) (Boucher et al., 2020). This integrative review has identified that uptake of diabetes devices resulted in a significant reduction in diabetes distress levels, anxiety, and demotivation (Boucher et al., 2020, Ramchandani et al., 2019). However, diabetes device technologies (insulin pumps and CGMs) are costly. In Aotearoa New Zealand, young adults lose access to fully funded diabetes devices when they transition from



paediatric health services. This lack of funding often leads to access problems, highlighting an essential gap in diabetes services (Chepulis et al., 2021; Paul & Corbett, 2021; Wheeler et al., 2019). For instance, CGM technology is not publicly funded in Aotearoa New Zealand under the Pharmaceutical Management Agency (PHARMAC), compared to other countries with more comprehensive diabetes device funding, such as the United Kingdom and Canada. Costing between NZD \$50 to \$100 per week, CGM is not affordable to most Aotearoa New Zealanders who would otherwise benefit from this technology (Diabetes NZ, 2019). Hennessy (2020) observes that funding by PHARMAC for continuous subcutaneous insulin infusion devices is a demonstrable stabilisation of glucose control. However, Māori and Pacific in Aotearoa New Zealand are two to three times more likely to stop using their devices (McKergow et al., 2017; Wheeler et al., 2019). Therefore, these vulnerable populations are likely to lose access, contributing to disparity and disadvantage (Hennessy 2020).

The way information is packaged and delivered to young people is equally important to facilitate buy-in. Technology alone is not the solution to self-management. This integrative review indicated that to be effective, the design and delivery style of diabetes education must be tailored to the developmental needs and preferences of young adults (Agarwal et al., 2017; Marsh et al., 2020; Ramchandani et al., 2019; Sanders et al., 2018). Young adults prefer flexible contact times with their service providers to accommodate their busy schedules (Agarwal et al., 2017; Ramchandani et al., 2019). Tailored service models of care concur with previous literature that young adults have unique needs and require specific age-appropriate services (Chiang et al., 2018; Los et al., 2016; Wong et al., 2020). However, there are logistical drawbacks to these suggested services. For instance, providing round the clock face-to-face diabetes care is complicated and not feasible in a health care system that is already facing acute nursing and resource shortages, particularly in diabetes services explicitly catering for young adults. Although electronic management systems have between business hours communication, this intervention is often perceived as impersonal. Access is urgently required to multidisciplinary team members from Te Whatu Ora (Health New Zealand) districts who are specialised and have roles providing dedicated diabetes services.

These include nurses, psychologists, dietitians, social workers, kaiāwhina and health navigator team members (Paul & Corbett, 2021).

Two studies in this review identified that young adults prefer to be engaged not as mere health consumers but as partners-in-care. Young adults value engaging in mutually respectful, therapeutic relationships with diabetes service teams (Farrell et al., 2019; Ramchandani et al., 2019). This approach to diabetes intervention delivery corresponded with the findings of a systematic review by Wong et al. (2020), who found that co-development of interventions resulted in intervention acceptability, satisfaction, and improved diabetes-related quality of life.

Peer-to-peer support through social media and shared group clinics was an important theme in three studies. A communal environment where all age groups can share experiences and expertise and collectively provide support on diet, glucose control and electronic advancements remodelling positive strategies. There was an appreciation of group education programmes, shared consultations, and social media (including blogs), as conducive environments where young adults can interact and share their experiences about managing T1D (Bakhach et al., 2019; Johansen et al., 2020; Sanders et al., 2018).

Strengths and limitations

One of the strengths of this international review is that current literature (2017-2021) was chosen to ensure that the findings represent current trends in diabetes care for young adults.

Previous studies have evaluated T1D interventions separately, which means health professionals have fragmented information to access. This synthesis of information is relevant to generalist and specialist nurses and for multidisciplinary team members who want to influence best outcomes for young adults.

This study has limitations. The articles included in this review were qualitative, with only one using longitudinal study design with a prospective cohort non-randomised trial, and one mixed methods design (Table 2). This methodological issue may have limited the quality of results by only providing a snapshot of data available and not incorporating multiple data collection points to establish patterns on proposed interventions over longer timeframes. This study was conducted prior to data released on how T1Ds care was navigated by technology



throughout the COVID-19 pandemic. This emerging area of research will warrant analysis. The sample sizes in the selected studies were relatively small, with participant numbers ranging between as low as seven (Boucher et al., 2020) to 115 participants (Dobson et al., 2017). Using a small sample in research can be problematic it does not have enough significance to ascertain if there really is a true effect. However, the studies selected for this integrative review were evaluated by two authors using a validated appraisal tool which also helped to eliminate studies that were subject to researcher or participant bias.

Implications for practice

This study has significant implications for nurses' practice both in primary and secondary care settings. The rapidly progressive nature of technology necessitates flexible, skilled, relevant, and responsive diabetes support services. Nurses and diabetes services can reduce health disparities by supporting young people affected by socioeconomic determinants of health. Urgent review of policies on funding, access criteria and allocation of CGM and CSII technology is necessary. Nurses and diabetes service teams have the opportunity to negotiate and incorporate young people in meaningful involvement in all aspects of care to provide person-centred care tailored to their developmental needs and preferences. Improving nurses' expertise on diabetes technology and empowering nurses to deliver evidence-based diabetes education and support can be done through targeted continued learning courses (online, print or workshops). Diabetes support and diabetes education is relevant to generalist and specialist nurses in primary and secondary care.

Recommendations for future research

This study highlights the dearth of research pertaining to the Aotearoa New Zealand context, and particularly in relation to nurses and nurse practitioners supporting Māori and Pacific young adults in primary and secondary healthcare contexts. The study demonstrates that although technological advances hold the promise of improving self-management for young adults, a holistic, relational, person-centred approach is needed to complement digital innovations. Given the significance of the problem in Aotearoa New Zealand there is some urgency for interventional studies, including

longitudinal studies that signpost culturally relevant approaches.

Conclusion

This review offers a comprehensive analysis of the challenges to effective T1D self-management for young adults with recommendations for nursing and diabetes services. Four main themes were identified. Firstly, digital information platforms including text messaging, social media, email, and smartphone apps are innovative communication strategies that work for this age group. Secondly, modern continuous glucose monitoring and insulin devices were found to improve self-management routines and psychological well-being of young adults. Thirdly, health service support and education need to be flexible, dynamic, with young adults treated as partners in their care. Finally, young adults preferred to be socially engaged, interacting either in a group educational setting or to engage with their peers through social media. It is clear that there is a need for nurses and nurse practitioners in Aotearoa New Zealand, who are well positioned in both primary and secondary care, to advocate for and contribute to comprehensive care packages for young adults.

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