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A Systematic Review of the Effects of Provider Bias on Health in Youth and Young Adults with Type 1 Diabetes

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Abstract

Purpose of Review Although pervasive inequities in the health outcomes of youth and young adults with type 1 diabetes (T1D) exist, the role of provider bias in these inequities is not well-understood. The purpose of this review is to synthesize evidence from existing studies on the associations between patient characteristics, provider bias, and patient health.

Recent Findings Fourteen articles were included. Determining the extent of the effects of provider bias on patient health is limited by a lack of consensus on its definition. Experiences of provider bias (e.g., shaming, criticism) negatively affects self-esteem, relationships with medical providers, and depressive symptoms. Provider bias also impacts diabetes technology recommendations, insulin regimen intensity, and risk for life-threatening T1D complications.

Summary Future studies are needed to develop questionnaires and interviews that better account for diverse experiences and interpretations of bias in T1D healthcare. More research is also needed to investigate mitigating factors to reduce provider bias as a way to improve psychological and physical health in individuals with T1D.

Keywords Provider Bias · Health Outcomes · Youth · Young Adults · Systematic Review

In the USA, approximately 1.6 million people have type 1 diabetes (T1D) [1], which is increasing in prevalence, mostly in individuals from Hispanic and non-Hispanic Black backgrounds [2, 3]. Individuals with T1D from low socioeconomic backgrounds and/or underrepresented groups experience suboptimal glycemia, higher rates of hospitalization for diabetic ketoacidosis (DKA) and long-term complications, and increased mortality compared to individuals with higher socioeconomic backgrounds and/or who identify as White, non-Hispanic [4, 5]. Additionally, youth with T1D from families with incomes < $60,000 have higher HbA1c than those with higher incomes, an association that exists across ethnic groups [6]. Although socioeconomic background plays a significant role in T1D health inequities, Black children from high socioeconomic backgrounds have higher HbA1c than White children from low socioeconomic backgrounds [7]. Regardless of their socioeconomic background, Black children and adults with T1D have higher HbA1c and are significantly more likely to die from T1D complications compared to their White counterparts [6–8]. Hispanic youth with T1D also have increased risk for T1D complications and may need higher insulin doses compared to White youth with T1D [9]. These inequities represent problematic patterns in T1D medical care that place Black, Indigenous, and People of Color (BIPOC) and individuals from low socioeconomic backgrounds at-risk for significant health complications.

To mitigate T1D complications, the American Diabetes Association recommends that individuals with T1D attend quarterly appointments with a T1D provider to evaluate and problem-solve T1D management barriers to engaging in T1D care [10]. However, non-Hispanic Black and Hispanic youth have lower T1D-related appointment attendance than non-Hispanic White youth, suggesting that there are systematic barriers to appointment attendance including limited transportation or caregiver unemployment [11]. Area deprivation (e.g., using area-based geographic estimates of socioeconomic disadvantage based on social determinants of health [e.g., education, employment, housing, poverty] to

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determine the extent to which living in disadvantaged neighborhoods contributes to adverse health outcomes) also influences T1D medical appointment attendance, insulin pump and CGM use, and risk of severe hypoglycemia, HbA1c, and DKA-related hospitalizations [12, 13]. Provider bias is a potential explanation for lower T1D appointment attendance in BIPOC and/or individuals from low socioeconomic backgrounds.

Provider implicit (i.e., unconscious) and explicit (i.e., conscious) biases contribute to racial, ethnic, and socioeconomic inequities in healthcare delivery through stereotyping and prejudice [14, 15]. Provider implicit bias against Black individuals with myocardial infarctions results in decreased likelihood of prescribing thrombolytic medications compared to White individuals [16]. Provider bias is also linked with higher depression and poorer life satisfaction and social integration in adults with spinal cord injury [17]. Pediatric pain providers with greater implicit pro-White bias are more likely to prescribe narcotic medications for postoperative pain for White youth compared to Black youth [18]. However, little is known about provider bias as it relates to health outcomes in T1D.

Significant inequities in prescribed insulin regimens and diabetes technology prevent individuals with T1D who are BIPOC and/or from low-income backgrounds from achieving and maintaining optimal glycemia [19]. Black individuals and those from low socioeconomic backgrounds experience higher HbA1c across the lifespan, especially those who do not use diabetes devices [20]. Moreover, provider bias regarding insurance affects whether diabetes devices are prescribed [21••]; youth and adults who are prescribed CGMs often have private insurance, and higher household income and education [22]. Further, White children are 3.6 times more likely than Black children and 1.9 times more likely than Hispanic children to use an insulin pump [7]. These differences persist across socioeconomic backgrounds and parental education; 68% of White children whose parents earned college or graduate degrees are prescribed insulin pumps compared to 34% of Black children with parents of similar educational backgrounds [7]. Similarly, 71–72% of non-Hispanic White, but only 37–40% of Hispanic and 18–28% of non-Hispanic Black adolescents and young adults use diabetes devices [19]. Additionally, negative experiences of and/or discrimination against individuals with T1D are related to less technology use in non-Hispanic White individuals and those from low socioeconomic backgrounds [23]. Finally, medical mistrust stemming from experiences of racism in non-Hispanic White individuals may contribute to disparities in diabetes device usage between Black and non-Hispanic White youth [24••].

While research examining health inequities in individuals with T1D has grown significantly, associations between provider bias and health outcomes of individuals with T1D have not been synthesized. To inform clinical practice and future research, the current review elucidates the association between provider bias and the physical and psychological health of youth and young adults with T1D.

Materials and Methods

Review Design and Study Selection

The methodology for the current systematic review is in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines [25]. PubMed, PsycINFO, CINAHL, Embase, and Web of Science databases were searched on 03/30/2022 and 04/05/2022. Search results were limited to English-language publications without restriction on study period or geographic location. Search terms relating to diabetes, provider bias, health outcomes, and children were used (see Table 1 in Supplemental Materials). Database-specific MeSH-equivalent terms were used when applicable to increase the breadth of search results. Studies were limited to peer-reviewed articles examining the impacts of provider bias on physical and/or psychological health outcomes in youth and young adults with a mean age between 12 and 35 years. Single case studies, measure validation studies, studies of individuals without T1D, systematic reviews, and meta-analyses were excluded. Search results were imported into Covidence, a record management tool for systematic reviews, wherein duplicate articles were automatically removed. Two independent reviewers (SWW, ACH) each screened 100% of the articles for eligibility based on titles and abstracts. All eligible articles were then full-text reviewed by SWW and ACH who met to resolve any discrepancies. Following the selection of articles, SWW conducted forward and backward reference searches.

Data Extraction and Quality Assessment

SWW and ACH extracted data from included studies using a standardized data extraction log embedded in Covidence: study location, design, aims, funding source(s), author-disclosed conflicts of interest, study sample characteristics, demographic information, assessed outcome information, study findings, covariates included in the study model, and study limitations. Qualitative articles were assessed for quality using the Critical Appraisal Skills Programme Qualitative Studies Checklist [26]. The quality of quantitative studies was assessed using the Study Quality Assessment Tools established by the National Heart, Lung, and Blood Institute [27]. Studies using mixed methods were evaluated for quality using both tools; scores were averaged to determine study quality. Every article was evaluated independently by both SWW and ACH using a standardized rating form (i.e., good = low risk of bias, fair = moderate risk of bias, or poor = high risk of bias) to assess study design-specific methodology and results reporting; rating disagreements were resolved through discussion. We used the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) framework [28] to assess the quality of evidence in quantitative studies. We used ConQual [29] to rate confidence of the synthesized findings of qualitative studies. Study evidence begins as high but can be downgraded due to concerns about dependability and credibility of evidence.

Results

Included Articles

Database searches yielded 2547 nonduplicate records; following title and abstract review, 74 full-text articles were screened for eligibility. Three articles were identified in forward–backward literature searches: of these, one met inclusion criteria. In total, 14 articles met inclusion criteria and were included in the current review (see Fig. 1) [25].

Participant Characteristics

A total of 771 participants were included in this review (sample size range = 14–178). The majority of studies (*n* = 10, 71.4%) included data from only youth or young adults with T1D; 5 studies (35.7%) included caregivers' data, and 4 studies (28.5%) included perspectives from healthcare providers. Race and ethnicity were inconsistently reported across studies (Table 1); 29.7% of participants were Black/African American (*n* = 229), 29% Hispanic/Latinx (*n* = 224), 24.4% White/Caucasian (*n* = 188), 1.1% Asian/Hawaiian/Pacific Islander (*n* = 8), and 0.4% identified as other race and ethnicity (*n* = 3). Notably, race and ethnicity were not reported in 15.4%, but these studies were conducted in other countries. Mean participant age was 25.1 years (range = 3–34 years). Average caregiver and medical provider ages were 41.2 years (range = 21–80 years) and 44.1 years old, respectively. See Table 1 for additional study and sample characteristics.

Study Characteristics and Design

All 14 articles used a cross-sectional design; 57.4% (*n* = 8) were qualitative with 21.4% (*n* = 3) using mixed methods and 21.4% (*n* = 3) including quantitative data. Half of the studies (*n* = 7) were conducted in the USA [21••, 24••, 30, 31••, 32, 40, 41]; the others were

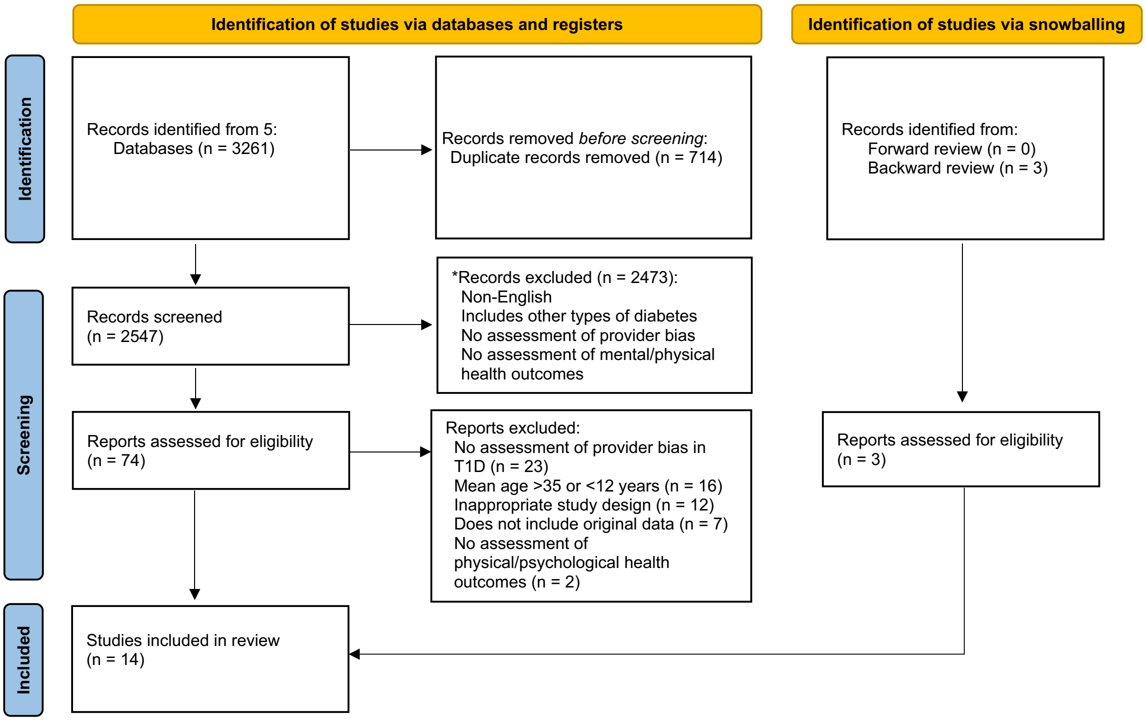

Fig. 1 PRISMA flow diagram: results of search for relevant articles. *Note: Specific numbers for articles excluded based on review of titles and abstracts are not produced when using Covidence

Table 1 Participant demographics and risk of bias quality rating

Article	Study design	*N*	Population	Location	Youth/young adult age M (SD); range	Youth/young adult sex (% female)	Quality rating
Addala et al. [30]	Mixed-methods	17	Young adults with T1D	USA	21.7 (2.1); NR	64.7%	Fair
Addala et al. [21••]	Non-randomized experimental	39	Pediatric T1D providers	USA	Vignette age: 13	89.7%	Fair
Agarwal et al. [31••]	Qualitative	40	Hispanic or non-Hispanic Black young adults with T1D	USA	21.5 (2.2); NR	62%	Good
Auslander et al. [32]	Non-randomized experimental	158	Children with T1D and their mothers/female guardians	USA	12.6 (3.5); 3–18	50.6%	Fair
Crespo-Ramos et al. [33]	Mixed-methods	65	Adolescents with T1D and their primary caregivers	Puerto Rico	15.05 (1.68); 12–17	55%	Good
Haugvik et al. [34]	Qualitative	41	Tajikistani children/youth with T1D, their parents, and endocrinologists	Tajikistan	14 (NR); 3–23	50%	Good
Ingersgaard et al. [35]	Qualitative	19	Danish young people with T1D	Denmark	19 (2.6); 15–23	73.6%	Good
Jeong et al. [36]	Qualitative	14	Young adults with T1D	NR	26.5 (4.5); 20–34	64.3%	Good
King et al. [37]	Qualitative	20	British adolescents with T1D living in economically disadvantaged areas	UK	18.3 (NR); NR	55%	Good
Kratzer [38]	Qualitative	17	Ghanaian children with T1D, parents of youth with T1D, and a medical doctor	Ghana	12.7 (NR); 8–21	NR	Fair
Mencher et al. [24••]	Qualitative	36	Black adolescents with T1D and their parents	USA	15.8 (2.2); 12.2–18.9	58%	Good
Montali et al. [39••]	Qualitative	22	Italian adolescents and young adults with T1D	Italy	21.5 (NR); 11–30	68.2%	Good
Morone et al. [40]	Mixed-methods	105	Single Black parents of youth with T1D	USA	13 (2.9); 6–17	NR	Fair
Valenzuela et al. [41]	Non-randomized experimental	178	Ethnically diverse youth with T1D, their caregivers, and medical providers	USA	13.9 (NR); NR	50.6%	Fair

N sample size, *M* mean, *SD* standard deviation, *NR* not reported

conducted in Puerto Rico [33], Tajikistan [34], Denmark [35], Ghana [38], the UK [37], and Italy [39••]. One study did not report study location [36]. Publication year ranged from 1997 to 2022; 71.4% ($n = 10$) were published in the previous 5 years.

Quantitative Studies: Measures of Provider Bias

Measures used to assess provider bias varied across the 3 quantitative studies [21••, 32, 41]: (1) Diabetes Provider Implicit Bias Tool includes a case vignette and providers rank-order factors influencing their recommendations about diabetes technology [21••]; (2) Perception of Racism questions from the Survey Interview Schedule [32] assess caregivers' perceptions of racism from health care providers [42]; and (3) a 7-item questionnaire was developed specifically for one study to determine physician perceptions of family and child T1D management [41].

Quantitative Studies: Measures of Psychological and Physical Health Outcomes

Two questionnaires were used to assess psychological health outcomes in the context of provider bias: the Family Inventory of Life Events and Changes [43] and a 71-item questionnaire specifically developed for the study to determine family stress [32].

A variety of methods were used to assess physical health: (1) provider recommendations about diabetes technology [21••] in which provider bias was defined as either recommending more technology for those with private versus public insurance or ranking insurance in the top 2 of 7 factors considered when offering diabetes devices; (2) Patient Satisfaction Questionnaire [44] assessed maternal satisfaction with T1D care through two subscales, Total Access to Care, Doctor Manner and Competence, and a Total Satisfaction with Medical Care score; (3) Adherence and Insulin Dependent Diabetes Mellitus Questionnaire-R [45] was completed by mothers and youth and assessed adherence to prescribed medical regimens; (4) HbA1c during the previous 6–8 weeks [32]; and (5) physician report of prescribed diabetes regimen and its intensity based on insulin type and dosage frequency [41].

Quantitative Studies: Quality and Evidence

For all 3 quantitative studies [21••, 32, 41], quality was rated fair (moderate risk of bias). Limitations that compromised quality and increased risk of bias included use of inadequately defined or unvalidated measures [41], insufficient description of study population [21••, 32, 41], lack of power analyses to justify sample size [21••, 32, 41], and failure to assess and statistically adjust for confounding variables [21••]. See Table 1 for overall quality assessment scores.

The quality of evidence presented in all 3 quantitative studies was low; all were observational studies. No study gave cause for concern regarding limitations, inconsistency, indirectness, imprecision, or publication bias. See Supplemental Table 2 for a summary of GRADE evidence profile for quantitative studies.

Quantitative Studies: Findings

None of the quantitative studies found significant associations between demographic variables (e.g., race, ethnicity, age, insurance status, income, sex) and provider bias. One study found that Black youth are less likely to be prescribed intensive insulin regimens and diabetes devices than White, non-Hispanic youth but physician perceptions of family competence were not associated with race or ethnicity [41]. Providers who had more practice-years [21••] and who cared for families with fewer resources [32] had biases in clinical decision-making. Families experiencing higher stress were less satisfied with doctor manner and competence, have greater perceptions of racism, and demonstrate lower engagement in dietary prescriptions [32]. See Table 2 for detailed study findings.

Qualitative and Mixed-Methods Studies: Measures of Provider Bias

There were 8 qualitative and 3 mixed-methods studies (total $n = 11$); of these 11, 9 used semi-structured interviews to evaluate perceptions about having T1D and experiences with T1D providers [24••, 30, 31••, 34–38, 39••]. Of the 9 studies using semi-structured interviews, none included quantitative measures to specifically assess bias; however, each of these 9 studies included unique semi-structured interviews that were developed specifically for that study. Negative or biased interactions with providers were identified using qualitative methods.

However, one mixed-methods study [40] included a questionnaire assessing families' perceived barriers to T1D management associated with the 5 Healthy People Social Determinants of Health. The other mixed-methods study [33] used the Adolescent Diabetes-Related Experiences Worksheet, which included 5 open-ended questions regarding adolescents' accounts of troubling situations or discussions with healthcare professionals. See Table 2 for measures assessing provider bias.

Qualitative and Mixed-Methods Studies: Measures of Psychological and Physical Health Outcomes

Nine studies (64.3%) used interviews to identify themes such as T1D self-care, T1D management, and diabetes device use to assess impacts of provider bias on psychological and physical health outcomes [24••, 30, 31••, 34–38, 39••]. One study [33] used the Children's Depression Inventory and the Diagnostic Interview Schedule for Children-IV, whereas another study [40] measured families' T1D management (e.g., HbA1c) as an extension of the questionnaire that assessed barriers associated with the 5 Healthy People

Table 2 Summary of articles

Article	Study design	Provider bias measure	Health outcome measure	Relevant findings
Addala et al. [30]	Mixed-methods	Focus group interview	Clinical data and focus group interview	Participants reported non-supportive and hostile approaches from their providers to T1D management and fear of criticism when attending medical visits, particularly when addressing hyperglycemia. Overall, they noted that provider approaches to T1D management were often more detrimental than helpful
Addala et al. [21••]	Non-randomized experimental	Diabetes Provider Implicit Bias Tool—case vignette and questionnaire	Recommendation for initiation of diabetes technology use	Implicit bias against public insurance was common in the study cohort ($n=33$, 84.6%). Providers who displayed bias against recommending diabetes technology had more practice-years ($p=0.003$) compared to providers who did not express bias; for each 1-year increase in practice, the odds of having bias increased by a factor of 1.47. Providers' personal diagnoses of T1D, roles, and workplace characteristics were not associated with bias
Agarwal et al. [31••]	Qualitative	Interview questions	Medical chart data and interview questions assessing use of diabetes devices	Many participants reported only hearing about diabetes devices during the study interview or within the past year of care in a specialized T1D clinic, even though they had been diagnosed with T1D 10 years prior. Of those who had been told about diabetes devices by their providers, few had been offered the opportunity to use them. Participants explained that their providers "unilaterally" decided whether or not they received diabetes devices and limited their technology options based on glycemic control or suboptimal self-monitoring of blood glucose. Conversely, some were forced to begin use of diabetes devices because their blood glucose values were not in range, though they had no say in the matter. Overall, participants enumerated that providers generally neglected to discuss diabetes devices with them

Table 2 (continued)

Article	Study design	Provider bias measure	Health outcome measure	Relevant findings
Auslander et al. [32]	Non-randomized experimental	Dressler's (1991) Perception of Racism section of the Survey Interview Schedule	Adherence and insulin-dependent diabetes mellitus (IDDM) questionnaire; medical chart data; 69-item Patient Satisfaction Questionnaire; 71-item Family Inventory of Life Events and Changes (FILE)	Greater perception of racism was significantly associated with dissatisfaction with doctors' manner and competence ($r = -0.31$, $p < 0.001$) and with total patient satisfaction of medical care ($r = -0.30$, $p < 0.001$)
Crespo-Ramos et al. [33]	Mixed-methods	5-item Adolescent Diabetes-Related Experiences Worksheet	Children's Depression Inventory (CDI) and Diagnostic Interview Schedule for Children-IV Parent Version	Total scores on the CDI were significantly associated with the total number of diabetes-relates stigma experiences ($r = 0.29$, $p = 0.009$) and social stigma events ($r = 0.30$, $p = 0.009$). There was a significant association between having at least one experience of social stigma and being diagnosed with a depressive disorder (DD); the odds for a current DD were 3.54 times higher among those with a history of social stigma than among those without such history
Haugvik et al. [34]	Qualitative	Interview questions with youth, parents, and providers	Interview questions	Some families stated that the providers they were familiar with were unaware of the symptoms and treatments for T1D. An endocrinologist agreed, saying, "They (doctors in general) don't think that children have this disease […] Doctors do everything but think about diabetes last." Five of 18 families experienced life-threatening complications due to delayed diagnosis and expressed their despair when traveling to various hospital only to receive treatment for various diseases including measles, food allergy, intestinal worms, typhoid fever, and malaria to no avail. One family noted: "Wherever we had been, the hospital, the diagnostic center and other places, nobody found out what was going on […] When we went to this other hospital, they said they needed to 'wash and clean' her stomach and she got glucose infusion. After that she went into a coma."

Table 2 (continued)

Article	Study design	Provider bias measure	Health outcome measure	Relevant findings
Ingersgaard et al. [35]	Qualitative	Semi-structured participatory workshops	Themes identified in interviews	Adolescents reported that their providers did not observe their autonomy and agency over their care, instead providing information about diabetes only to their parents. One teen reported: “When I bring my mother with me [to the clinic] they [health care professionals] talk to my mother instead of me and that’s something that annoys me a lot, because it’s me who’s responsible for it [diabetes care] and I’m in charge of it in my daily life. My mother is really not as involved in my blood sugar as much as I am.” Generally, participants felt that their providers’ misdirected communication may be an expression of misunderstanding who manages their diabetes care
Jeong et al. [36]	Qualitative	Semi-structured interview questions	Outcomes determined through interview questions	Many participants expressed frustration and anger due to stereotypical thinking on the part of friends, family members, and health care professionals regarding their diabetes care. One participant explained that he had been criticized by his provider regarding his self-management: “I feel there’s a lot of high shaming…. I got yelled at by my endo [endocrinologist] for that, like ‘Why are you doing manual boluses? Do you know what you were [blood glucose]?’ and I’m like, ‘Not really,’ but I really kind of knew how high I was.”

Table 2 (continued)

Article	Study design	Provider bias measure	Health outcome measure	Relevant findings
King et al. [37]	Qualitative	Semi-structured interview questions	T1D management assessed by interview questions	Generally, adolescents reported they had negative experiences with their diabetes providers. They expressed that many conversations concerning their diabetes care were directed at their parents, and that their providers did not take time to hear their concerns, often not observing them as individuals. They also noted that their providers had made attempts to “scare” them. For example, some said that their provider “had literally banged on the table and told them that they were going to die if they did not get their blood glucose level down.”
Kratzer [38]	Qualitative	Individual semi-structured interviews	Outcomes identified in interviews	Many families interviewed reported taking their child to multiple clinics and hospitals before being correctly diagnosed; many children were initially diagnosed with malaria or typhoid. As a result of delayed treatment, several participants went into a diabetic coma, even though they had already seen multiple medical professionals. Both parents and children commented on the common misconception that diabetes affects only adults and those with overweight and obesity, which may contribute to misdiagnoses of underweight children. Families also reported a frustration in the lack of urgency expressed by primary care facility staff even when an accurate diagnosis was given. One child was referred to a nearby hospital for treatment but because their parents were unaware of the seriousness of the diagnosis, they did not go to the hospital until the following day. Upon learning their child’s condition required immediate admission for a week, they were frustrated that they had waited an extra night, putting their child at greater risk of diabetic coma

Table 2 (continued)

Article	Study design	Provider bias measure	Health outcome measure	Relevant findings
Mencher et al. [24••]	Qualitative	Individual semi-structured interviews	HbA1c, current pump usage, previous pump usage, current CGM usage, previous CGM usage determined from interview questions	Various difficulties with T1D management were described by families. One mother felt that clinicians may not understand the burdens of lack of financial resources, support, and time: “I think providers just think…it’s nothing, go get the medicine…it’s simple.” Parents and adolescents described a variety of reasons why they thought that Black people might be less likely to use diabetes devices (DDs). These included various fears, lack of exposure to T1D and DDs, and mistrust of the medical community. One family noted: “culturally you’ll find…beyond the fear of change, has this been tested enough. And then there’s the worry…not knowing is what drives a lot of people in my community to say no…But I do think it’s about trust that could stem from the racial disparities of the past.” Many also expressed that providers had limited knowledge of the importance of cultural foods and traditions which may affect glycemia
Montali et al. [39••]	Qualitative	8 semi-structured interview questions	Diabetes self-care based on interview questions	Participants reported that providers gave limited attention to psychological care and treatment as the majority of sessions were focused on diabetes management. Additionally, patients noted that they experienced significant difficulty transferring from pediatric to adult diabetes units. Patients transitioned from in-depth visits with a single endocrinologist with whom they had been working since diagnosis to brief and “superficial” visits with inconsistent providers. Moreover, they expressed that adult diabetes providers may have less knowledge than those in pediatrics and even that of the patients themselves. This perception led to feelings of dissatisfaction and disappointment following what had been a long and collaborative relationship with their previous providers

Table 2 (continued)

Article	Study design	Provider bias measure	Health outcome measure	Relevant findings
Morone et al. [40]	Mixed-methods	71-item survey of items organized across the 5 Healthy People Social Determinants of Health domains	Family management of T1D survey	Parents endorsed feeling like diabetes team members need to be more understanding being blamed by members of their child's diabetes team, and not having a cooperative relationship with their child's diabetes team. The highest ranked health and healthcare domain issues included emotional impacts, diabetes supplies, and relationships with clinical teams. The emotional impacts of diabetes management were of significant concern for parents and were associated with higher HbA1c levels
Valenzuela et al. [41]	Non-randomized experimental	Physician ratings of perceived child and family competence and self-management	Prescribed regimen and regimen intensity (i.e., injection type, sliding scale type, BG test frequency) scores	Greater physician perceptions of family competence ($r = 0.53$, $p < 0.01$) and self-management ($r = 0.47$, $p < 0.01$) were associated with more intensive youth regimens. Black, non-Hispanic race/ethnicity ($\beta = -0.34$, $p < 0.001$) and Hispanic race/ethnicity ($\beta = -0.22$, $p < 0.05$) were associated with less regimen intensity compared with White, non-Hispanic race/ethnicity

Social Determinants of Health. See Table 2 for methods used to assess psychological and physical health outcomes.

Qualitative and Mixed-Methods Studies: Quality and Evidence

Of the 8 qualitative studies, 7 were rated good (87.5%; low risk of bias [24••, 31••, 34–37, 39••]) and one was rated fair (12.5%; moderate risk of bias [38]). One study did not include a detailed description of recruitment strategies or ethical considerations, which affected the risk of bias [38]. All 3 mixed-methods studies were rated fair (moderate risk of bias [30, 33, 40]); use of unvalidated measures [30, 33, 40], insufficient description of the study population [30, 40], lack of power analyses to justify sample size [30, 33, 40], and failure to assess and statistically adjust for confounding variables [30, 33, 40] increased the risk of bias. See Table 1 for overall quality assessment scores. The quality of the synthesized findings from qualitative and mixed-methods studies was rated moderate; the majority of studies did not include a statement describing study location or an acknowledgment of their potential influence on the research. See Supplemental Table 3 for a summary of the ConQual evidence profile for qualitative and mixed-methods studies.

Qualitative and Mixed-Methods Studies: Findings

Results from the qualitative and mixed-methods studies provide inconclusive evidence of the association between demographics and provider bias in youth and young adults with T1D. Race and ethnicity, urban zone of residence, and greater family size were associated with more experiences of bias, while employment status, number of caregivers in the home, and school type (i.e., public vs. private) were not [33]. Group differences in health outcomes could not be assessed because 64.3% of studies used only interviews [24••, 30, 31••, 34–38, 39••].

Individuals with T1D who experience negative or biased interactions with providers (e.g., dissatisfaction with T1D care, shame about T1D management) reported feelings of self-doubt and incompetency to manage T1D care [30, 36, 37], as well as clinically significant depressive symptoms and disorders [33]. Additionally, age-related bias or misunderstandings about T1D responsibility led providers to discuss care with caregivers rather than youth, increasing self-doubt [35, 37]. Transition of care from pediatric to adult endocrinology was implicated as a time when bias occurs, with adult endocrinologists perceived as having less investment in, knowledge of, and time for young adults with T1D [39••]. Provider negative perceptions of an individual's T1D management also significantly impacted whether recommendations for diabetes technology are made [30, 31••]; however, providers required different standards for glycemia when prescribing diabetes devices (e.g., one provider requires 7% HbA1c, whereas another provider requires 9% HbA1c). Further, provider misunderstanding or repudiation of an individual's or family's culture, background, and competing demands negatively affected trust with the provider and engagement with recommendations, thereby increasing glycemia [24••, 40]. Finally, limited knowledge of T1D and how its symptomatology differs from T2D emerged as an area of bias, particularly in countries with limited T1D educational resources and exposure to youth with T1D, which led to life-threatening complications [34, 38].

Discussion

Until recently, provider bias has not been considered as a contributing factor to T1D health inequities. We identified 14 articles for the current review that assessed the relationship between bias and psychological and physical health outcomes in youth and young adults with T1D. Provider bias and its impact on health is a burgeoning area of research; 10 of the 14 (71.4%) articles were published between 2017 and 2022.

Findings from this review reinforce that problematic inequities exist in the experiences and psychological and physical health outcomes of youth and young adults with T1D. Evidence was inconclusive regarding the roles of sex, age, race, and ethnicity on psychological and physical health outcomes in individuals with T1D who experienced provider bias. Some studies reported that demographic characteristics did not affect the psychological and physical health of individuals with T1D or provider bias [21••, 32], while another study reported that those of non-White race and ethnicity and older age were less likely to be prescribed diabetes technology or intensive insulin regimens [41]. More provider practice-years [21••], fewer family resources and increased neighborhood stressors [32], urban zone of residence [33], and larger family size [33] were associated with increased risk of provider bias as was caregivers' dissatisfaction with providers' demeanor and competence. Taken together, these mixed findings suggest that inequities in T1D medical care and psychological and physical health outcomes among youth and young adults with T1D are impacted by a variety of individual, interpersonal, systemic, and societal factors.

The majority of studies included investigated T1D physical health outcomes as they relate to provider bias. Provider bias regarding public insurance [21••] and provider perceptions of a family's lower competence to engage in T1D self-management [31••, 41] impacts whether diabetes technology and intensive insulin regimens are prescribed, which are impacted by providers' misunderstanding of barriers associated with a family's ability to engage in T1D management (e.g., competing demands, financial constraints)

[40]. In turn, individuals with T1D may not engage in T1D management if they perceive their provider to be biased [24••]. Additionally, medical mistrust from systemic racism in healthcare and lack of consideration for cultural foods or traditions in dietary recommendations facilitate skepticism about providers' willingness to recommend diabetes devices [24••]. Because many studies examined similar aspects of T1D self-management (e.g., HbA1c), further research is necessary to explore other aspects of T1D management such as time in range, medical appointment attendance, hospitalizations, and episodes of DKA. Finally, misinformation and/or lack of education about T1D may cause provider bias about how T1D presents in youth and young adults, which can result in a misdiagnosis of T1D and life-threatening complications [34, 38]. It is possible that information about T1D is limited in low-resource countries due to the World Health Organization's emphasis on T2D management [46]. In addition, individuals residing in low-resource countries are susceptible to infectious diseases which may be higher priorities [47].

This review provides evidence that provider bias negatively affects the psychological health of individuals with T1D. Only one study examined depressive symptoms [33], but providers who engaged in shaming and criticism had adversarial relationships and self-doubt and blame occurred in individuals with T1D about its management [35, 37]. Additionally, caregiver stress was associated with greater dissatisfaction with provider demeanor and competence, which was in turn associated with greater caregiver perceptions of racism [32]. One study [39••] found that providers paid little attention to the psychological health of youth during routine T1D appointments, which is exacerbated by the transition from pediatric to adult care, where providers are perceived to have less time and interest in psychological health. Across all studies, mood was not directly assessed as being related to provider bias, despite evidence that mood affects physical health [48, 49]. Thus, there is an urgent need to investigate how provider bias impacts mood specifically, but also other aspects of psychological health (e.g., anxiety, suicidality) in individuals with T1D.

No studies investigated moderating or mediating variables that may impact the relationship between provider bias and psychological and physical health outcomes in T1D. For example, prolonged exposure to discrimination in the general population may result in heightened stress reactivity, which can increase risk for negative psychological and physical health outcomes across time [50, 51]. Characteristics of healthcare settings (e.g., hospital clinics, primary care offices), intersectionality of identities, and patient-provider interactions may also moderate or mediate associations between provider bias and psychological or physical health outcomes [52, 53]. Future studies should account for histories of discrimination and other potential confounding variables such as an individual's race and ethnicity, gender identity, age, and income to fully understand the experiences of provider bias and subsequent impacts on health. In addition, future studies should explore providers' clinical decision-making to better understand factors that affect providers' treatment recommendations. Further, healthcare organizations should incorporate trainings on implicit bias and cultural competence into provider continuing education, allowing them to better support individuals with T1D.

A significant limitation of the studies included in this review is the lack of consistency in how provider bias is conceptualized. Because different approaches to examining bias were used, it was difficult to determine which methods are the most useful in future research. Therefore, a questionnaire demonstrating high reliability and validity for assessing bias and a standardized, comprehensive structured interview specific to T1D are needed. Until these are developed, the Diagnostic and Statistical Manual of Mental Disorders—Fifth Edition (DSM-V) Cultural Formulation Interview provides a framework for asking culturally relevant questions (e.g., "Are there any aspects of your background or identity that make a difference to your [T1D];" "Sometimes doctors and patients misunderstand each other because they come from different backgrounds or have different expectations. Have you been concerned with this [during T1D appointments]?") [54]. Moreover, individuals vary widely in their backgrounds, cultures, and experiences, as do their definitions of bias. For this reason, future development of bias measures should first incorporate qualitative information from individuals with T1D and strive for adaptation and validation to account for their diverse experiences.

Individual studies had methodological weaknesses including small sample sizes, lack of inclusion of study participants' demographic characteristics, study location, confounding or intervening variables and power analyses, and cross-sectional designs hindering the ability to make inferences across studies. Future studies with robust methodology should assess group differences in experiences of provider bias and physical and psychological health outcomes to understand how these mechanisms affect individuals with T1D.

Finally, race and ethnicity are conceptualized differently in the USA, which uses specific, but flawed racial and ethnic categories compared to other countries [55]. For example, individuals from Middle Eastern countries are categorized as White, but individuals from the Middle East often do not self-identify as White [56]. In addition, because T1D disproportionately affects individuals of White European descent [57], representation of individuals from other backgrounds (e.g., Native American or Indigenous, Asian) in studies of bias is lacking. Future research in the USA should recruit diverse samples of participants in accordance with National

Institutes of Health guidelines [58] for the inclusion of underrepresented groups.

Strengths of the current systematic review include use of a systematic search strategy and gold standard methods of assessing the quality of studies and evidence [28]; inclusion of quantitative and qualitative studies which provided rich data on the experiences of youth and young adults with T1D and their families; and a review sample that was heterogeneous, with the majority of participants being Black, non-Hispanic or Hispanic/Latinx. Spanning 7 countries and 3 continents, this diverse study sample allows for representation of varied accounts of provider bias.

Conclusions

The results of this review highlight the significant opportunities for future research to expand our understanding of the experiences of individuals with T1D who encounter racial and ethnic bias in their T1D medical care. Highly reliable and valid questionnaires and comprehensive semi-structured interviews to assess bias are needed as are interventions to decrease provider bias. National and international clinical practice guidelines can then be established to improve the lives of all individuals with T1D.

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Declarations

Conflict of Interest The authors declare no competing interests.

Human and Animal Rights and Informed Consent This review does not contain any studies with human or animal subjects performed by any of the authors.

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- • Of importance
- •• Of major importance

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