International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Operating Publisher
SciFormat Publishing Inc.
ISNI: 0000 0005 1449 8214

2734 17 Avenue SW,
Calgary, Alberta, T3E0A7,
Canada
+15878858911
editorial-office@sciformat.ca

ARTICLE TITLE	CONTINUOUS GLUCOSE MONITORING AS AN INNOVATIVE DIGITAL HEALTH TECHNOLOGY IN TYPE 1 DIABETES: PSYCHOSOCIAL BARRIERS, PHYSICAL ACTIVITY AND EQUITY OF ACCESS
DOI	https://doi.org/10.31435/ijitss.3(51).2026.5803
RECEIVED	30 May 2026
ACCEPTED	17 August 2026
PUBLISHED	24 August 2026
LICENSE	The article is licensed under a **Creative Commons Attribution 4.0 International License.**

CONTINUOUS GLUCOSE MONITORING AS AN INNOVATIVE DIGITAL HEALTH TECHNOLOGY IN TYPE 1 DIABETES: PSYCHOSOCIAL BARRIERS, PHYSICAL ACTIVITY AND EQUITY OF ACCESS

Aleksander Krupski *(Corresponding Author, Email: aleksanderkrupski.pl@gmail.com)*
National Medical Institute of the Ministry of the Interior and Administration in Warsaw, ul. Wołoska 137, 02-507 Warsaw, Poland
ORCID ID: 0000-0002-6432-4982

Michał Marusza
National Medical Institute of the Ministry of the Interior and Administration in Warsaw, ul. Wołoska 137, 02-507 Warsaw, Poland
ORCID ID: 0009-0008-0065-9928

Victoria Stielow
Faculty of Medicine, Lazarski University, ul. Świeradowska 43, 02-662 Warsaw, Poland
ORCID ID: 0009-0007-0954-0918

Antonina Zatyka
Faculty of Medicine, Lazarski University, ul. Świeradowska 43, 02-662 Warsaw, Poland
ORCID ID: 0009-0009-7849-6978

ABSTRACT

Research objectives. While CGM plays an essential role in managing the modern type one diabetic's condition it becomes most critical for those with type 1 diabetes who engage in physical activity as they are often fearful of experiencing low blood glucose levels (hypoglycemia) or post-exercise elevated glycemic levels (dysglycemia), which can limit their ability to participate in such activities. To conduct a focused evaluation of the recent evidence-based research regarding the psychosocial and access related aspects of using Continuous Glucose Monitoring (CGM) technology among physically active individuals with type 1 diabetes.
Methods. Using a focused search strategy that included articles from peer-reviewed journals indexed within MEDLINE/PubMed published between 2022 and 2026 this article has reviewed the original evidence-based research.
Key findings. There is strong evidence concerning exercise related safety, the immediate nature of clinical decision making and fear of experiencing low blood glucose (hypoglycaemia) when exercising. Alerts for predictive post-exercise hypoglycaemic events and the use of CGM that includes information on exercise can both potentially be effective at reducing episodes of clinically significant post-exercise hypoglycaemia. Generic quality of life and diabetes distress have very little direct evidence available regarding these as outcomes in physically active populations.
Conclusions. CGM provides meaningful clinical support for safer exercise in type 1 diabetes. However, it is insufficient to overcome behavioural barriers by itself. Inequitable access to CGM represents a major barrier to achieving its potential benefit in the "real world".

KEYWORDS
Type 1 Diabetes, Physical Activity, Continuous Glucose Monitoring, Quality of Life, Health Equity

CITATION
Aleksander Krupski, Michał Marusza, Victoria Stielow, Antonina Zatyka. (2026) Continuous Glucose Monitoring as an Innovative Digital Health Technology in Type 1 Diabetes: Psychosocial Barriers, Physical Activity and Equity of Access. *International Journal of Innovative Technologies in Social Science*. 3(51). doi: 10.31435/ijitss.3(51).2026.5803

1. Introduction

The administration of type 1 diabetes (T1D) means that individuals are required to continually measure their blood glucose, make multiple self care decisions a day and utilize a lifetime regimen of insulin. Continuous Glucose Monitoring (CGM) was previously viewed as secondary to the primary treatment for T1D. It has been placed as central to the majority of clinician's treatment protocols for persons diagnosed with diabetes. When assessing whether new technologies for diabetes are effective, contemporary standards call for more than just the measure of the impact of these new technologies on the glycemic control of individuals with diabetes. They encourage consideration of other important factors including treatment burden, safety, patient experience and the personal well-being and quality of life of individuals with diabetes (American Diabetes Association Professional Practice Committee, 2025, 2026).

Regular physical activity is highly recommended for patients with type 1 diabetes due to the multiple cardiometabolic, functional and psychosocial health benefits it provides. However, actual physical activity rates are relatively low particularly among young people (children and adolescents) that are generally much less physically active and spend more hours being sedentary compared to their non-diabetic counterparts (Huerta-Uribe et al., 2023). Physical activity in a patient with type 1 diabetes is unique as there can be considerable variability in how glucose levels respond to different types of exercise at varying intensities depending on several factors including the amount of insulin on board, the blood glucose level before starting an exercise session, the quantity of carbohydrates consumed during or After the exercise session. Whether the individual has experienced hypoglycemic episodes previously and what time of day the individual starts exercising (Perkins et al., 2024; Riddell et al., 2024; Sherr et al., 2024a). Because fear of low blood sugar still inhibits many from long-term exercise, fear of low blood sugar can affect confidence, motivation and overall participation with regular physical activity (Patton et al., 2025; Perkins et al., 2024).

The importance of continuous glucose monitoring (CGM) is evident in this area because of its ability to provide individuals with near-continuous glucose data along with trending information and alert capabilities. The recent body of research focused on exercise has demonstrated that CGM is best utilized as a safety-enabling tool and not solely as a solution (Jacobs et al., 2024; Perkins et al., 2024; Rilstone et al., 2024). The hypoglycemic alert system that predicted low blood glucose levels prior to it happening was effective at reducing the amount of clinically significant hypoglycemia < 2.8 mmol/l when used across the entire PACE study period as well as in the 24 hours post-exercise compared to using alerts based on thresholds (Rilstone et al., 2024). When consistently lowering doses of insulin for meals prior to physical activity adults living independently were able to reduce their amount of time spent at or below their target (time below range) during periods of activity (Jacobs et al., 2024).

At the same time, it can't simply be assumed that the psychosocial advantages of using a device are based on improvements to glycemic data. Studies about diabetes devices have indicated that when patients report their own outcomes about their health with diabetes they show much clearer improvements for specifically diabetes-related aspects (such as treatment satisfaction and fear of hypoglycemia) compared to general quality-of-life questions (Liarakos et al., 2024; Speight et al., 2023). Evidence directly related to exercise has been somewhat limited. The results from studies specific to exercise suggest that those who experience higher levels of hypoglycemia fears will be less likely to participate in activities due to fear and also use more conservative methods to manage blood-glucose during physical activity. While other studies indicate that regardless of advancements in technology, many people with diabetes remain distressed by their disease and are still at risk for severe episodes of hypoglycemia (Lorenzen et al., 2024; Patton et al., 2025; Sherr et al., 2024b).

Inequitable access to Continuous Glucose Monitoring (CGM) is still a problem. Reviews published recently have identified many ways in which there continue to be disparities related to race, ethnicity, insurance coverage, socio-economic status, geography, etc. - all considered structural determinants of health (Been et al., 2024; Conway et al., 2025; Dicks et al., 2025; Patel et al., 2024). Additionally, numerous original studies conducted in both the U.S. and England demonstrate how inequities in various aspects of healthcare systems impact whether patients receive CGM at some point, how long they can continue to use it and how prescriptions and implementations vary by type of setting (Lee et al., 2024; Mathias et al., 2022; Prahalad et al., 2024; Seidu et al., 2025; Tilden et al., 2024; Tremblay et al., 2024; Wallia et al., 2024). Physically active individuals with type 1 diabetes (T1D) face additional barriers relative to their physical activity. This is due to the fact that an individual's ability to participate safely and sustainably in physical activities is impacted by his/her potential lack of equitable access to CGM technology.

This focused literature review aims to present an overview of the latest scientific research regarding the exercise-related psychosocial and access aspects of using Continuous Glucose Monitoring (CGM) in physically active individuals with type 1 diabetes (T1D). In order to not make unsubstantiated claims about a broad causal relationship of CGM to each and every patient reported outcome measure, this study will examine those areas where the current scientific evidence is strong as well as where there are gaps in current knowledge and how these findings may inform clinical practice and exercise-based programs that provide support to individuals with diabetes and equitable diabetes care (American Diabetes Association Professional Practice Committee, 2026; Liarakos et al., 2024; Patel et al., 2024; Perkins et al., 2024).

2. Methodology

2.1. Review design

The authors selected this manuscript to be written based on their findings from a focus literature review for this purpose instead of writing it as a formal systematic review or meta-analysis. This is what the authors chose because the current body of research in the area of continuous glucose monitoring in type 1 diabetes includes several related areas that are also somewhat methodologically different. These areas include exercise related safety, behavioral and psychosocial outcomes.

2.2. Information sources and search strategy

The major resource for information used for this project was PubMed/MEDLINE. An exhaustive computerized literature review was conducted utilizing several different databases (from 2022 to 2026) in an attempt to identify every article written during this time period which examined studies/trials relating to type 1 diabetes. The searches were performed with both singular word searches as well as multiple word searches by combining the following words: type 1 diabetes, continuous glucose monitoring, physical activity and exercise, fear of hypoglycemia, diabetes distress, quality of life, barriers to care, adherence to treatment plans, differences in access to health care, insurance status, race/ethnicity and socioeconomic deprivation/geography. Only clinical guidelines and high-quality reviews were used as references for the background information and interpretation for each body of primary research evidence found.

2.3. Eligibility and selection approach

Original research on humans was given priority over other study types when they dealt with either one of two areas: (1) safety, self management and/or psychological elements related to physical activity in individuals using continuous glucose monitors for type 1 diabetes and (2) equity issues regarding continuous glucose monitor prescription, implementation, uptake, adherence, reimbursement and retention in type 1 diabetes populations. The original research is contextualized by narrative, systematic reviews and existing clinical practice recommendations.

2.4. Data extraction and synthesis

Beginning with the data that were collected from the primary sources of this analysis (the study designs, the settings, the populations, the modalityies by which Continuous Glucose Monitoring (CGM) was used, the contexts for the participants' physical activity/exercise/fitness as well as their access to diabetes care services, the domains regarding which outcomes were assessed and the results of each study concerning the review question) since each study included in this review varied considerably in terms of study design, the populations studied, the specific physical activity/exercise/fitness contexts in which the studies were conducted and how CGM was applied in addition to how each study's respective outcomes were defined, it was possible to complete a qualitative rather than a quantitative synthesis of the evidence. The evidence was therefore categorized into thematic areas including: (1) exercise-related safety and self-management issues with diabetes, (2) fear of hypoglycemia and psychological aspects of diabetes management, (3) equity of access and concerns related to implementing CGM technology in various environments and (4) limitations inherent in the methodology used in the existing body of research on CGM.

2.4 AI

AI was utilized for two specific purposes in this research. Text analysis of clinical reasoning narratives to identify linguistic patterns associated with specific logical fallacies. Assistance in refining the academic english language of the manuscript, ensuring clarity, consistency and adherence to scientific writing standards. AI were used for additional linguistic refinement of the research manuscript, ensuring proper english grammar, style and clarity in the presentation of results. It is important to emphasize that all AI tools were used strictly as assistive instruments under human supervision. The final interpretation of results, classification of errors and conclusions were determined by human experts in clinical medicine and formal logic. The AI tools served primarily to enhance efficiency in data processing, pattern recognition and linguistic refinement, rather than replacing human judgment in the analytical process.

3. Results

3.1. Scope of the reviewed literature

The primary synthesis of this review was based upon thirteen recently conducted original research papers published from 2022 to 2026. Six of these studies examined the use of Continuous Glucose Monitoring systems (CGMs) during physical activity for individuals with type one diabetes who are also physically active, while seven studies investigated equity of access to CGMS, prescribing, utilization and maintenance/continuity of CGMs (Henske et al., 2025; Jacobs et al., 2024; Lee et al., 2024; Mathias et al., 2022; Patton et al., 2025; Prahalad et al., 2024; Riddell et al., 2024; Rilstone et al., 2024; Seidu et al., 2025; Sherr et al., 2024a; Tilden et al., 2024; Tremblay et al., 2024; Wallia et al., 2024). Additionally, other high quality, peer-reviewed guidelines and systematic reviews were consulted as background information for the original findings. The representative original studys included within the core synthesis are outlined in Table 1.

Table 1. Representative original studies included in the focused review.

Study	Country	Design	Population	CGM/ exercise context	Main outcome domain	Key finding
Rilstone 2024	UK	Randomized crossover trial	24 adults with T1D performing regular physical activity	Dexcom G6 with predictive alert on vs off	„Exercise“ hypoglycemia	Predictive alert reduced exposure to glucose <2.8 mmol/l overall and in the 24 h after exercise.
Jacobs 2024	USA/ Canada	Observation al study	561 adults with T1D	Free-living exercise with CGM, insulin and nutrient data	Exercise self-management	Guidelines requiring behavior change were rarely used; reducing meal insulin before exercise was associated with less time below range in open-loop therapy.
Patton 2025	USA/ Canada	Observation al study	251 physically active adolescents with T1D	T1DEXIP cohort using CGM during free-living activity	Fear about hypoglycemia	Higher fear scores were linked to fewer competitive/high-intensity events and to more hyperglycemia-oriented protective behavior during exercise.
Sherr 2024	USA/ Canada	Observation al study	Adolescents with T1D	Postexercise CGM analysis in T1DEXIP	Postexercise safety	Longer activity duration was associated with more nocturnal hypoglycemia after exercise.
Henske 2025	Internation al online sample	Cross-sectional survey	102 regular aerobic exercisers with T1D	Self-reported exercise management; most used CGM/pump technology	Adherence to exercise recommendatio ns	Despite high technology use, 86% reported frequent activity-related hypoglycemia and many guideline-based strategies were underused.
Tremblay 2024	USA	Retrospectiv e cohort	Youth with T1D at diagnosis or after CGM uptake	Initiation and meaningful CGM use over 1 year	Equity of initiation and continuity	Public insurance was associated with slower CGM start, fewer use-days, and faster discontinuation; disparities were stronger among Hispanic and Black youth.

Study	Country	Design	Population	CGM/ exercise context	Main outcome domain	Key finding
Tilden 2024	USA	Retrospective cohort	2008 children with T1D	CGM-billed clinic visits	Geographic access	Children in small rural and isolated rural towns had substantially lower odds of CGM-associated visits than urban peers.
Mathias 2022	USA	Implementation study	1357 underserved adults with T1D	CGM prescribing in safety-net diabetes practice	Prescribing equity	Practice transformation increased CGM prescription rates from 15% to 69%, with improvements for all three ethnic groups (Black, Hispanic and White adults).
Lee 2024	USA	Pilot feasibility study	91 youth with T1D and public insurance	CGM plus remote patient monitoring support	Continuity of CGM use	The team-based support model improved HbA1c levels and highlighted the feasibility of a program but also demonstrated both adherence and data-completeness challenges that persist beyond study completion.
Wallia 2024	USA	Cross-sectional EHR study	1168 patients with T1D in FQHCs	CGM prescription orders	System-level prescribing disparities	Only 11.0% of patients with T1D had CGM prescriptions in this vulnerable-care setting, despite increasing use over time.
Prahalad 2024	USA	Prospective implementation study	Young people with newly diagnosed T1D	Early CGM start and remote monitoring (4T program)	Equitable implementation	In an intentionally equitable digital health program, strong one-year glycemic outcomes were achieved in a cohort with substantial representation of Hispanic patients and those who are publicly insured.
Seidu 2025	England	Cross-sectional ecological analysis	ICB/PCN prescribing data	CGM prescribing across regions	Ethnicity and deprivation	Both deprivation and ethnicity explained significant variance in the prescribing rate of cgms, as lower prescribing was observed in areas serving more Afro-Caribbean and South Asian populations.

3.2. Exercise-related safety and self-management

The most consistent finding across all CGM focused studies has been that CGM provides better support for safe glucose management during and immediately after physical activity but does not uniformly improve psychosocial outcomes. Evidence from the PACE study clearly identified the urgent low soon predictive alert as reducing total (overall) and post-exercise (24 hours) clinically significant hypoglycaemic events less than 2.8 mmol/l (Rilstone et al., 2024). Data from adults at T1DEXI who used Continuous Glucose Monitoring systems (CGMs) to track their blood sugar levels also supported this approach. Specifically, they demonstrated that consistent behaviors based on guidelines such as taking less insulin prior to exercise for meals taken prior to exercise and waiting a short period of time after recent episodes of hypoglycemia to engage in physical activity resulted in less time spent in low blood sugar states while exercising (Jacobs et al., 2024).

In pediatric patients the results were similar. Glycemic response both during and immediately after exercise was influenced by behaviorally and contextually controllable factors, which supports the use of CGMs as an active tool to inform decisions rather than being simply an observational tool (Riddell et al., 2024; Sherr et al., 2024a). At the same time, a study conducted by Henske et al. (2025) also indicated that even for the most active users of modern diabetes technology they don't always follow the best practices of self-management and are prone to experiencing frequent hypoglycemic episodes due to their physical activity.

3.3. Fear of hypoglycemia, patient-reported dimensions and persistent barriers

The best-represented psychosocial area in the recent literature on exercise was fear of hypoglycemia. Patton et al. (2025) demonstrated that adolescents with higher fear scores were less likely to participate in competitive and/or high-intensity exercise. In addition, adolescents who scored the highest on the "maintain high blood glucose" subscale experienced significantly lower Time In Range (TIR) and higher Time Above Range (TAR) than other groups during exercise. These results show that fear is not just present during the management of physical activity but also plays an important role on how people make decisions and could result in intentional conservative glycemic strategies being implemented.

Although there are some studies which do provide evidence for a positive relationship between the use of Continuous Glucose Monitoring systems (CGMs) and generic quality of life as well as reduced levels of diabetes-related stress within physically active populations. However, this relationship has been less consistently supported in direct exercise-based research. Additionally, many of these same diabetes technology review articles also found that the specific health related outcomes from using diabetes technology typically are associated with improvements in disease-specific measures rather than general quality of life measures (Liarakos et al., 2024; Speight et al., 2023). In an adult Danish survey there was no correlation between using diabetes technology and reduced levels of emotional distress. However, as seen in a large scale randomized trial that included racially/ethnically diverse children/young adults, increased CGM usage and decreased HbA1c values did not result in meaningful improvements in self-reported levels of diabetes-related distress, depression or empowerment (Bisno et al., 2023; Lorenzen et al., 2024).

Newer research on barriers to the adoption of emerging technologies has been characterized by increasing skepticism about technological optimism. The main reason cited for being physically inactive by participants in the BETTER registry (who had access to CGM and AID) was their fear of experiencing hypoglycemic episodes. Additionally, those with lower incomes and/or less education tended to have greater total barrier ratings as did those who expressed little confidence in their ability to manage episodes of low blood glucose (Guédet et al., 2025). Collectively, the body of research reviewed here indicates that CGM may help with making decisions about specific events and with decreasing levels of uncertainty regarding activity. However, technology by itself is unlikely to be sufficient in removing the psychological or behavioral barriers that exist for individuals engaging in physical activity.

3.4. Equity of access, uptake and implementation

The literature on access was more consistent than the literature examining the relationship between access and PROMs/physical activity. In terms of timing of access, a study conducted by Tremblay et al. (2024) indicated that privately insured youth had publically insured youth start their CGM earlier (151 vs. 233 days) and accumulate more days using the CGM over the course of one-year (324 vs. 232 days), privately insured youth also stopped using their CGM sooner. The differences noted by Tremblay et al. were greater when comparing hispanic and black youth. Rural residency was found by Tilden et al. (2024) to be an independent predictor of decreased likelihood for CGM-related clinic visits for youth with T1D. This demonstrates how geography continues to represent a substantial obstacle for those seeking medical care despite having access to the same regional health system.

Implementation studies have shown that disparities can be modified as opposed to being inevitable. A stakeholder driven transformation in clinical practices resulted in an increase in CGM prescription rates for underserved adult populations from 15% to 69%. These increases were observed across all three racial/ethnic groups (Black, Hispanic and White) (Mathias et al., 2022). The study found that youth who were publicly insured using team-based support for remote monitoring showed improvements in their HbA1c levels as well as sustained engagement with technology use, even while they continued to experience both significant issues related to access to supplies and compliance (Lee et al., 2024). Similarly, the 4T program was specifically designed to pair initial CGM use with a team-based digital support system which resulted in very good glucose control at one year in a population that included a large number of hispanic patients and individuals whose care was covered through medicaid or other forms of government-funded health insurance (Prahalad et al., 2024).

However, there are wide variations in how different health care organizations approach this issue. For example, in federally qualified health center (FQHC) settings the authors report that there is an extremely low level of adoption of CGM among those identified in the national EHR analysis by Wallia et al. (2024). Only 11.0 percent of patients in the T1D group demonstrated evidence of having been prescribed a CGM device. At the system level in England, Seidu et al. (2025) reported that both ethnic differences and socioeconomic status accounted for the majority of variability regarding the prescription rates of continuous glucose monitoring (CGM) by region. The areas that had larger Afro-caribbean and south asian populations were less likely to have prescriptions written (Seidu et al., 2025). In addition, these findings agree with systematic reviews at the level of the body of evidence indicating that inequitable access to diabetes technologies is a persistent global issue (Been et al., 2024; Conway et al., 2025; Dicks et al., 2025; Patel et al., 2024).

3.5. Methodological considerations and evidence gaps

There are several important limitations related to the literature reviewed. Exercise-focused studies frequently use CGM as either a means to enable study participants to measure their physiological responses to exercise or as a measuring device in order to assess their physiological response during exercise. This does not allow researchers to make clear statements about whether CGM itself was responsible for the changes observed. In addition, there are no standard definitions for psychosocial outcomes across all studies. Furthermore, the primary outcomes within most access studies are observational based on implementation and/or ecological data and therefore while very useful for assessing equity issues and interpreting health systems,do not provide good evidence of causality. Lastly, because the access studies and exercise studies are limited in their overlap, it is impossible to answer this complete research question using one single homogenous body of evidence. Table 2 shows methodological considerations of representative original studies. It summarizes the main methodological strengths and limitations of the representative original studies.

Table 2. Methodological considerations of representative original studies.

Study/group	Design	Main strengths	Main limitations
Rilstone 2024	Randomized crossover trial	Direct exercise intervention;, clinically relevant postexercise endpoint	Small sample;,short follow-up, alert-based rather than whole-system comparison
Jacobs, Patton, Sherr	Observational exercise studies	Real-world activity data, direct relevance to free-living exercise	No randomization, self-management behaviors may confound results
Henske 2025	Online survey	Focus on highly active exercisers and guideline adherence	Recall bias, self-selection, largely self-reported technology use
Tremblay and Tilden	Retrospective cohort studies	Large pediatric datasets, clinically relevant access endpoints	Residual confounding, health-system and coding limitations
Mathias, Lee, Prahalad	Implementation studies	Actionable equity interventions, real-world practice relevance	Non-randomized designs, workflow and co-intervention effects
Wallia and Seidu	Cross-sectional / ecological analyses	System-level perspective on inequity	Cannot determine individual causal mechanisms or patient-level behavior

4. Discussion

4.1. Principal findings

This targeted focused literature review supports an argument that, while there are many benefits of Continuous Glucose Monitoring systems (CGMs) use in the physically active individual with type 1 diabetes (T1D), it appears that those who benefit most from this technology and will likely have their quality-of-life improved the most through its utilization, will be the individuals who can utilize the data generated by the device to improve their own safety during physical activity as well as make better decisions based upon real-time information. The majority of studies included within this review also suggest that the primary reasons individuals with T1D may choose to wear a CGMs are to provide them with predictive alerts about potential hypoglycemic events and/or hyperglycemic events and to help guide their ability to manage their blood sugar levels based upon the amount of physical activity they engage in throughout each day. While these technologies do appear to be helpful in providing both predictive alert systems and glucose-based interpretations related to physical activity the majority of reviews within the field of T1D indicate that the current body of literature does not demonstrate sufficient evidence to suggest that utilizing a CGM will result in significant psychosocial changes to an individual's overall quality-of-life (Been et al., 2024; Conway et al., 2025; Dicks et al., 2025; Lee et al., 2024; Liarakos et al., 2024; Lorenzen et al., 2024; Mathias et al., 2022; Patel et al., 2024; Prahalad et al., 2024; Seidu et al., 2025; Sherr et al., 2024a, 2024b; Speight et al., 2023; Tilden et al., 2024; Tremblay et al., 2024; Wallia et al., 2024).

4.2. CGM as a facilitator of safer physical activity

CGM is best thought of from a medical standpoint as an aid to more safely engage in physical activities rather than a standalone promise that the outcomes will always be "optimal" when using this tool. Therefore, our approach to conceptualizing CGM is consistent with the current approaches to diabetes technology and a number of recent research studies that have focused on exercise (American Diabetes Association Professional Practice Committee, 2026; Perkins et al., 2024). Therefore, while CGM can improve an individual's awareness (visibility) and anticipation of possible future changes in their glucose levels, it is also contingent upon several variables including: education, an individual's behavioral flexibility and the appropriate use of both insulin and carbohydrate intake to achieve the benefits of CGM (Henske et al., 2025).

4.3. Psychosocial interpretation

The psychosocial interpretation should be taken with a grain of salt. There may be clinical relevance for CGM improving self-confidence in exercise and reducing uncertainty. There are also specific data regarding fear of hypoglycemia supporting these views (Jacobs et al., 2024; Patton et al., 2025; Rilstone et al., 2024). There is no reason to draw conclusions based on the currently available literature as to whether CGM provides uniform improvement to generic quality of life in active T1D populations or if it will significantly decrease diabetes-related stress (distress) in such groups. These distinctions are important since review articles that generalize broadly from benefits related to glycemic control and/or events to broader psychosocial benefit may be overestimating what the current literature supports. (Bisno et al., 2023; Guédet et al., 2025; Liarakos et al., 2024; Lorenzen et al., 2024; Speight et al., 2023).

4.4. Equity of access as a clinical issue

The current literature base demonstrates that equity of access to Continuous Glucose Monitoring sysyems (CGMs) as a clinical concern rather than just a policy consideration. The available literature clearly shows that there is a disparity in access to CGMs at multiple different levels: initiation, continued use of the technology, prescribed by whom (specialist vs GP), rural vs urban populations, languages spoken and how CGMs were implemented regionally (Lee et al., 2024; Mathias et al., 2022; Prahalad et al., 2024; Seidu et al., 2025; Tilden et al., 2024; Tremblay et al., 2024; Wallia et al., 2024). This has significant implications for sport and physical activity. If CGM provides individuals with type 1 diabetes (T1D) with an environment where they can safely engage in physical activity without fear of hypoglycemic events or other negative consequences then it stands to reason that unequal distribution of CGM could have similar effects on the ability of certain groups to participate in physically active lifestyles. Thus, equity of access to CGM is not solely a healthcare policy issue but also a clinical determinant of who will actually be able to effectively utilize the benefits of modern exercise supportive diabetes management (Been et al., 2024; Conway et al., 2025; Dicks et al., 2025; Patel et al., 2024).

4.5. Practical implications for clinicians and educators

The most likely recommendation for diabetologists, sports medicine doctors, diabetes educators and other multidisciplinary teams could be to combine Continuous Glucose Monitoring systems (CGMs) with physical activity education programs. This is supported by the recent Brar et al. (2024) review of athletes which clearly identifies the importance of understanding the operation of devices, the lag time between when glucose readings were taken and when they can be displayed, the use of alarms and the ability to assess the trend of glucose values while engaging in sporting activities as important factors to enable the safe participation of elite level athletes. Exercise support therefore needs to provide information regarding the technology of CGMs and include an education component related to evaluating trends while physically active, observing post-exercise blood glucose levels and adapting individualized to changing amounts of carbohydrates or/and insulin.

4.6. Strengths and limitations of this review

The key advantage of this paper lies in its specificity to diabetes type 1 (T1D) with respect to technology application (CGMs), physical activity, psychological factors and equity of access. However, a significant disadvantage to this research lies within the methodology. The paper is a targeted literature overview of original research papers that are indexed in PubMed with some review or guideline articles to provide background. The article will not be a comprehensive systematic review/meta-analysis based on searching all relevant databases. As such the paper can be thought of as an evidence base thematic synthesis and not a definitive quantitative systematic review. In other words, the author's decision to limit his study is intentional and better than having claimed completion of a comprehensive review when the available body of evidence and/or review design did not provide for such.

4.7. Implications for future research

The future for research will be to use validated measures for the assessment of physical activity level and type of T1D related fears (fear of hypoglycemia), emotional/psychological stressors (diabetes-related distress), overall quality of life and the degree of treatment burden experienced by physically active individuals with T1D as well as their self-assessed ability to engage in physical activities safely (exercise confidence). As a means of differentiating the influence of the technology used within CGMs from that resulting from use of more comprehensive Automated Insulin Delivery systems (AIDs) researchers need to do a better job of distinguishing these influences. From an equity perspective, the goal of future research will not be to document differences in outcomes among groups, rather it will be to determine if specific approaches for implementing AIDs can result in sustainable reductions in such differences across various health care systems (Lee et al., 2024; Mathias et al., 2022; Prahalad et al., 2024; Seidu et al., 2025; Wallia et al., 2024).

5. Conclusions

Continuous Glucose Monitoring (CGM) provides significant clinical application to individuals with type 1 diabetes (T1D) who are physically active. It can provide a means for improving safe exercise related glucose control and decreasing uncertainty associated with potential episodes of hypoglycemia while exercising.

There is strong evidence supporting that CGM enhances the safety of physical activity, facilitates real time self-management of blood glucose levels and may also enhance behaviors associated with decreased fear regarding hypoglycemic events.

While there is some early evidence suggesting improvements in quality of life and/or distress associated with having a chronic illness such as T1D may occur in active populations with T1D using CGM. These findings are currently very preliminary and should be viewed cautiously due to the limited nature of existing research.

A remaining major barrier to realizing the clinical benefits associated with use of CGM in active individuals with T1D remains the persistent disparity in rates of CGM prescription initiation, CGM use continuation and overall CGM prescribing among different subpopulations.

Author contributions: Aleksander Krupski - coordination. Michał Marusza - literature research. Victoria Stielow - data collection. Antonina Zatyka - article selection assistance.

Founding statement: this research received no external funding.

Declaration of the use of generative AI and AI-assisted technologies in the writing process: the authors used only AI-assisted resources to improve writing clarity, grammar and formatting, as well as assist with a review process. All remaining authorship responsibilities included interpretation of data, source selection, synthesis of all study results and final approval of the written manuscript.

REFERENCES

1. American Diabetes Association Professional Practice Committee. (2025). 5. Facilitating positive health behaviors and well-being to improve health outcomes: Standards of care in diabetes—2025. *Diabetes Care, 48*(Suppl. 1), S86–S127. https://doi.org/10.2337/dc25-S005
2. American Diabetes Association Professional Practice Committee. (2026). 7. Diabetes technology: Standards of care in diabetes—2026. *Diabetes Care, 49*(Suppl. 1), S150–S165. https://doi.org/10.2337/dc26-S007
3. Been, R. A., Lameijer, A., Gans, R. O. B., van Beek, A. P., Kingsnorth, A. P., Choudhary, P., & van Dijk, P. R. (2024). The impact of socioeconomic factors, social determinants, and ethnicity on the utilization of glucose sensor technology among persons with diabetes mellitus: A narrative review. *Therapeutic Advances in Endocrinology and Metabolism, 15*, 20420188241236289. https://doi.org/10.1177/20420188241236289
4. Bisno, D. I., Reid, M. W., Pyatak, E. A., Flores Garcia, J., Salcedo-Rodriguez, E., Torres Sanchez, A., Fox, D. S., Hiyari, S., Fogel, J. L., Marshall, I., Bachmann, G., & Raymond, J. K. (2023). Virtual peer groups reduce HbA1c and increase continuous glucose monitor use in adolescents and young adults with type 1 diabetes. *Diabetes Technology & Therapeutics, 25*(9), 589–601. https://doi.org/10.1089/dia.2023.0199
5. Brar, G., Carmody, S., Lumb, A., Shafik, A., Bright, C., & Andrews, R. C. (2024). Practical considerations for continuous glucose monitoring in elite athletes with type 1 diabetes mellitus: A narrative review. *The Journal of Physiology, 602*(10), 2169–2177. https://doi.org/10.1113/JP285836
6. Conway, R. B., Snell-Bergeon, J., Honda-Kohmo, K., Peddi, A. K., Isa, S. B., Sulong, S., Sibomana, L., Gerard Gonzalez, A., Song, J., Lomax, K. E., Lo, C.-N., Kim, W., Haynes, A., de Bock, M., Burckhardt, M.-A., Schwab, S., & Hong, K. (2025). Disparities in diabetes technology uptake in youth and young adults with type 1 diabetes: A global perspective. *Journal of the Endocrine Society, 9*(1), bvae210. https://doi.org/10.1210/jendso/bvae210
7. Dicks, J. H., McCann, L. J., Tolley, A., Barrell, A., Johnson, L., Kuhn, I., & Ford, J. (2025). Equity of continuous glucose monitoring in children and young people with type 1 diabetes: A systematic review. *Pediatric Diabetes, 2025*, 8875203. https://doi.org/10.1155/pedi/8875203
8. Guédet, C., Alexandre-Heymann, L., Yardley, J. E., Messier, V., Boudreau, V., Chahal, T., Dostie, M., Mathieu, M.-E., Brazeau, A.-S., Tagougui, S., & Rabasa-Lhoret, R. (2025). Exploring perceived barriers to physical activity among individuals with type 1 diabetes in the era of new technologies: An analysis from the BETTER registry. *Diabetes & Metabolism, 51*(5), 101677. https://doi.org/10.1016/j.diabet.2025.101677
9. Henske, J., Albashaireh, A., Turner, L. V., Beach, G., & Riddell, M. C. (2025). Are regular aerobic exercisers with type 1 diabetes following current physical activity self-management guidelines? Insights from an online survey. *Clinical Diabetes, 43*(3), 378–387. https://doi.org/10.2337/cd24-0100
10. Huerta-Uribe, N., Hormazábal-Aguayo, I. A., Izquierdo, M., & García-Hermoso, A. (2023). Youth with type 1 diabetes mellitus are more inactive and sedentary than apparently healthy peers: A systematic review and meta-analysis. *Diabetes Research and Clinical Practice, 200*, 110697. https://doi.org/10.1016/j.diabres.2023.110697
11. Jacobs, P. G., Marak, M. C., Calhoun, P., Gal, R. L., Castle, J. R., & Riddell, M. C. (2024). An evaluation of how exercise position statement guidelines are being used in the real world in type 1 diabetes: Findings from the Type 1 Diabetes Exercise Initiative (T1DEXI). *Diabetes Research and Clinical Practice, 217*, 111874. https://doi.org/10.1016/j.diabres.2024.111874
12. Lee, M. Y., Ritter, V., Shaw, B., Ferstad, J. O., Johari, R., Scheinker, D., Bishop, F., Desai, M., Maahs, D. M., & Prahalad, P. (2024). Addressing disparities using continuous glucose monitors and remote patient monitoring for youth with type 1 diabetes. *Journal of Diabetes Science and Technology*. Advance online publication. https://doi.org/10.1177/19322968241305612
13. Liarakos, A. L., Crabtree, T. S. J., & Wilmot, E. G. (2024). Patient-reported outcomes in studies of diabetes technology: What matters. *Diabetes, Obesity and Metabolism, 26*(Suppl. 7), 59–73. https://doi.org/10.1111/dom.15858
14. Lorenzen, J. T., Madsen, K. P., Cleal, B., Joensen, L. E., Nørgaard, K., Pedersen-Bjergaard, U., Schmidt, S., Rytter, K., & Willaing, I. (2024). Associations between use of diabetes technology and diabetes distress: A Danish cross-sectional survey of adults with type 1 diabetes. *BMJ Open, 14*(3), e080053. https://doi.org/10.1136/bmjopen-2023-080053

15. Mathias, P., Mahali, L. P., & Agarwal, S. (2022). Targeting technology in underserved adults with type 1 diabetes: Effect of diabetes practice transformations on improving equity in CGM prescribing behaviors. *Diabetes Care, 45*(10), 2231–2237. https://doi.org/10.2337/dc22-0555
16. Patel, P. M., Thomas, D., Liu, Z., Aldrich-Renner, S., Clemons, M., & Patel, B. V. (2024). Systematic review of disparities in continuous glucose monitoring and insulin pump utilization in the United States: Key themes and evidentiary gaps. *Diabetes, Obesity and Metabolism, 26*(10), 4293–4301. https://doi.org/10.1111/dom.15774
17. Patton, S. R., Bergford, S., Gal, R. L., Calhoun, P., Clements, M. A., Sherr, J. L., & Riddell, M. C. (2025). Fear of hypoglycemia relates to glycemic levels during and after real-world physical activity in adolescents with type 1 diabetes. *Diabetic Medicine, 42*(4), e15482. https://doi.org/10.1111/dme.15482
18. Perkins, B. A., Turner, L. V., & Riddell, M. C. (2024). Applying technologies to simplify strategies for exercise in type 1 diabetes. *Diabetologia, 67*(10), 2045–2058. https://doi.org/10.1007/s00125-024-06229-x
19. Prahalad, P., Scheinker, D., Desai, M., Ding, V. Y., Bishop, F. K., Lee, M. Y., Ferstad, J., Zaharieva, D. P., Addala, A., Johari, R., Hood, K., & Maahs, D. M. (2024). Equitable implementation of a precision digital health program for glucose management in individuals with newly diagnosed type 1 diabetes. *Nature Medicine, 30*(7), 2067–2075. https://doi.org/10.1038/s41591-024-02975-y
20. Riddell, M. C., Gal, R. L., Bergford, S., Patton, S. R., Clements, M. A., Calhoun, P., Beaulieu, L. C., & Sherr, J. L. (2024). The acute effects of real-world physical activity on glycemia in adolescents with type 1 diabetes: The Type 1 Diabetes Exercise Initiative Pediatric (T1DEXIP) Study. *Diabetes Care, 47*(1), 132–139. https://doi.org/10.2337/dc23-1548
21. Rilstone, S., Oliver, N., Godsland, I., Tanushi, B., Thomas, M., & Hill, N. (2024). A randomized controlled trial assessing the impact of continuous glucose monitoring with a predictive hypoglycemia alert function on hypoglycemia in physical activity for people with type 1 diabetes (PACE). *Diabetes Technology & Therapeutics, 26*(2), 95–102. https://doi.org/10.1089/dia.2023.0376
22. Seidu, S., Tetteh, J., Kunutsor, S., Choudhary, P., Khunti, K., & Ajjan, R. A. (2025). Prescription distribution and inequities in diabetes care: A comparative analysis of continuous glucose monitoring access by diabetes status, ethnicity and socio-economic factors in England. *Diabetic Medicine, 42*(11), e70130. https://doi.org/10.1111/dme.70130
23. Sherr, J. L., Bergford, S., Gal, R. L., Clements, M. A., Patton, S. R., Calhoun, P., Beaulieu, L. C., & Riddell, M. C. (2024a). Exploring factors that influence postexercise glycemia in youth with type 1 diabetes in the real world: The Type 1 Diabetes Exercise Initiative Pediatric (T1DEXIP) Study. *Diabetes Care, 47*(5), 849–857. https://doi.org/10.2337/dc23-2212
24. Sherr, J. L., Laffel, L. M., Liu, J., Wolf, W., Bispham, J., Chapman, K. S., Finan, D., Titievsky, L., Liu, T., Hagan, K., Gaglia, J., Chandarana, K., Bergenstal, R., & Pettus, J. (2024b). Severe hypoglycemia and impaired awareness of hypoglycemia persist in people with type 1 diabetes despite use of diabetes technology: Results from a cross-sectional survey. *Diabetes Care, 47*(6), 941–947. https://doi.org/10.2337/dc23-1765
25. Speight, J., Choudhary, P., Wilmot, E. G., Hendrieckx, C., Forde, H., Cheung, W. Y., Crabtree, T., Millar, B., Traviss-Turner, G., Hill, A., & Ajjan, R. A. (2023). Impact of glycaemic technologies on quality of life and related outcomes in adults with type 1 diabetes: A narrative review. *Diabetic Medicine, 40*(1), e14944. https://doi.org/10.1111/dme.14944
26. Tilden, D. R., French, B., Datye, K. A., & Jaser, S. S. (2024). Disparities in continuous glucose monitor use between children with type 1 diabetes living in urban and rural areas. *Diabetes Care, 47*(3), 346–352. https://doi.org/10.2337/dc23-1564
27. Tremblay, E. S., Bernique, A., Garvey, K., & Astley, C. M. (2024). A retrospective cohort study of racial/ethnic and socioeconomic disparities in initiation and meaningful use of continuous glucose monitoring among youth with type 1 diabetes. *Journal of Diabetes Science and Technology, 18*(5), 1081–1090. https://doi.org/10.1177/19322968231183985
28. Wallia, A., Agarwal, S., Owen, A. L., Lam, E. L., Davis, K., Bailey, S. C., DeLacey, S. E., Pack, A. P., Espinoza, J., Bright, D., Eggleston, A., Walter, E., & O'Brien, M. J. (2024). Disparities in continuous glucose monitoring among patients receiving care in federally qualified health centers. *JAMA Network Open, 7*(11), e2445316. https://doi.org/10.1001/jamanetworkopen.2024.45316