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REVIEW

A Framework for Addressing Diabetes-Related Disparities in US Latino Populations

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Abstract

Despite national efforts to redress racial/ethnic disparities, Latino Americans continue to share a disproportionate burden of diabetes-related morbidity and mortality. A better understanding of underlying causes and influencing factors is needed to guide future efforts to eliminate racial/ethnic disparities in diabetes control. The objectives of this review are: (1) to summarize our understanding of determinants and modifiable predictors of glycemic control; (2) to provide an overview of existing strategies to reduce diabetes-related disparities; and (3) to identify gaps in the literature regarding whether these interventions effectively address disparities in US Latino populations. Key findings include evidence that diabetes care services can be designed to accommodate heterogeneity within the Latino American community by addressing key modifiable predictors of poor glycemic control, including insurance status, diabetes care utilization, patient self-management, language access, culturally appropriate care, and social support services. Future research efforts should evaluate the effect of structurally tailored interventions that address these key modifiable predictors by targeting patients, providers, and health care delivery systems.

Keywords Health disparities · Diabetes mellitus · Latino Americans · Minority health

Introduction

Type 2 diabetes is a major source of morbidity and mortality in the United States, with an estimated prevalence of 9.3%, or more than 29 million people [1]. Among Latino Americans, the estimated prevalence of diabetes nearly doubles to 16.9% [2]. US Latino populations also have a disproportionate burden of diabetes-related complications. Hemoglobin A1c (HbA1c), a measure of glucose control over the preceding two or three months, is estimated to average 0.5% higher in Hispanic patients than in non-Hispanic Whites [3]. Disparities in HbA1c are of particular concern given that a 0.5% increase in HbA1c has been associated with a 10.5% greater risk of diabetes-related vascular complications [2]. Indeed, Hispanic Americans are significantly more likely to develop retinopathy, end-stage renal disease, or require lower extremity amputations that non-Hispanic Whites [4]. Perhaps most troubling, the prevalence of diabetes among Hispanic Americans is increasing at a substantially higher rate than among non-Hispanic Whites and at a time when the Hispanic American community is the fastest growing minority group in the US [5–7]. A better understanding of the current evidence on social determinants, modifiable predictors of glycemic control, and effective interventions is critically needed to guide future strategies to reduce racial/ethnic disparities in diabetes health outcomes.

Methods

This article reviews the current evidence on efforts to understand and address disparities in diabetes control among Hispanic Americans. The PubMed database was searched for articles that examined determinants of racial/ethnic diabetes-related health disparities; modifiable predictors of glycemic control; and strategies to improve diabetes control among racial/ethnic minorities. Search terms included: (diabetes)

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AND (racial and ethnic health disparities) AND (determinants OR prevalence OR management OR control) AND (Latin* OR Hispanic). The literature review focused on articles that contained Hispanic participants in the study, aimed to understand determinants of glycemic control, and considered modifiable predictors of glycemic control in order to improve diabetes control or reduce racial/ethnic disparities. The evidence was drawn from the PubMed search and backward searches based on cited articles. Greater weight was placed on systematic reviews and meta-analyses, in addition to more recent articles. The objectives of this narrative review are: (1) to summarize the evidence on the determinants and modifiable predictors of diabetes-related disparities; (2) to provide a broad overview of existing strategies to reduce disparities in diabetes control; and (3) to identify gaps in the literature regarding whether these interventions effectively address diabetes-related disparities in US Hispanic populations.

Results

Determinants of Hispanic Health Disparities

The determinants of racial/ethnic health disparities in diabetes prevalence, management, and control are complex, involving a myriad of socioeconomic, psychosocial, environmental, and biologic factors [7–10]. An understanding of how these factors interact with the diversity of the Latino American community can aid further efforts to eliminate racial/ethnic disparities. Diabetes prevalence in US Latino populations varies significantly based on country or region of origin. The Hispanic Community Health Study/Study of Latinos (HCHS/SOL), a multicenter population-based survey of 16,415 self-identified Latino/a Americans, reported significant diversity in diabetes prevalence by Hispanic background: 10.2% in South Americans, 13.4% in Cubans, 17.7% in Central Americans, 18.1% in Dominicans and Puerto Ricans, and 18.3% in Mexicans [2]. Many of these differences are further influenced by foreign-born nativity. Analyzing National Health Interview Survey (NHIS) data from 2001 to 2005, authors found that foreign-born Cubans, Dominicans, Central and South Americans had lower adjusted odds of diabetes prevalence compared with foreign-born Mexican Americans [11].

Reasons for this diversity are not well understood but may have both behavioral and genetic origins. A narrative review identified several key determinants of diabetes among Hispanic adults, including less active lifestyles, greater adiposity, and a predisposition for insulin resistance [4]. Several studies have also detected disparities in diabetes prevalence even after controlling for obesity and disease stage between Mexican American and non-Hispanic White populations [12, 13]. Additionally, a recent study analyzed data from 1144 participants (320 with type 2 diabetes) in the Genomic Resource in Atherosclerosis study. The authors reported that a HMGA1 gene variant was associated with type 2 diabetes and obesity, and was present at a much higher frequency among self-identified Latino Americans (21.4%) than among non-Hispanic Whites (3.1%) [14]. Several ongoing studies continue to investigate the extent to which genetic factors contribute to ethnic disparities in diabetes prevalence or control, which remains poorly understood at this time.

Several studies have demonstrated the significant influence of socioeconomic factors in predicting diabetes prevalence. Two analyses, using 1997–2012 NHIS and 2008–2011 HCHS/SOL data, found that income/education levels are inversely associated with diabetes prevalence, even after adjusting for age, sex, Hispanic background, and length of residence in the US [2, 5]. Related factors, such as neighborhood segregation and deprivation, housing instability, and food insecurity, are more pronounced among low-income Latino/a Americans and can affect how diabetes-related health care services are accessed and utilized [15–17]. A recent cross-sectional analysis of 2010–2012 Boston Area Community Survey data estimated that elevated socioeconomic, environmental, psychosocial, and behavioral risk scores explained 21.8% of the additional risk of diabetes prevalence associated with Hispanic ethnicity [18]. Given the wide range of factors influencing diabetes-related disparities, recognition of the heterogeneity of experience among Hispanic Americans is necessary to develop more effective interventions.

Modifiable Predictors of Poor Glycemic Control

Although certain social and biological determinants are improbable targets for health services interventions, various modifiable predictors of diabetes-related disparities present more promising targets. This section summarizes the evidence on modifiable predictors of glycemic control in US Latino populations by describing a framework by which to target the effects of health insurance status, diabetes care utilization, patient self-management, language access, acculturation, and social support services.

Health Insurance

Health insurance status, a proxy for access to health care services, is a substantial predictor of poor glycemic control in US Latino populations. Using 1988–1994 data from the National Health and Nutrition Examination Survey (NHANES), authors found that Mexican American respondents were more likely than non-Hispanic Whites to be uninsured or have public health insurance coverage [19]. Even after implementation of the Affordable Care Act, which

helped four million Latino/a Americans gain coverage, more than 10 million Hispanic adults between the ages of 18–64 remain uninsured [20]. Although reasons for these disparities remain unclear, documentation status likely contributes to disproportionately higher rates of uninsurance. By some estimates, more than half of the approximately 11 million undocumented immigrants in the US are uninsured [21]. Uninsured Latino Americans are more likely to report having no usual source of care, being unable to receive or delaying necessary care, having no access to prescription drugs, and lower levels of diabetes knowledge and awareness [22–24].

Additionally, researchers have documented several cases of segregated care based on health insurance status. A case study of New York City hospital inpatient facilities elucidated how a wide-array of financial, political, and institutional factors allowed for the systemic provision of separate and lower quality care to uninsured or publicly insured patients [25]. Given that Latino Americans are more likely to be uninsured or have public insurance, these policies may also contribute to diabetes-related disparities. Further research on this topic should address how health insurance status, especially among patients with public insurance, influences long-term diabetes health outcomes. Relatedly, recent Medicaid expansions have been associated with increased physician visits and diagnosis of diabetes. Still, it remains unknown to what degree low-income Latino Americans with diabetes have benefited from these policies [26].

Even though differences in health insurance status can predict diabetes health outcomes, these differences may not fully explain disparities in diabetes control. Using data from the Health and Retirement Study (HRS), a nationally representative sample of 1034 participants older than 55 and taking antihyperglycemic medication, authors found that lack of health insurance was associated with poor glycemic control among Latino Americans. Yet disparities in glycemic control persisted between Hispanic and non-Hispanic Whites even after adjusting for access to care variables [27]. Results from HCHS/SOL corroborated this finding: Latino Americans with diabetes were more likely to lack health insurance and have poor glycemic control (HbA1c $\geq$ 7%) compared with non-Hispanic Whites. Yet non-Hispanic White patients were just as likely as Hispanic patients to be unaware of their diagnosis [2]. Lack of insurance is certainly a substantial barrier to accessing appropriate diabetes care services, but a wider range of factors likely contributes to ethnic disparities in glycemic control.

Diabetes Care Utilization

When controlling for health insurance status, differences in the utilization of health care services may also affect diabetes control among Latino Americans. An analysis of 1988–1994 NHANES data measured the effect of health care access on intermediate health outcomes, including glycemic control, in patients with type 2 diabetes. Measures of health care access included: having a usual source of primary care; seeing one primary care physician at that source; having two or more physician visits in the past year; and receiving appropriate diabetes therapies. Although Mexican Americans were less likely to have cholesterol checks than non-Hispanic Whites, the analysis found no significant difference in other measures of health care access. Still, high rates of hyperglycemia, albuminuria, hypertension, and dyslipidemia were found among all patients regardless of race/ethnicity [28]. Relatedly, the Insulin Resistance Atherosclerosis Study, a large multicenter study in California, Texas, and Colorado, measured whether diabetes care processes affected intermediate health outcomes in 452 Hispanic, Black, and non-Hispanic White patients. The authors found that Hispanic and non-Hispanic White patients had similar rates of not receiving any diabetes therapy, treating only with diet and exercise, taking only oral agents, or taking both oral agents and insulin. Notwithstanding similar rates and intensity of treatment, Hispanic patients still exhibited poorer glycemic control (HbA1c > 8%) than non-Hispanic Whites [29].

Though evidence suggests that Latino Americans access health care providers and receive diabetes therapies at similar rates as non-Hispanic Whites, patterns of diabetes care may differ in meaningful ways. Using national survey data from the 2001–2010 Behavioral Risk Factor Surveillance System (BRFSS), an observational study of 355,620 respondents found lower odds among Hispanics of receiving annual HbA1c tests, foot exams, eye exams, and influenza vaccinations compared with non-Hispanic Whites. Hispanic respondents were also less likely to participate in self-management education programs or self-monitor blood glucose levels [30]. The question of whether diabetes-related health care utilization predicts poor glycemic control remains unsettled, but evidence suggests that utilization may have less impact on disparities among older adults. Among patients older than 65 in the BRFSS study during 2008–2012, Hispanic Americans reported 15% more visits to a health care provider and more HbA1c tests than non-Hispanic Whites [31]. A majority of respondents (98.4%) reported having health insurance, suggesting that differences in health care utilization, like differences in health insurance status, may be less pronounced among older Hispanic patients.

Patient Self-Management

Racial/ethnic disparities in glycemic control may also be partially attributed to differences in patient self-management. A national survey of 34,214 respondents from 2011 BRFSS

data examined whether the number of daily self-care activities by individuals differed based on race/ethnicity. Overall, Hispanic respondents engaged in similar levels of diabetes self care activities as those of other racial/ethnic groups. Compared with the total sample average, Latino Americans had lower odds of engaging in daily glucose monitoring and foot checks, but higher odds of being nonsmokers and consuming fruits and vegetables. Again, Hispanic participants were less likely than other racial/ethnic groups to participate in self-management education programs [32].

There is some evidence that differences in patient self-management are partly modified by differences in medication use. Using HRS data, authors also found that medication underuse was independently associated with poor glycemic control among Hispanic Americans [27]. Other studies have corroborated that while Hispanics are more likely to take oral antihyperglycemic agents, they are less likely to receive or use insulin therapy [7, 33]. Differences in diabetes care processes may partially explain these differences in medication use. In a secondary analysis of 2003–2012 NHANES data, no significant differences were found in the prescription of recommended antidiabetic therapies between cohorts of Mexican Americans and non-Hispanic Whites. However, Mexican Americans were less likely to take antidiabetic medications or to have existing regimens intensified, especially among those with poorest glycemic control [34]. Differences in patient circumstances and beliefs also modify rates of medication use, as both household income and cultural beliefs have been found to predict medication underuse [35]. For example, an analysis of 749 Mexican American patients in Southern California found that lower household income was significantly correlated with medication underuse due to cost, while neighborhood deprivation was independently associated with underuse due to negative cultural beliefs about antidiabetic medications [36].

In addition to medication use, health literacy is another possible modifier of patient self-management. Defined as the "degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions," health literacy has been independently associated with worse glycemic control among patients with type 2 diabetes [37]. Still, further research in the field has failed to elucidate the pathways by which health literacy affects diabetes health outcomes. A recent review of 20 studies exploring this relationship found that inadequate health literacy was only associated with lower diabetes-related knowledge. Evidence on whether inadequate health literacy was related to poor self-care behaviors, medication use, self-efficacy, or glycemic control was largely inconclusive [38].

Finally, self-efficacy is defined as a patient's confidence in their ability to manage their illness, and is often cited as another potential modifier of successful self-management. A study of 308 English- and Spanish-speaking Hispanic patients in an urban clinic examined the relationship between health literacy, self-efficacy, and self-reported diabetes health status. Although Spanish-speaking participants consistently reported poorer health statuses than English-speaking participants, health literacy was not found to mediate these differences. Instead, high diabetes self-efficacy was associated with significantly better health outcomes and self-management behaviors in both Spanish- and English-speaking participants [39]. This finding is further validated by a growing body of literature showing that self-efficacy may be a significant predictor of poor glycemic control, especially among racial/ethnic minorities [40–42]. Although patient education interventions are widely cited as effective strategies to reduce disparities, successful implementation ultimately requires navigating a convoluted assortment of patient knowledge and behaviors. Further research on this topic should continue to elucidate how medication use, health literacy, and self-efficacy affect diabetes self-management.

Language Access

Limited English Proficiency (LEP), a term describing individuals who speak English less than "very well," affects an estimated 16 million Latino Americans [43]. It is well documented that LEP patients are less likely to have regular physician visits, receive the standard of care for diabetes, receive dietary and physical activity advice from providers, and more likely to exhibit poor health literacy than non-LEP populations [44–47]. However, many of these disparities are moderated by patient-provider language concordance. One study of Latino Americans with diabetes, based on an integrated health care system in Northern California, found that glycemic control between English-speaking and LEP patients with language-concordant providers did not significantly differ. In contrast, LEP patients with language-discordant providers were more likely to have poor glycemic control (HbA1c > 9%) than LEP patients with language-concordant providers (27.8% vs. 16.1%, $p = 0.02$) [48]. Additional findings have corroborated that patient-provider language concordance is associated with increased patient satisfaction, medication use, certain self-management behaviors, and improved glycemic control [49–52].

Unfortunately, few studies have evaluated the impact of interpreting services or the use of other multilingual members of the health care team as strategies to increase language concordance in the context of diabetes care. In a retrospective cohort study, authors measured rates of diabetes-related complications based on type and amount of language services received in a Massachusetts-based health system. Greater amounts of language services, including either interpreting services or contact with language

concordant providers, were associated with fewer diabetes-related complications, including emergency department visits [53]. Another study of 94 Hispanic patients with diabetes appraised their knowledge of heart disease risk based on type of interpreting services received. Use of ad hoc interpreters, as opposed to professional interpreting services, significantly predicted lower knowledge of diabetes-related risk of heart disease [54]. Both of these studies support the use of professional interpreting services to improve diabetes care, but more evidence is needed to show how different types of interpreting services by various members of the diabetes care team can also influence diabetes control.

Differences in Acculturation

Acculturation, defined as the process by which an immigrant adopts the culture of a host country, may also contribute to poor diabetes management and glycemic control. In HCHS/SOL, the authors examined whether length of residence in the US, used as a proxy for acculturation, affected diabetes prevalence. Although they failed to detect a difference between US-born and foreign-born Hispanics residing in the US for less than 10 years, foreign-born Hispanics residing for more than 10 years exhibited significantly higher rates of diabetes prevalence [2]. In several other studies, using various proxies for acculturation, the relationship between acculturation and glycemic control remains less clear. An analysis of 2003 NHIS data, using language preference as a proxy, reported no independent association between language preference and several indicators of diabetes quality of care [55]. A literature review on the effects of acculturation on dietary quality among Hispanics reported a positive correlation between the two, but no such evidence linking dietary quality and glycemic control [56]. Lastly, a cross-sectional survey and chart review of 66 Mexican American patients with diabetes found no significant association between measures of acculturation and glycemic control [57].

Other efforts have explored whether acculturation explains differences in patient self-management. An integrative literature review of 15 reports developed an explanatory model of type 2 diabetes based on the beliefs of Hispanic adults. Authors found that Latino Americans expressed similar understandings of diabetes symptoms, course of illness, and treatments, regardless of country of origin. However, there were certain cultural and religious differences perceived in the etiology of the disease. Significantly, Hispanic adults were more likely to have negative perceptions about insulin, with many associating blindness and amputations as adverse effects of insulin use [58]. These findings are consistent with evidence on medication underuse and have been corroborated by other reports. A qualitative study of 675 Chicago residents with diabetes found that Latino and African Americans are more likely to report quality of life-related concerns with antidiabetic medications than non-Hispanic Whites [59]. Reasons for these findings have not been expounded, but may stem from patient perceptions about the health care system. In a series of focus groups in the South Bronx, 110 participants (31 Hispanic) voiced fear and distrust of the health care system, and reported feeling devalued in their interactions with health care providers [60]. Additional research on this topic must continue delineating ways that perceptions and cultural beliefs in US Latino populations influence diabetes health outcomes.

Social Support

An increasing number of studies have described a notable interaction between social support services, diabetes-related distress, and glycemic control. The Health and Retirement Study described an independent association between measures of diabetes-related distress and poor glycemic control among Hispanic respondents [27]. Elaborating on this finding, a 2009 analysis of California Health Interview Survey data reported that Hispanic ethnicity modified the relationship between psychological distress and diabetes self-efficacy [61]. Interestingly, several studies have found that gender modifies the association between self-efficacy and diabetes-related distress. A study of 180 Black and Hispanic participants in the REACH Detroit Partnership found that male sex was a significant predictor of diabetes-related emotional distress [62]. One possible explanation, suggested by a qualitative study of six focus groups with Latino men, reported that low diabetes self-efficacy was associated with a sense of "fatalism" regarding long-term diabetes outcomes [63]. Among Latina women, psychological distress has been found to be associated with socioeconomic factors. A case–control study of 201 inner city Latinas in Connecticut found that increased rates of food insecurity predicted both increased diabetes prevalence and higher levels of depressive symptoms [64].

Although further research should continue to delineate the relationship between gender and diabetes-related distress, social support services may help moderate many of these discrepancies. A cross-sectional study of 284 Hispanic patients with diabetes, from four community health centers in Texas, assessed the relationship between gender, social support, and self-efficacy. Better-perceived support among women was associated with better self-efficacy, yet Latinas were less likely than Latino men to report receiving support [65]. Other studies have found that the provision of social support services—especially those targeting Latina women with housing instability and food insecurity—was associated with better health outcomes, including lower incidence of depression [66, 67]. Among Latino men, several studies have reported lower participation and higher attrition rates than Latina women. In an evaluation of a community

health worker program that included 180 Latino and African American adults with diabetes, Latino men had significantly lower participation rates than Latina women (38.9% vs. 73.6%, p = 0.01), but no comparable difference was found among African Americans (67.9% vs. 79.0%, p = 0.23) [68]. Consistent with these findings, a systematic review of culturally tailored interventions found that male sex in Hispanic participants was a significant predictor of attrition [69]. Again, further research is needed to elucidate how gender, self-efficacy, diabetes-related distress, and social support services affect diabetes-related disparities.

Addressing Latino Health Disparities in Diabetes Control

Quality Improvement Interventions

Recent efforts to reduce racial/ethnic disparities in diabetes control have primarily focused on generalized quality improvement (QI) interventions. QI initiatives aim to reduce disparities by improving the general quality of all diabetes care, with the hope that these efforts will, in turn, improve the care that racial/ethnic minorities receive. Over the past two decades, dozens of studies have evaluated a wide-range of QI interventions targeting patients, providers, health care systems, or some combination of the three. To date, the evidence for the effectiveness of each target remains inconclusive. A systematic review of 43 studies reported that QI interventions have been largely effective at improving general diabetes care for all patients, but have yielded mixed results at reducing disparities [70]. A consistent finding in many of these studies was that QI interventions increased HbA1c testing and monitoring, but did not lead to better glycemic control among racial/ethnic minorities [71, 72]. The systematic review identified all three targets (patients, providers, and health care systems) as potential "lever[s] of change," and recommended using all three to target minority health care through "culturally tailored interventions" [70].

Culturally Tailored Interventions

Because QI studies have largely proven insufficient at reducing racial/ethnic disparities, a growing body of literature has assessed the efficacy of culturally tailored diabetes-related interventions. In contrast to the indiscriminate nature of QI initiatives, culturally tailored interventions are designed to focus on a specific population subgroup in order to overcome culture-related barriers that may contribute to racial/ethnic disparities [73]. A conceptual framework on cultural competency summarized nine common features of these interventions: (1) language interpreter services; (2) recruitment and retention of minority staff; (3) provider training; (4) coordinating with traditional healers; (5) use of community health workers; (6) culturally competent health promotion; (7) inclusion of family and/or community members; (8) immersion into another culture; and (9) administrative and organizational accommodations [74].

To date, a majority of studies has focused on patient-level interventions that incorporate language services, culturally competent health promotion, and inclusion of family/community members into self-management education programs. A meta-analysis reviewed 20 studies evaluating the effectiveness of patient self-management interventions in racial/ethnic minorities, with 41% of participants self-identifying as Hispanic. The authors reported a modest but significant improvement in HbA1c of −0.31 (95% CI −0.48 to −0.14) [75]. Another meta-analysis of "culturally appropriate" diabetes education programs also reported modest improvements in HbA1c levels of −0.32 (95% CI −0.63 to −0.01) at 3 months, and −0.60 (95% CI −0.85 to −0.35) at 6 months among a population of ethnic minorities [76]. By most accounts, culturally tailored self-management education interventions are associated with improved short-term glycemic control among racial/ethnic minorities.

Fewer studies have measured the effectiveness of culturally tailored interventions targeting Hispanics, but most available evidence supports the positive association found by studies of more diverse minority populations. A systematic review of eight culturally tailored education interventions found that Hispanic patients who participated in the program showed modest short-term improvements in HbA1c, ranging from −0.8 to −1.8 [69]. However, in only two of these eight studies were follow-up mean HbA1c levels < 8%, the American Diabetes Association's recommended goal for high-risk patients with diabetes who struggle to achieve optimal glycemic control despite appropriate medical treatment [77]. In three of the studies, HbA1c levels remained > 9.5%. Still, culturally tailored, education-based interventions were nevertheless associated with modest short-term improvements in glycemic control.

In addition to patient self-management interventions, several articles have reported on the use of provider trainings, alternative health care providers, faith-based and risk-based interventions. While no studies have focused exclusively on diabetes, a recent comparative effectiveness review evaluated the effect of provider education programs on various treatment outcomes and found little evidence that provider training led to better health outcomes among racial/ethnic minorities [78]. Moreover, a systematic review of community health worker-led interventions reported significant improvements of HbA1c in seven of twelve trials, with reductions ranging from −0.37 to −0.75 [79]. Other interventions with family-led and pharmacist-led programs targeting Hispanic Americans also found modest short-term improvements in glycemic control [80, 81]. Furthermore, several case studies

on the Bronx Health REACH Faith-Based Initiative have described the potential of a community-based participatory approach to addressing disparities using religious organizations to engage community members [82, 83]. Finally, several studies have found that risk-based interventions, targeting patients with poorly controlled diabetes, have been associated with reductions in disparities between racial/ethnic groups relative to non-Hispanic White populations [84, 85].

Discussion

Gaps in the Literature

The literature on diabetes-related health disparities in US Latino populations has examined an expansive set of factors that predict poor glycemic control. Many of these predictors are modifiable and potential targets for addressing disparities at system-, provider-, and patient-levels. Although more research is needed to unravel the complex relationships between Hispanic ethnicity and glycemic control, there is ample evidence describing the varying effects of insurance status, diabetes care utilization, patient self-management, language access, acculturation, and social support. The literature is also replete with studies implementing, testing, and evaluating diabetes-related interventions addressing racial/ethnic disparities. Many articles describe patient-level interventions that target diabetes self-management using appropriate language services and culturally competent curriculums. Fewer reports examine provider- and system-level interventions, with most focusing on provider training and the use of additional members of the diabetes care team. Few studies have explored system-level interventions that address disparities in health insurance status or the effect of organizational/administrative changes on the utilization of diabetes care services. Remarkably, few published studies have directly evaluated whether diabetes-related interventions reduce racial/ethnic disparities. Most studies on disparities examine changes in glycemic control, yet few studies have rigorously compared these changes between Hispanic and non-Hispanic White patients undergoing interventions. Without directly measuring changes in racial/ethnic disparities, determining the effectiveness of an intervention will remain elusive. Many studies are also limited by short intervention periods and insufficient follow up for assessing the effect of the intervention on longer-term diabetes health outcomes. Without improved study designs addressing these limitations, it remains unclear whether culturally tailored interventions can meaningfully eliminate racial/ethnic health disparities.

Recommendations for Further Research

The Latino American community is heterogeneous with respect to socioeconomic, psychosocial, and environmental needs. The literature on modifiable predictors of glycemic control reveals several key levers that may be used to design personalized and effective diabetes-focused interventions to accommodate the diversity of needs and experiences among Latino patients. At the system level, researchers should evaluate organizational/administrative interventions that improve the mechanisms by which health care systems manage and deliver diabetes care services to US Latino patients. Interventions targeting providers should continue to implement training but must also find additional ways to support and improve patient-provider trust and communication. Patient-level interventions should continue promoting patient self-management by enabling patient self-efficacy and improving rates of medication access and use.

Future research may also consider evaluating "structurally tailored interventions" to address racial/ethnic disparities. Culturally tailored solutions often qualify "culture" in ways that do not fully capture the diversity of needs and conditions within the heterogeneous Latino American community. Structurally tailored interventions are defined as those that recognize and react to the socioeconomic, political, cultural, and environmental forces that shape individual health and provide context for patient-provider interactions, as described in Metzl and Hansen's theoretical framework for "structural competency" [86]. Challenging the contemporary relevance of "cultural competency," Metzl and Hansen argue that eliminating inequities in the health system compels providers to see beyond individual cross-cultural interactions, and instead consider patients within the upstream socioeconomic and environmental context of their health. Adopting structurally tailored interventions may help better address key determinants of health in the increasingly diverse US Latino community.

Additionally, efforts to address racial/ethnic disparities have been weakened by the absence of comprehensive and standardized data on patient demographics. In many cases, the literature on diabetes-related disparities considers US Latino populations as a homogenous community, often confounding substantial differences in diabetes prevalence, management, and control. In a 2009 report, the Institute of Medicine (IOM) recommended the adoption of "granular ethnicity," or detailed patient demographic data that can better inform efforts to eliminate racial/ethnic disparities [87]. Since the report was published, several institutions have documented efforts to implement IOM recommendations and described novel opportunities to use the information in meaningful ways [88].

Finally, eliminating racial/ethnic health disparities will require a substantial reorganization of diabetes care

services to ensure access for the most vulnerable communities. To negate the harmful consequences of the social determinants, more intensive treatments and interventions for racial/ethnic minorities are necessary to eliminate fully all health disparities. Addressing disparities as a "place-based issue," as described by Dankwa-Mullan and Perez-Stable, may prove valuable for Latino Americans with diabetes. Place-based interventions focus on using structural resources, such as schools, faith-based organizations, and health systems, to develop healthy communities and improve long-term health outcomes [89]. Existing articles that have documented community efforts to mobilize and tackle systemic determinants of racial/ethnic disparities may inform future efforts to enact effective place-based interventions [90]. With more than half of all US Latinos residing in three states (California, Texas, and Florida), research that maps the distribution of diabetes-related disparities may be especially valuable in guiding communities with higher populations of Latino Americans toward health equity moving forward.

Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflicts of interest.

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