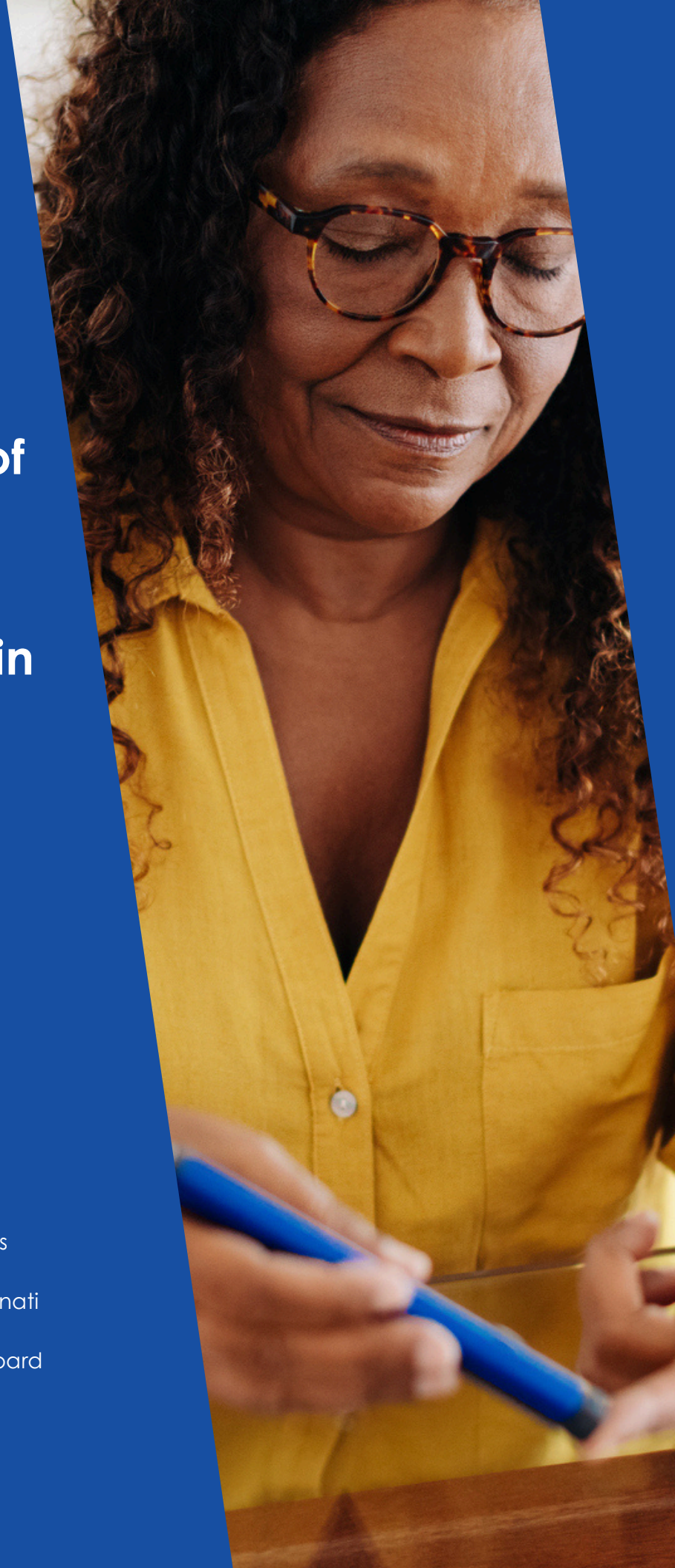
Social determinants of health interventions for diabetes in Black and South Asian-origin populations: An international systematic review



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Contents

Introduction

The social determinants of health contribute to increased diabetes risk, hinder effective blood sugar management and exacerbate disease complications[1]. Extensive research highlights the higher rates of diabetes and related complications in Black and South Asian-origin* populations in Canada[2]. These groups also face greater exposure to social factors that have been linked to diabetes incidence and progression, such as poverty, discrimination, food insecurity and poor housing[1,3-5]. Therefore, interventions targeting social determinants of diabetes may offer promising approaches mitigating diabetes outcomes for these populations.

The social determinants of health hinder diabetes management for Black and South Asian-origin populations.

A recent scoping review revealed that low income, food insecurity, limited healthcare access and cultural barriers hindered diabetes management for Black and South Asian-origin populations[6]. Lack of access to high quality healthcare clinics and resources impeded diabetes education, retinopathy screening and HbA1c monitoring. Even when clinics were available, a lack of culturally and linguistically appropriate care acted as a barrier. Findings identified a need for culturally tailored management plans, community resources and language services. This review also emphasized concerns about healthcare workers' cultural insensitivity, particularly regarding food insecurity and dietary recommendations. Although community resources existed, there was a need to address systemic drivers of food insecurity, such as stable income and better access to healthy food. Social support from family, peers and religious institutions was also found to be a facilitator for diabetes management among Black and South Asian-origin populations.

Several findings from this scoping review identified opportunities for strategies and initiatives to target these associations among Black and South Asian-origin populations. Using a mixed-methods systematic review methodology with risk of bias assessments, this study examined the effectiveness of social determinants of health interventions that have been used to decrease the incidence or prevalence of prediabetes and diabetes, the progression from prediabetes to diabetes and complication rates for diabetes in South Asian-origin and Black populations. By bringing together findings on intervention effectiveness along with patient and clinician experiences, this review can better support both clinical and policy decision-making[7]. This approach is useful in addressing health inequities, as it allows decision-makers to understand not only the effectiveness of

This study examines the effectiveness of social determinant of health interventions for diabetes.

interventions but also why they may or may not work based on the experiences of marginalized groups[7]. Ultimately, this can inform targeted strategies for improving diabetes care and outcomes for Black and South Asian-origin populations.

[*] The South Asian community is made up of people who are born in a South Asian country as well as people who identify as having South Asian heritage. Unless referring to individuals from a specific country, this report uses the term "South Asian-origin" throughout to reflect respectfully the heterogeneity of this community.

Methods

This mixed-methods systematic review was conducted in accordance with the JBI Mixed Methods Review guidelines[7] and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[8]. Eligible studies met the following inclusion criteria: (1) evaluated a social determinants of health intervention designed to reduce the burden of diabetes; (2) examined at least one outcome related to incidence or prevalence of prediabetes or diabetes, progression from prediabetes to diabetes, or diabetes management and complications; (3) focused on Black or South Asian-origin populations; (4) conducted in Canada, United Kingdom or Australia; and (5) published in English from the year 2000 onwards.

Literature search strategy and study screening

A comprehensive search strategy was developed in MEDLINE (Ovid) in consultation with a social work librarian (YL) and was peer reviewed by another librarian (MW) according to the Peer Review of Electronic Search Strategies (PRESS) Checklist[9]. The search was then translated for the following five electronic databases that were searched up until October 2024: Embase (OVID), PsycINFO (OVID), CINAHL (EBSCO), Applied Social Sciences Index and Abstracts (Proquest) and Scopus. The search strategy combined key terms related to diabetes, Black and South Asian-origin populations and social determinants of health, as drawn from the Government of Canada's determinants of health[10]. This included terms related to socioeconomic status, education levels, job security, food security, housing and the environment, systemic barriers and discrimination and access to health services. Geography filters were also adapted to focus the search on literature from Canada, the United Kingdom and Australia[11,12]. These countries were selected as they have similar healthcare systems and challenges related to social determinants of health and diabetes care among Black and South Asian-origin populations. Searches were limited to publications from the year 2000 onwards. The full search strategy in MEDLINE is shown in Table 1 of the supplemental materials. Additional records were identified by hand-searching reference lists of relevant review articles.

Two independent reviewers (among ME, CS, RT) screened records for potentially eligible titles and abstracts and subsequently reviewed full texts to determine inclusion. Disagreements were resolved by discussion until a consensus was reached. Covidence systematic review software[13] was used to facilitate the screening process.

Data extraction and analysis

The extraction of study-level data was led by one reviewer (ME) and was independently reviewed by another member of the research team (CS). The following data were extracted a common data collection spreadsheet: publication year, country, research design,

intervention characteristics, diabetes outcome under study, sample size and participant characteristics (summarized according to Progress Plus guidelines[14,15]), and key findings.

Two study authors (ME and CS) independently assessed the quality of all included studies. Assessment discrepancies were resolved through discussion and consensus. A modified Downs and Black checklist[16] was applied to studies using quantitative methodologies, which is one of the most widely used quality assessment tools in systematic reviews that include both randomized and non-randomized studies[17]. It consists of 27 items that evaluate the quality of study reporting, external and internal validity, and power. Consistent with prior studies, the final question on power calculations was modified to a dichotomous scale of 1 (power calculation present) or 0 (no indication if the sample size was appropriate)[18].

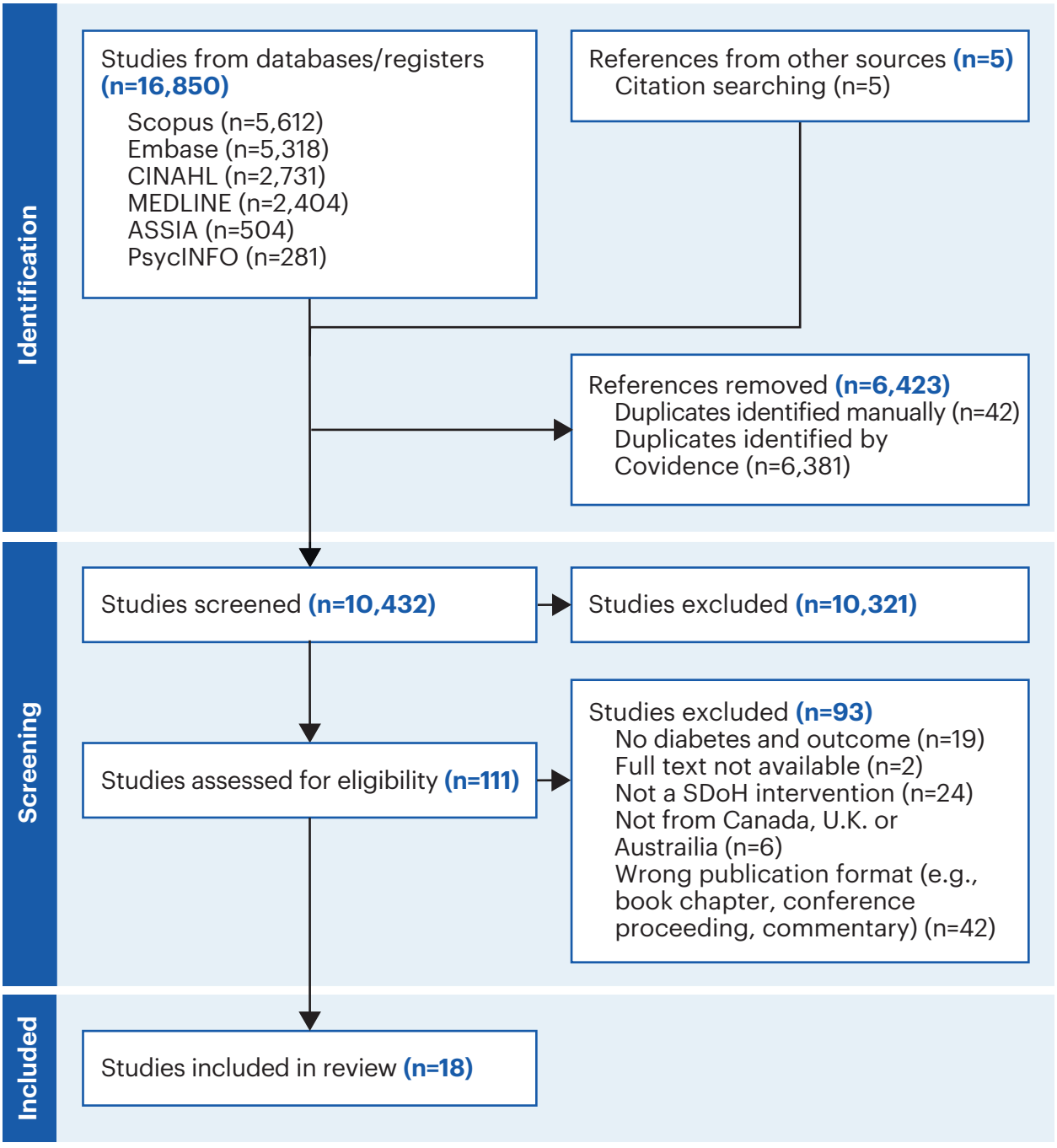
The Critical Appraisal Skills Programme (CASP) tool[19] was applied to studies using qualitative methodologies, which is the most widely used checklist for quality appraisal in health and social care reviews of qualitative evidence[20] and is recommended in the Cochrane Handbook for Systematic Reviews of Interventions[21]. It consists of 10 domains that assess methodological strengths and limitations to determine study rigour, including clear aims and research questions, congruence with research design and methods, rigour of sampling and data collection, appropriate application of qualitative methods, richness of findings, and reflexivity of the researchers[19,21].

As this was a mixed-methods systematic review, a convergent segregated approach to data synthesis and integration was used[7]. Quantitative data on the effects of interventions on each diabetes outcome was synthesized across the various social determinants of health in a narrative review. Qualitative data gathered on the perceptions of social determinants of health interventions from the perspectives of the intervention deliverers or participants was analyzed separately using deductive content analysis[22-24]. Findings from both syntheses were then integrated to examine the overall impacts of the various interventions on each diabetes outcome.

Results

A total of 10,432 unique records were screened through database and hand searching and 111 articles were assessed for eligibility (see Figure 1). In total, 18 peer-reviewed articles met the full inclusion criteria and were assessed as part of this review.

Figure 1. PRISMA flowchart



Included studies were primarily published in the United Kingdom (67 per cent), followed by Canada (28 per cent) and Australia (6 per cent), between 2001 and 2024. Most studies (72 per cent) reported on South Asian-origin populations while 38 per cent reported on Black populations. There was a mix of methodologies, including randomized trials (22 per cent) and non-randomized trials (28 per cent), as well as qualitative (33 per cent) and mixed-methods approaches (17 per cent). Only two diabetes outcomes were examined: progression from prediabetes to diabetes (17 per cent) and diabetes management and complications (83 per cent), which was predominately assessed through HbA1C levels, anthropometric measures, or patient-reported health behaviours. All the examined interventions targeted access to health services (100 per cent), but social support (44 per cent), demographic factors (11 per cent), immigrant status (11 per cent) and employment (6 per cent) were also addressed. These characteristics are summarized in Table 1 below, which provides a further breakdown by study population. Detailed extraction for each study can be found in Table 2 of the supplemental materials.

Table 1. Summary of study characteristics

Study characteristics	Overall (n=18)	South Asian-origin populations (n=13)	Black populations (n=7)
Location			
Canada	5 (27.8%)	4 (30.8%)	3 (43.0%)
United Kingdom	12 (66.7%)	8 (61.5%)	4 (57.0%)
Australia	1 (5.5%)	1 (7.7%)	0 (0%)
Methodology			
Qualitative	6 (33.3%)	3 (23.1%)	4 (57.1%)
Randomized controlled trial (RCT)	4 (22.2%)	4 (30.8%)	0 (0%)
Non-RCT	5 (27.8%)	5 (38.4%)	1 (14.3%)
Mixed methods	3 (16.7%)	1 (7.7%)	2 (28.6%)
Diabetes outcome			
Progression from prediabetes to diabetes	3 (16.7%)	3 (23.1%)	0 (0%)
Diabetes complications and management	15 (83.3%)	10 (76.9%)	7 (100%)
Social determinants of health			
Immigrant status	2 (11.1%)	1 (7.7%)	1 (14.3%)
Access to services	18 (100%)	13 (100%)	7 (100%)
Social support	8 (44.4%)	4 (30.8%)	4 (57.1%)
Employment	1 (5.5%)	0 (0%)	1 (14.3%)

Risk of bias assessments

The results of the risk of bias assessment for each study is presented in Tables 3 (CASP tool) and 4 (Downs and Black checklist) of the supplemental material. The three mixed-methods studies were assessed twice, whereby qualitative components were assessed using the CASP tool and quantitative components were assessed using the Downs and Black checklist.

A total of nine qualitative studies (including three mixed-methods studies) were assessed using the CASP tool. These studies used a variety of methodologies, including co-designed approaches with patients and healthcare professionals/educators (n=2), focus groups with participants or educators around intervention feedback (n=3), and narrative interviews on participant experiences with the intervention (n=4).

Most of the studies were found to be of high quality (n=6) as they clearly described their research aims and design, qualitative methodology, data collection and analysis, and findings. Only one, however, provided details on the relationship between the researcher and the participants. Two studies were found to have some concerns for not clearly articulating their research aims or findings. One low-quality study was assessed to not present study findings in a way that was valuable for the field.

Twelve studies (including three mixed-methods studies) were assessed using the Downs and Black tool. These included five randomized controlled trials and seven non-randomized studies. Randomized studies were found to range in quality from poor (n=1), to fair (n=2), to good (n=2). Across all five randomized studies, diabetes outcomes were clearly defined and measured accurately with the appropriate statistical tests. However, many did not report on blinding of subjects (n=5), sample representativeness (n=3), or patients lost to followup (n=5).

Non-randomized studies (n= 7) were found to range in quality from poor (n=4) to fair (n=3). All non-randomized studies used a pre-post-test design. However, only one included a control group. In addition to the lack of randomization, most of these studies failed to report on sample representativeness (n=7), patients lost to followup (n=7), compliance with the intervention (n=7), and power of the study (n=6). Additionally, some studies (n=5) did not provide information on confounding factors related to the participants' diabetes diagnosis, such as diabetes type, length of time since diagnosis, or current use of medications to manage blood sugar levels.

Diabetes outcome: Management and complications

Fifteen studies reported on diabetes management and complications. Of these studies, seven reported on Black populations and 10 on South Asian-origin populations.

Interventions in the Black population: All seven studies on Black populations explored access to services. Four of the studies examined social support, while one study addressed employment. One study also explored intersectionality with immigrant status. Four studies took place in the United Kingdom while three took place in Canada. The majority were qualitative in design (n=4), along with two mixed-methods studies and one non-randomized study.

Two studies focused on the design and development of the HEAL-D program, a culturally tailored diabetes self-management education and support program for Black-British adults with type 2 diabetes. Another two studies examined effectiveness and feasibility of this program, aiming to improve access to services and social support[25-28]. The developmental phase used participatory and co-design approaches with patients, community leaders and healthcare professionals to identify barriers and facilitators for effective diabetes management[25,28]. Focus groups and interviews with participants living with type 2 diabetes identified barriers that included knowledge gaps about how cultural foods affect blood glucose, lack of access to culturally relevant physical activity opportunities (e.g., dancing), competing work demands that make attending medical appointments challenging, and a preference for medical advice from informal sources, such as friends or family[25,28]. Facilitators included culturally tailored diabetes content, clear and simple communication (i.e., visual and verbal learning methods), and strong social support from family and friends whose roles ranged from providing informal information and advice to assisting with food preparation[25,28]. Flexible scheduling and community-based education sessions helped make the programs more accessible for participants as well[25,28]. A mixed-methods randomized controlled feasibility trial of the HEAL-D program conducted in group-based sessions to foster social support showed high engagement, with a 93 per cent retention rate and improvements in HbA1c levels (–2.4 mmol/mol, significance not tested), waist circumference (-1.0cm, significance not tested), and self-reported physical activity (17 per cent decrease in the proportion reporting low physical activity) in the intervention group[27]. An online adaptation of the program showed a lower completion rate at 77 per cent. However, participants still reported weight loss (78 per cent) and reduced diabetes-related emotional distress (drop in PAID-5 scores from 7 to 4)[26]. Interviews with participants of the program highlighted that the flexibility and convenience of HEAL-D's virtual delivery was helpful for managing diabetes, especially when faced with competing work demands[26]. They also valued the cultural relevance and peer support that was part of the program[26].

Another study used similar co-design approaches to create a culturally and linguistically tailored intervention aimed at improving diabetic retinopathy screening by increasing access to services and social support among French-speaking African immigrants in Canada[29]. Through community workshops with individuals and family members, key

barriers to diabetic retinopathy screening, such as language, cultural factors, transportation, and wait times, were identified[29]. These were then used to develop culturally appropriate solutions (e.g. language support, information flyers and workshops, and social support through community champions) in collaboration with health system partners[29]. Changes to uptake in diabetic retinopathy screening were not evaluated in this study[29].

Interventions in South Asian-origin populations: All 10 studies of South Asian-origin populations examined access to health services. One study also examined social support, and intersectionality of access to services with immigrant status was examined in another study. Six studies were conducted in the United Kingdom, three took place in Canada, and one study took place in Australia. Four of the studies used non-randomized methodologies, three were randomized controlled trials, two were qualitative in design, while the remaining one was a mixed-methods study.

Several culturally tailored diabetes self-management and education programs (n=7) have shown positive outcomes for South Asian-origin populations with type 2 diabetes. Two studies specifically focused on the DESMOND (Diabetes Education and Self-Management for Ongoing and Newly Diagnosed) program. One study on a culturally adapted version of DESMOND tailored to South Asian-origin populations showed similar positive effects at 12 months, including statistically significant reductions in weight (-1.06 kg) and BMI (-0.39 kg/m^2), and improvements in vigorous physical activity[30]. Despite these overall findings, this intervention had less of an effect on individuals of South Asian origin compared to the White European population[30]. A real-world evaluation of individuals who attended DESMOND courses in Leicester City in the United Kingdom over 15 months showed reductions in HbA1c levels at six months (0.96 per cent) and 12 months (0.7 per cent) and 18 per cent who completed the quality assessments indicated the course helped improve their ability to self-manage their diabetes[31]. Findings were not disaggregated by race, but 28 per cent of the study sample was of South Asian-origin, which reflected the overall population breakdown of the area[31].

Other culturally tailored diabetes education programs delivered by peer educators have shown positive results in improving health outcomes for South Asian-origin populations. A program for people with origins in Bangladesh improved self-management behaviours including diet and exercise[32], while a 24-week intervention for women who emigrated from Pakistan to Australia with metabolic syndrome significantly improved physical activity (+4,617 daily steps), BMI (-1.4 kg/m^2), plasma insulin (-20.9 μU/mL) and glucose (-0.5 mmol/L)[33]. Similarly, a three-month diabetes self-management education and support intervention for South Asian-origin adults from Vancouver, Canada with type 2 diabetes showed significant improvements in HbA1c (-4 mmol/mol), BMI (-0.5 kg/m^2) and blood pressure (-5.1 mmHg)[34]. However, this study found the intervention had limited

effects on psychosocial factors, which were measured using the Diabetes Distress Scale. Specifically, this scale examined issues such as diabetes taking up mental and physical energy, lack of support from healthcare provider or family/friends on diabetes care, feeling angry, scared and/or depressed about living with diabetes[34].

Literacy (defined as the ability to read or write in English or their first language) was also shown to play a role in diabetes health education and the ability to understand diabetes diagnosis and management among South Asian-origin populations. One study examined a structured diabetes education program using a pre-post-test design adapted from XPERT[35]. The program incorporated visual aids to address varying literacy levels and was tailored to the cultural aspects of diabetes management among South Asian-origin communities. Results showed significant improvements in waist circumference (-1.61cm) and diabetes knowledge (+16 per cent) and empowerment (+16 per cent) scores (evaluated using the Michigan Diabetes Knowledge Test and the Diabetes Empowerment Scale-Short Form), though reductions in HbA1c and BMI were not statistically significant[35]. Similarly, a randomized controlled intervention providing culturally appropriate health education for British women of Pakistan heritage that using pictorial flashcards significantly improved HbA1c levels and led to better knowledge of diabetes-related issues, with literacy levels influencing both outcomes. However, the authors did not provide information on how literacy was assessed or measured[36]. Another qualitative study on British South Asian patients with type 2 diabetes found SMS messages to be helpful in supporting medication adherence, but patients frequently needed family support to translate the short messages that were in English[37]. Participants suggested offering messages in different formats or in-person for those unable to understand English or who didn't use digital devices. They also wanted messages that addressed information on other self-management needs, such as diet, exercise and stress management[37].

The effectiveness of a smartphone-based health coaching intervention for managing type 2 diabetes was also examined in two other studies that included both South Asian-origin and Black populations[38,39]. These studies did not disaggregate findings by race. However, 14 per cent of particpiants were African, 14 per cent were Caribbean and 14 per cent were South Asian[39]. The single-arm, pre-post-test, longitudinal feasibility study showed that the intervention led to a significant reduction in HbA1c levels (-0.28 per cent) and weight (–1.3 kg), with participants who had sub-optimal baseline HbA1c experiencing greater improvements with HbA1c (-0.43 per cent) and weight (-1.9 kg)[39]. However, changes in BMI and waist circumference were less consistent, with BMI showing a non-significant reduction and waist circumference increasing overall[39]. The qualitative evaluation of this intervention showed participants valued the app's utility for tracking diet, exercise and blood glucose, and appreciated the support and encouragement from health coaches[38].

Diabetes outcome: Progression from prediabetes to diabetes

There were no studies assessing the impact of social determinant of health interventions on the progression from prediabetes to diabetes in Black populations.

Three studies reported on two interventions designed to reduce the risk of progression to type 2 diabetes within South Asian-origin populations, each using distinct strategies to address concerns related to both access to services and social support. Two of these studies took place in the United Kingdom, while one study was conducted in Canada.

A one-group, 10-week diabetes education program with a pre-post-test design implemented among adolescents with a family history of diabetes found a significant increase in diabetes knowledge and risk factors, with 73.2 per cent of participants increasing their physical activity and 80.5 per cent reducing their intake of sweets and junk food[40]. Additionally, 70.7 per cent of the adolescents encouraged their families to be more active and eat healthier[40]. Despite these improvements, 59.1 per cent of participants showed no change in their perceived diabetes risk[40].

A family-cluster randomized controlled trial that involved adults with impaired glucose tolerance or impaired fasting glucose found that the intervention group, which received 15 visits from a dietitian over three years, had a mean weight loss of 1.13 kg compared to a mean weight gain of 0.51 kg in the control group, which only received four visits[41]. Additionally, more individuals in the intervention group lost 2.5 kg and 5 per cent of their body weight compared to the control group[41]. Although diabetes progression was less frequent in the intervention group, the difference was not statistically significant[41]. The same trial used narrative interviews to study the motivations and experiences of reducing obesity in trial participants of South Asian-origin at high risk for diabetes[42]. Although the study found participants experienced weight loss of up 8 kg and increased physical activity, adherence was challenging due to cultural food preferences, social obligations (e.g., Ramadan), and environmental factors like weather conditions[42]. Family support, particularly a sense of responsibility among relatives, played a significant role in participation throughout the trial[42].

Discussion

The results from the reviewed studies highlight the effectiveness of culturally tailored diabetes management programs for both South Asian-origin and Black populations. Across the included studies, a common theme was the focus on improving access to health services, addressing social support, and incorporating cultural considerations in diabetes education and intervention programs.

Culturally tailored diabetes programs have shown positive outcomes for South Asian-origin and Black populations.

In Black populations, the HEAL-D program identified barriers such as knowledge gaps, cultural norms and competing demands on participant time when it came to managing type 2 diabetes[25-27]. These barriers were addressed by integrating culturally appropriate content, clear communication strategies and strong social support networks[25-27]. The significant improvements in HbA1c levels, weight loss and physical activity further suggest the effectiveness of community-based, flexible interventions in managing diabetes in these populations[25-27]. This is particularly important for Black communities, who often face challenges due to under-resourced and target-driven healthcare environments, which can lead to patient disengagement[43]. Benefits were maintained when the intervention was adapted for an online environment that provided more flexibility for participants with varying schedules and commitments[26]. As prior research shows, participants were more likely to decline participation in diabetes education programs if there were logistical or financial barriers (e.g., timing or costs)[44]. Therefore, offering options online[26] or in-person at multiple locations[45] may be important strategies for improving access to diabetes education.

Studies that focused on family involvement were impactful, particularly among Black populations, not only for providing emotional support but also for encouraging healthier eating habits and increased physical activity. The HEAL-D program, which integrated family and peer support, demonstrated improved health outcomes, indicating that interventions that attempt to target family and support systems are impactful in managing chronic diseases such as diabetes. These findings align with previous research emphasizing the crucial role of family in sustaining behaviour change among Black populations[46].

For South Asian-origin populations, several studies demonstrated positive outcomes in managing diabetes-related complications and reducing the progression from prediabetes to diabetes. Specifically, culturally tailored programs, such as DESMOND, showed significant reductions in HbA1c levels and improvements in weight management and physical activity[30-33,36]. One study highlighted that South Asian-origin populations had a less pronounced response compared to White Europeans[31], suggesting that while

culturally adapted interventions can be beneficial, there may still be a need for further customization to better meet the unique health needs of South Asian-origin communities. The evidence also suggested that literacy levels had significant impacts on the effectiveness of diabetes education for South Asian-origin participants, emphasizing the need to implement strategies that are effective for people with lower literacy levels[36].

In addition to diabetes management, studies on the progression from prediabetes to diabetes among South Asian-origin populations demonstrated that culturally tailored interventions had a positive impact on diabetes-related health behaviours, such as increased physical activity and improved diet[40-42,47]. Particularly, family-based interventions resulted in modest weight loss, but adherence was affected by cultural and environmental factors, with family support being crucial to maintaining participation[40-42]. These findings emphasized the effectiveness of tailored interventions and the importance of addressing cultural challenges and social support in diabetes prevention.

Most of the literature examined in this review focused on South Asian-origin populations, and there was less attention overall towards interventions addressing social determinants of health among Black populations. Additionally, most of the studies reported on diabetes management and complications, with only three studies exploring progression from prediabetes to diabetes. Studies also predominately reported on interventions targeting access to services and social support while other social factors associated with diabetes outcomes in Black and South Asian-origin populations were not explored. For instance, studies have shown that food insecurity and poor access to healthy food, particularly among Black and South Asian-origin populations, increase the risk for diabetes[6]. The physical environment, particularly low-walkability neighbourhoods, has also been identified as a key factor linked to higher diabetes prevalence, especially among South Asian-origin populations, with environmental improvements recommended to reduce diabetes incidence and enhance management[6]. Research conducted in the United States has shown the impact of interventions like food bank programs that provide healthy food options are successful in improving diabetes risk factors among food-insecure populations, which includes Black populations[48]. Therefore, more research is needed to explore the impact of interventions targeting food security, as well as interventions targeting other social determinants of health, like income, physical environment and housing, on diabetes management and outcomes in Black and South Asian-origin populations.

There were several methodological gaps identified in the quality assessment. For instance, several studies lacked information on blinding, sample representativeness, adjustment of confounders, and patient followup, which affected the overall quality and reliability of the findings. These should be considered in future research evaluating other social

determinant of health interventions for diabetes. Furthermore, most of the interventions identified in the current research are operating at the individual level, focusing on specific behaviours or conditions, but more research is needed to explore how population-level interventions targeting the social determinants of health can impact diabetes outcomes.

Conclusion

This mixed-methods systematic review combined quantitative studies on intervention effectiveness with qualitative insights from patient and clinician experiences, providing a more comprehensive understanding of the role of social determinant of health interventions in decreasing the progression from prediabetes to diabetes and complication rates for diabetes in South Asian-origin and Black populations. Culturally tailored diabetes management programs for these populations, such as HEAL-D and DESMOND, have shown positive outcomes in improving HbA1c levels, weight and physical activity. It is essential that self-management education interventions targeting healthcare access be individualized according to not just the type of diabetes, but also to the unique context of each individual. This includes taking into account the person's literacy level, cultural background, health beliefs and preferences, as well as their socioeconomic status, and other health challenges. Social support, especially from family and peers, was also a key factor in managing and reducing the risk of diabetes. The review also highlighted the lack of focus on other social factors, like food insecurity, which contribute to diabetes risk. Further research is needed to address broader social determinants in diabetes care.

Further research is needed to address broader social determinants in diabetes care.

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