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Addressing Disparities in Technology Use Among Patients with Type 1 Diabetes: A Review

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Abstract

Purpose of Review: The benefits of continuous glucose monitors (CGMs) and insulin pumps in the management of type 1 diabetes are widely recognized. However, glaring disparities in access exist, particularly in groups that stand to benefit significantly from diabetes technology use. We will review recent data describing drivers of these disparities and approaches to address the disparities.

Recent Findings: Several qualitative studies were published in recent years that have investigated the drivers of disparities reported over the past decades. These studies report that in addition to typical barriers seen in diabetes technology, these patients have unique challenges that make insulin pumps and CGMs less accessible.

Summary: Barriers to technology use in these groups include stigmatization, lack of support, and financial constraints, provider biases, stringent insurance policies and clinic infrastructure. To address these inequities, multifaceted strategies across community, healthcare, and provider sectors are essential. Key initiatives include enhancing public awareness, refining health policies, ensuring access to high-quality care, and emphasizing patient-centered approaches. The equitable use of technology can further narrow the gap in T1D outcomes. The social and economic implications of suboptimal T1D management further underscore the urgency of these efforts for both improved health outcomes and cost-efficient care.

Keywords

Disparities; type 1 diabetes; technology; continuous glucose monitoring; insulin pump

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Introduction

The management of type 1 diabetes (T1D) has witnessed significant advancements over the past several decades. Devices such as continuous glucose monitors (CGMs) and insulin pumps enhance clinical outcomes in patients with T1D by offering improved glycemic control and quality of life, and reduced instances of severe hypoglycemia and diabetic ketoacidosis (DKA) [1]. Given these observed clinical benefits, multiple meta-analyses have established that both CGMs and insulin pumps are cost-effective for managing T1D, especially among individuals with suboptimal management or a high risk of severe hypoglycemia [2,3]. Over the past decade, the American Diabetes Association (ADA) Standards of Medical Care in Diabetes, along with guidelines from other major national societies, have progressively broadened the indications for use of diabetes technologies. CGMs have now become the standard of care for all T1D patients, and automated insulin delivery systems are recommended for patients who are able to use them safely [4–6].

Despite the well documented benefits of diabetes technology and broad guidelines for use, the literature has consistently demonstrated inequities in real-world access to these technologies [7–14]. The SEARCH for Diabetes in Youth study was among the early research to highlight disparities in insulin pump use based on socioeconomic status and race/ethnicity. It reported that Hispanic patients used pumps half as often as Whites, while Black and Asian patients used them only one-fifth as often as Whites. Furthermore, the majority of insulin pump users came from families with higher socioeconomic status, characterized by incomes over \$75,000, parents with education at the college level or beyond, and/or private insurance [7]. Subsequent studies have confirmed these socioeconomic disparities [8–11,13] and have also shown these racial-ethnic disparities to persist, even after adjusting for socioeconomic status and glycemic control [9–11]. These findings are alarming, especially since these marginalized populations are at an elevated risk for adverse T1D outcomes and stand to benefit significantly from these technologies. For example, Black patients with T1D are only half as likely to utilize insulin pumps and CGMs as non-Hispanic White patients, however, they face a three-fold increased risk of hospitalization due to DKA and hypoglycemia, a 1.5% elevated A1C, and double the mortality rate [11,12,15]. The SEARCH for Diabetes in Youth study recently nearly a doubling of technology use from 2001 to 2019 but notably, racial, ethnic, and socioeconomic disparities, such as education, income, and insurance coverage showed no improvement over these two decades [16]. The drivers of these disparities are likely multifactorial and arise from patient, provider, and healthcare system barriers.

Drivers of Disparities in Diabetes Technology Use

Patient-Level Barriers

- 1. Stigmatization & Social Burdens**—Diabetes related stigma is very common in individuals living with T1D and can have more pronounced effects within marginalized communities [17,18]. Investigations into the barriers to diabetes technology adoption in these communities reveal concerns about device visibility, unsolicited inquiries, and fear of differential treatment due to T1D diagnosis [19**]. A participant insightfully remarked, “there are so many things that we worry about as people of color within society...meeting

social normalities... We don't want other attention" [19**], showing the complexity of living with multiple marginalized identities.

We know that people who are oppressed and marginalized by society are more vulnerable to psychological distress, such as anxiety, depression, which have both been associated with reduced use of these diabetes technologies [20]. It has also been described that there is a general lack of familiarity with T1D and consequently lack of exposure to diabetes technology in some communities [19**]. While T1D summer camps can bridge these gaps for some children, studies show Black and Hispanic children are less likely to attend. Valenzuela et al. reported that in a camp cohort, about 90% of attendees were non-Hispanic White, in contrast to a 70% prevalence in the broader age group [21]. Meanwhile, Black and Hispanic attendees represented 5%, even though their respective prevalences in the age group are 10% and 15%. This is a lost opportunity for these youth to learn more about diabetes and technology use, address psychosocial challenges, foster relationships, and develop a support network amongst others with T1D [22].

2. Inadequate support—The lack of support for patients and their families may be a barrier to technology initiation and adherence [23]. Loomba et al found that Spanish-language-preferring children with type 1 diabetes, had similar familiarity with insulin pumps compared their non-Hispanic White counterparts, but experienced more concerns about confidence in learning to use the device [24]. Furthermore, they found that Spanish-language-preferring patients were far more likely to report previous insulin pump but discontinuing it [24]. This may indicate that appropriate education and support systems, perhaps from both families and the healthcare system, are lacking to appropriately prepare patients to confidently initiate and adhere to diabetes technology.

3. Financial Insecurity—Cost is another frequently highlighted barrier to diabetes technologies; high deductibles and copays required for devices and supplies can be prohibitive. This particularly impacts patients from lower socioeconomic backgrounds and those with inadequate insurance coverage. Notably, patients with an income below the median household income (i.e., \$75,000) were found to be about half as likely to receive an insulin pump as those with a higher income [*16]. Patients from marginalized populations and young adults often lack financial security and are more prone to fragmented insurance coverage, leading to disruptions in their care and challenges initiating and continuing treatment with insulin pumps and CGM [25].

Provider-Level Barriers

After cost, provider barriers is one of the most common barriers cited from patients from groups experiencing disparities in diabetes technology use [19**,26–28*]. Qualitative studies involving minority patients have reported that providers often act as gatekeepers of diabetes technology and limit patients' autonomy [19**,27**]. While endocrinologists may be limiting diabetes technology use to those who they perceive will appropriately use and/or benefit from its use, studies have demonstrated that providers are not always able to accurately predict who will benefit from diabetes technology [29]. The Endocrine Society diabetes technology guidelines also underscores that there is no high quality data

examining what predicts success with technology and that some patients do well despite not exhibiting characteristics considered to be favorable for success [5]. Patients have reported that providers have “discouraged and blocked” the use of technology due to “glycemic control” concerns or perceptions of a “device being too complex for the patient,” even against their wishes [27**]. There have also been reports of receiving infrequent discussions and incomplete information about the benefits of technologies [25,28*]. Given that patients heavily rely on providers for knowledge and recommendations regarding technology use [19**], any limitations in these discussions could exacerbate disparities among these groups. Additionally, a study involving pediatric endocrinologists found that insurance status might be interpreted as a proxy for social determinants, influencing providers’ treatment recommendations [30,31]. This also raises concerns about the potential inappropriate use of race as a proxy for socioeconomic status or social determinants of health [32].

System-Level Barriers

To qualify for an insulin pump or CGM under certain insurance providers or historic clinical practice guidelines, patients were typically required to demonstrate specific diabetes self-management skills [33,34]. These include frequent self-monitoring of blood glucose levels, carbohydrate counting, consistent visits to a certified diabetes educator, and maintaining a relatively controlled diabetes status [33,34]. However, not all these criteria are evidenced based and they may pose challenges for patients from disadvantaged backgrounds who may have more barriers to care and social determinants of health. While clinical guidelines have broadened their criteria for use [4–6], many insurance providers continue to have restrictive criteria resulting in a major barrier for many patients [35–39]. From the provider’s perspective, a lack of infrastructure or support staff in clinics to address the multifaceted requirements of prescribing and managing patients with diabetes technology (such as handling insurance prior authorizations, providing diabetes education, and downloading reports etc) [40] may present a system-level barrier that may deter the use of such technology.

Strategies to Promote Equal Access to Diabetes Technology

The widespread disparities observed in diabetes care underscore the need for systemic changes across multiple fronts (see Figure 1). From raising public awareness to revising health policies and redefining care delivery methods, each facet plays a critical role in ensuring equitable care for all.

Community-Level Strategies

Public awareness.—To reduce disparity, efforts should start by raising public awareness about the benefits of technology for patient education, acknowledging existing disparities, and creating opportunities for open dialogue about drivers and solutions amongst key stakeholders, which can in turn inform policy. Increasing public awareness of the diagnosis of T1D in underserved communities and the use of diabetes technology, as well as increasing opportunities for social support among their peers from similar backgrounds (e.g. T1D camp, support groups) may improve health literacy and reduce stigmatization, feelings of isolation and also empower patients to self-advocate.

Population health data collection.—As we move forward with strategies to diminish disparities, establishing population based registries that over-samples underserved communities becomes pivotal. Such data are crucial for better understanding barriers and facilitators experienced in this population, gauging the progress and trends in disparities and understanding the effectiveness of efforts to combat them. Additionally, it is essential to include racial and ethnic minorities and those of low socioeconomic status in clinical trials, as most studies primarily involve white, high socioeconomic status participants, and often excluding those with very poorly control [41–48].

Reforming Health policies.—Enhanced public awareness, coupled with diligent population health data, can inform policies that more effectively address issues that impact uptake and adherence of diabetes technology. Insurance policies, for instance, should consider short and long term benefits as well as clinical care guidelines when establishing their eligibility criteria for these devices and co-payment costs. Moreover, policies and programs are needed to tackle social determinants of health that impact management of and outcomes of T1D, especially in underserved areas. It is also worth noting that the healthcare system has observed a burgeoning gray market. This market, capitalizing on an oversupply of diabetes technology, offers these essentials at discounted prices. Without substantial reductions in device costs or improved coverage, the ethical, legal, and moral dilemmas tied to this market are bound to persist.

Health Care-Level Strategies

Access to high-quality health care.—To reduce disparities, ensuring access to high-quality care at the healthcare level is paramount. High-quality care should encompass providers who are up to date on guidelines, comfortable using diabetes technology, and a team-based approach that integrates mental health services and provides avenues to address social determinants of health. Care coordination and navigation services are also essential to prevent fragmented care and ensure that patients are supported as they transition to different management strategies, such as insulin pumps and CGMs, which involve a multifaceted process that includes interactions with representatives, consultations with a diabetes education nurse and dietician, and frequent follow-ups with an endocrinologist.

Moreover, healthcare systems must emphasize the importance of implicit bias training for providers so that providers are more aware how unconscious biases can unknowingly impact the way they deliver care. Another aspect of consideration is promoting racial/ethnic and language concordance among patients and providers, as studies have demonstrated improved patient outcomes in this setting [49]. Finally, the presence of medical interpreters is vital for patients for whom English is not their primary language when there is no language concordance amongst the patient and provider [50,51]. By adopting and executing these strategies, healthcare systems are poised to make significant strides in providing equitable care to their entire patient base.

Provider-Level Strategies

Whole-person or patient-centered care.—Providers should allocate adequate time to discuss the advantages and disadvantages of medical technologies and address potential

barriers. This approach not only respects patient autonomy but also promotes shared decision-making, establishes trust, and empowers patients with T1D to be active in their health care decisions. Such discussions should be standardized across all patients and it is imperative that providers inquire about barriers to care including self-management burnout, diabetes distress, and social determinants of health and seek to understand how these factors may impact their current management and future therapy options [52]. Understanding why patients might be reluctant to use insulin pumps and CGMs is crucial, as is addressing potential stigmatization and other addressable concerns. Additionally, providers should offer resources that support patient management, which includes mental health services, T1D support groups and summer camps.

Diabetes Technology can be leveraged to Address Disparities in Type 1 Diabetes Outcomes

Poorly controlled T1D is linked to significant morbidity, mortality, and elevated healthcare costs. As previously discussed, racial-ethnic minorities and those of lower socioeconomic status bear a greater burden of both short and long-term diabetes complications and associated healthcare expenditures [53,54]. Everett et al. conducted a study examining the influence of insurance features and socioeconomic status on use of CGM and insulin pumps and their consequent impact on adverse outcomes. They determined that both CGM and pump use were associated with fewer adverse outcomes. Moreover, the association between health insurance features, socioeconomic status, and adverse outcomes exhibited significant indirect effects through access to diabetes technology. This suggests that addressing disparities in technology use could potentially mitigate disparities in diabetes outcomes.

In 2017, the national cost of diabetes was estimated at \$27 billion, with 55% attributed to complications from suboptimal control. Conversely, only 0.4% of this cost was tied to diabetes technology. Given these financial implications, it would be prudent for insurers and policymakers to prioritize investments in strategies, such as diabetes technology, that enhance glycemic outcomes. Prioritizing early adoption of diabetes technology among groups most vulnerable (such as racial-ethnic minorities, those with low socioeconomic status, and high A1c levels) could substantially mitigate disparities in type 1 diabetes outcomes and the associated economic burden.

Conclusion

The advancement of diabetes technologies presents a hope for improved patient outcomes, especially for those living with T1D. While their benefits are innumerable, persistent disparities in access and use, particularly among minoritized and economically disadvantaged groups. These disparities stem from multifaceted barriers at the patient, provider, and system levels, encompassing stigmatization, health literacy, financial constraints, implicit biases, and system inequities. Addressing these challenges necessitates a concerted effort: enhancing public awareness, utilizing robust population health data, reformulating health policies, and ensuring high-quality care that emphasizes a whole-person approach (Figure 2). By strategically integrating these measures, we can edge closer to the equitable dissemination and utilization of diabetes technologies, which may ultimately

translate into improved health outcomes in some of the most vulnerable populations living with T1D.

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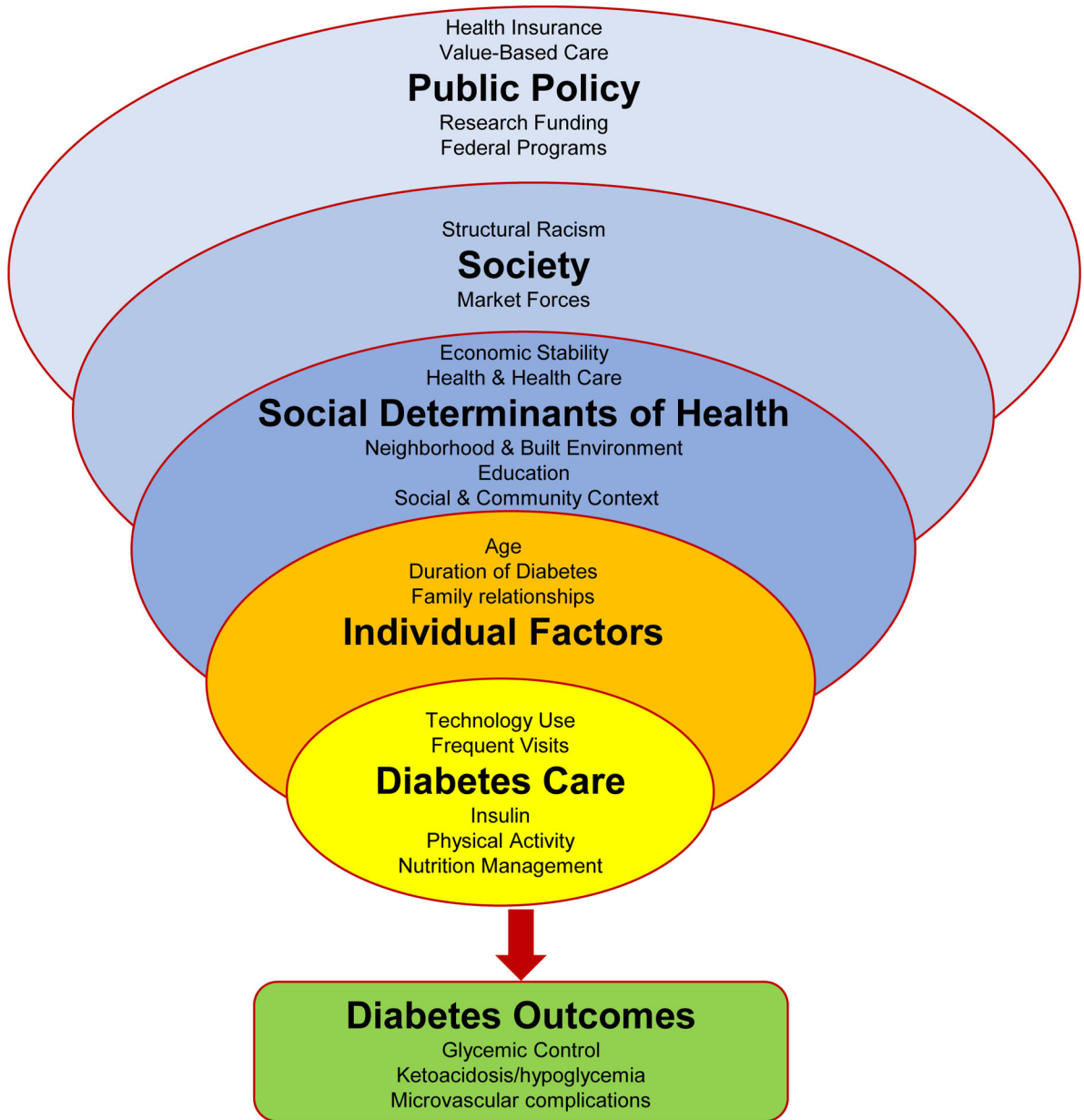


Figure 1: Domains impacting Diabetes Technology Access & Diabetes Outcomes

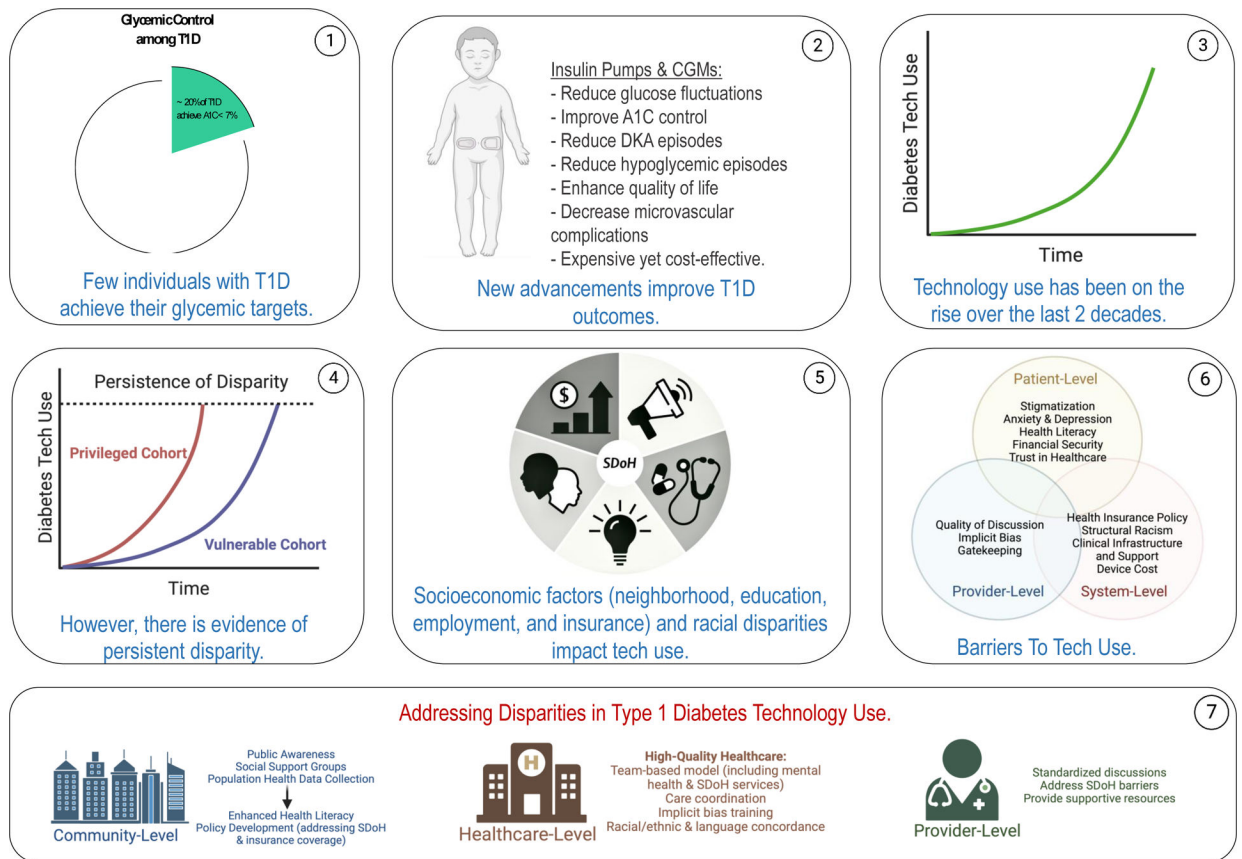


Figure 2:
Summary Figure- Addressing Disparities in Type 1 Diabetes Technology Use