Egede LE, Walker RJ, Linde S, Campbell JA, Dawson AZ, Williams JS, et al.
Nonmedical interventions for type 2 diabetes: evidence, actionable strategies, and policy opportunities.
Health Aff (Millwood). 2022;41(7).

APPENDIX
TABLE OF CONTENTS

Supplementary Text

Supplementary Exhibits

Appendix A
Supplementary Background: Overview of Social Determinants of Health as They Relate to Diabetes

The impact of social determinants of health on adults with diabetes has received increased attention as evidence mounts for their influence on health outcomes [1-2]. Defined as the social and economic conditions in the places where people live, learn, work, and play, social determinants of health include the neighborhood and built environment, health and health care, social and community context, education, and economic stability [1;3]. Social determinants of health include both structural factors, such as the socioeconomic and political context, policies, and cultural and social norms, as well as more intermediary factors, such as material circumstances and psychosocial factors [4]. Structural determinants of health shape more downstream intermediary factors, having both direct and indirect effects on health and health disparities [4-5]. Though social determinants in themselves are neither positive nor negative, specific adverse social conditions referred to as social risk factors are associated with poor health outcomes across multiple disease states and conditions [5].

Structural Racism as Antecedent to Social Determinants of Health

Structural racism refers to the many ways in which societies foster racial discrimination via mutually reinforcing inequitable systems across housing, education, employment, earnings, benefits, credit, media, criminal justice, and health care that in turn reinforce discriminatory beliefs, values, and distribution of resources [6-9]. As noted by Bailey et al. (2017), structural racism has a significant negative impact on individual health via multiple mechanisms including: (1) economic injustice and social deprivation; (2) environmental and occupational health inequities; (3) psychosocial trauma; (4) targeted marketing of health-harming substances; (5) political exclusion; (6) maladaptive coping behaviors; (7) stereotype threats; (8) state-sanctioned violence and alienation from property and traditional lands; and (9) inadequate health care [7].

One important example of structural racism is the previously legal practice of redlining. Redlining refers to the historic practice of systematically denying residents in select neighborhoods (primarily African Americans) access to credit [10]. First initiated in 1933 by the Federal Housing Administration, the Home Owners' Loan Corporation (HOLC) used the racial composition of neighborhoods to classify their creditworthiness as "Best", "Still Desirable", "Definitely Declining", or "Hazardous" (where "Hazardous" areas were commonly colored red) [11-12]. Residential redlining is now prohibited under the Fair Housing Act of 1968; however, the lasting effects due to this discriminatory practice are still present to this day. Using digitized copies of HOLC maps, several recent studies document the persistent negative impact of redlining on present day residential segregation, economic inequity, economic mobility, and health disparities [13-17]. Key associations include the increased occurrence of poor physical and mental health [10;18-19], lower levels of self-rated health status [20], lower life expectancy at birth [10], greater risk of experiencing a preterm birth [21-22], higher rates of emergency department visits due to asthma [23], worse postoperative outcomes in terms of mortality, complications, and readmissions [11], and significant disparity gaps with respect to COVID-19 outcomes [24-25]. Though little work has investigated the impact of redlining on chronic disease, such as diabetes, this is an important area to understand given the intensive self-management requirements, which are influenced by structural racism and social determinants of health.

Food Environment

Significant evidence exists regarding the impact of the food environment on physical and mental health outcomes for adults with diabetes [1;26-28]. Food insecurity, often defined as the lack of consistent access to enough food to lead an active and healthy life [29], is associated with a higher prevalence of diabetes, worse glycemic control, higher likelihood of eye or kidney complications, and lower quality of life in adults with diabetes [26;30-33]. One systematic review and meta-analysis found that food

insecurity was associated with 27% increased odds for type 2 diabetes, 40% increased odds of emergency department visits and hospitalizations, 100% increased odds of cardiovascular disease, 53% increased CVD mortality, and 58% overall mortality [27]. Current categorization schemes for food insecurity focus on capturing a range of severity based on how often individuals skip meals or go hungry [29]. However, key dimensions of the food environment including accessibility, availability, affordability, and quality of food are not often captured using current measurement methodologies [34].

The physical food environment surrounding an individual, including the physical presence and distribution of food stores, and conditions that influence food choices, impact food and nutrition security within neighborhoods [2]. Higher food access and availability, generally measured by distance to grocery stores, is associated with lower prevalence of type 2 diabetes [35-36]. There is some evidence for a relationship between density of grocery stores and diabetes prevalence, and a combination of having both healthy food outlets and residential walkability have been shown to be associated with better glycemic control in adults with diabetes [2;37]. A better understanding of interventions that are effective at addressing food insecurity and improving health outcomes for adults with diabetes is greatly needed [38].

Neighborhood Factors

Beyond access to healthy food, neighborhood factors such as violence, safety, crime, social support and social cohesion, discrimination, and resource availability have been shown to significantly influence glycemic control and self-care behaviors [2;39-46]. Evidence shows these social and environmental factors can result in decreased medical adherence, poor physical health, higher rates of obesity, and increased risk for chronic disease [46-47]. For example, individuals with diabetes living in unsafe neighborhoods were 69% more likely to delay filling a prescription [40]. In addition, results from a cross-sectional study showed increased levels of neighborhood violence were associated with increased LDL levels among patients with type 2 diabetes [44].

With regards to potential pathways and mechanisms of influence, evidence shows factors such as neighborhood aesthetics have a direct effect on glycemic control, while factors such as social support and access to healthy food have indirect effects via self-care behaviors [44]. Also, socioeconomic position has been shown to moderate the relationship between neighborhood factors and self-management behaviors such as healthy food consumption, physical activity, blood sugar monitoring, and medication adherence [40]. Furthermore, socioeconomic position and residential/regional area deprivation are associated with poor process measures for diabetes and increased risk for microvascular and macrovascular complications [48].

Built environment

The built environment including factors such as walkability, green space, air pollution, roadway proximity, and physical activity spaces are widely studied environmental characteristics in the diabetes literature [49]. Exposure to greenspace has been associated with improved clinical outcomes such as decreased salivary cortisol, heart rate, diastolic blood pressure, high-density lipoprotein cholesterol (HDL-C), both cardiovascular and all-cause mortality and a lowered risk for type 2 diabetes [50-52]. Greenspace exposure is also associated with a lower risk for comorbid conditions such as hypertension, coronary heart disease, and dyslipidemia and complications such as stroke [50-52]. Evidence suggests an increase in physical activity and lower body mass index, two important factors associated with a lower risk for developing type 2 diabetes and slowing the progression of diabetes-related adverse outcomes, may be the mechanism through which greenspace influences diabetes outcomes [36,51-52].

Housing Stability

Evidence shows that housing stability, or the ability to secure safe and stable housing, is associated with decreased risk and improved chronic disease self-management for conditions such as type 2 diabetes and result in improved health outcomes [2;41;53-56]. With housing stability, adults with diabetes can minimize the stressors associated with trying to secure a place of residence and establish routines that lead to better outcomes such as improved diet, blood sugar monitoring, medication

adherence and increased physical activity [54]. Stable housing provides a sense of security and affords the opportunity for adults with diabetes to prioritize their own personal health [2;54-55]. Stable housing also facilitates improved self-efficacy and locus of control, providing an opportunity for the conservation of both emotional and physical qualities of life [56]. Similarly, evidence shows there is a link between housing stability and other social determinants of health such as social support, where stable housing results in the establishment of social networks that can result in mutually beneficial exchanges of resources [54].

Conversely, housing instability, independently and in conjunction with challenges that include suboptimal neighborhood factors, poor quality housing, and unaffordable housing costs, may serve as a structural driver associated with diabetes inequities at the population health level such as lower healthcare access, poorer processes of care, higher complication rates, and increased morbidity and mortality [2;54-57]. Adults with diabetes and housing insecurity had lower odds of having completed a physician visit within the previous 12 months (OR 0.67; 95% CI: 0.53,0.85) and having had an eye exam (OR 0.60; 95%CI 0.52,0.70) [57]. Most often, adults from historically marginalized, disadvantaged, and under-resourced areas with diabetes are the individuals disproportionately impacted by structural barriers such as housing instability [2;54-56]. Studies show that providing supportive housing and/or rental assistance and improving social capital via housing stability, particularly for adults residing in environments such as public housing, may be beneficial to improving diabetes self-management [54-56].

Chronic Stress

Evidence from multiple scientific reviews, cross-sectional studies, and a prospective cohort study show stress to be one of the major health and socioeconomic determinants globally, especially among lower-income populations [2;46;58-61]. Both acute and chronic stress have been shown to negatively impact health outcomes, not only in overall health and well-being, but also as they relate to diabetes-related clinical and behavioral outcomes [46;61]. Stress related to the daily management of diabetes or to life events, which are proposed to occur via behavioral, environmental, physiological, and psychological mechanisms, can lead to suboptimal diabetes management [46;61]. Furthermore, stress is significantly and directly associated with other determinants of health such as neighborhood factors that include neighborhood crime, neighborhood poverty, neighborhood violence, and discrimination, signifying its independent and additive impact on diabetes health outcomes [46;61]. Evidence shows that stress is associated with poorer glycemic control, lower levels of self-efficacy, and suboptimal self-care behaviors [46].

Economic Instability/Poverty

As an added burden to or co-occurrence with chronic stress, poverty is a strong risk factor for diabetes and has been associated with limited healthcare access, premature death from diabetes, more hospitalizations and less preventative care, higher rates of comorbid conditions such as cardiovascular disease and cancer, and an increased risk for diabetes-related complications [2;59-60;62]. Poverty is associated with lower educational attainment, lower paying jobs/wages, uncertain employment, unstable housing, and unsafe neighborhood factors or poorly maintained built environment spaces [2;59-60]. All of these are needed for and contribute to optimal and comprehensive management of a complex and multifaceted condition such as type 2 diabetes [2;59-60]. Surviving an environment filled with various stressors and the competing demands of poverty force adults with diabetes to prioritize basic needs and focus less on their immediate health-related needs [59]. However, despite being identified as a modifiable risk factor for diabetes, evidence suggests poverty is seldom a target for intervention or investigation to improve diabetes outcomes, even amongst some of the more vulnerable population groups [59-60].

Integration of Medical Care and Social or Non-medical Care

Despite the evidence that social determinants of health impact health care, health outcomes, and health care costs, compared to other high-income countries, the United States spends little to address social factors and more on health care services [2;63-64]. The United States spends $0.50 on social

services for every $1 spent on health care compared to about $2 spent on social services for every $1 spent on health care by countries in the Organization for Economic Co-operation and Development [65]. A recent study identified 30 health and social care programs in eleven high-income countries including the United States, and using a structured survey, examined the core design features of these programs and how they have been implemented [66]. These programs targeted different high need populations including frail elderly (10 programs), adults with serious mental health conditions (4 programs), and adults with complex chronic medical conditions (16 programs). While all mental health programs and most of the programs for the frail elderly were classified as high activity (programs providing wide range of social services in a highly coordinated manner), many programs serving populations with complex chronic medical conditions were categorized as having low activity (programs providing limited number of social services with minimal coordination).

Most of the literature on integrated care in populations with diabetes, a high-risk high-cost group, has excluded non-medical intervention and focused primarily on team-based care which includes the patient, their primary care provider, and one or more other health professionals [67-68]. The goals of team-based care include diabetes risk factor control, promotion of healthy behavior, improved self-management, quality of life and prevention of diabetes complications. A recent report from the National Academies of Sciences, Engineering and Medicine [69] identified five complementary activities to integrate social care into healthcare delivery including awareness (identifying social risks and assets), adjustment (altering clinical care to accommodate identified social barriers), assistance (reducing social risk by aiding in connecting with relevant resources), alignment (understanding, organizing, investing, and deploying existing social care assets in the community), and advocacy (promotion of policies that facilitate creation and redeployment of resources to address needs). However, it is unclear how much of the actionable strategies for integrating medical and social services laid out in this report are being implemented in both general and diabetes populations.

Appendix B
Supplementary Methods

Information Sources, Eligibility Criteria, and Search

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Guidelines were used for identifying, screening, and study selection for final synthesis [70]. Articles were chosen based on the following inclusion criteria, established a priori by the authors: 1) published in English, 2) based in the United States, 3) study design: clinical trial, quasi-experimental, or pre-post study design measuring an intervention effect, 4) sample population included adults aged 18 or older with type 2 diabetes. Additionally, one or more of the following diabetes outcomes had to be included: 1) hemoglobin A1C, 2) blood pressure, 3) lipids, 4) self-care, or 5) quality of life. Protocol and design papers were excluded as well as studies that involved medical interventions (e.g., medications or devices). In addition, natural experiments and retrospective designs were excluded because of the focus on inclusion of designs that purposely tested interventions. Studies that included both type 1 and type 2 diabetes were excluded.

A reproducible search strategy was used to identify non-medical clinical trials or interventions designed to address one or more social determinants of health using the Healthy People 2020 framework, with the addition of structural racism and strategies to integrate medical care with social care in adults with type 2 diabetes. Three different databases were utilized to ensure the inclusion of a robust set of articles. These included PubMed, Cochrane, and Medline. The databases were searched with no date parameters, and the search was conducted in January 2022. Medical Subject Heading (MeSH) terms capturing the above-mentioned social determinants of health and social risk factors are listed in Appendix D. Papers that were not categorized under the specified MESH terms were not included in the manuscripts identified by the original search.

Study Selection and Data Collection

Study selection was based on an initial title and abstract review by AZD and JAC. Studies were evaluated for inclusion using a checklist that included eligibility criteria. Articles that did not have the diabetes outcomes specified in the inclusion criteria in the main measures section of the abstract were excluded. While the majority of interventions were tested outside the healthcare system, those that integrated clinical and social needs within clinical settings were included. Articles conducted in clinical settings that did not purposely integrate social and medical care were excluded. After the title and abstract review, full text articles that met initial inclusion criteria were included for full text synthesis. After full text synthesis, articles not meeting inclusion criteria were excluded with reasons. Appendix E provides details of studies excluded and retained at each phase [70]. The articles included for data extraction are shown in Appendix F. Data extraction was conducted using a standardized data collection form and included the study design, social determinant and social risk category, study objective, sample populations, and impact of the intervention on outcomes. Final article decisions were made by AZD, JAC, and LEE.

Appendix C
Details of Studies Selected for Inclusion in the Final Review

Results of Study Selection

After searching PubMed, Cochrane, and Medline, 1,676 articles were identified. An additional 8 articles were found after completing a hand search. After duplicates were removed, 530 articles remained for title and abstract screening using the inclusion criteria listed above. Three hundred seventy-five articles met inclusion criteria, and an additional 346 were excluded with reasons listed in Appendix E. A total of 10 articles were included for final synthesis. Of the 10 articles, 3 focused on addressing food insecurity to improve outcomes in patients with type 2 diabetes [71-73], 3 studies were categorized as social risk by focusing on the use of financial incentives to improve outcomes in patients with type 2 diabetes [74-76], 2 focused on integration of care to improve outcomes in patients with type 2 diabetes [77-78], 1 focused on the built environment [79], and 1 focused on improving housing and its impact on diabetes outcomes [53].

Study Characteristics and Outcomes

Appendices F-H provide a summary of the 10 studies. Of the 10, 8 were randomized clinical trials and 2 were pre-post study designs. Sample sizes ranged from 35 to 4,498. Nine of the 10 studies examined treatment of type 2 diabetes, with 1 study examining the impact on prevention of type 2 diabetes. Appendix H provides a summary of each study by the outcomes measured and whether there was a statistically significant difference found post intervention. All 10 studies included hemoglobin A1C (HbA1c) as an outcome, 2 included blood pressure in addition to HbA1c, and 2 included LDL-C in addition to HbA1c and blood pressure. Seven of the 10 studies demonstrated a statistically significant reduction in HbA1c post intervention; of these, three reductions were also clinically meaningful--that is, 0.5 percentage points (pp) or greater.

Summary of Evidence from Studies Included in the Review, by Category

Food Environment. Three studies examined the impact of an intervention addressing food insecurity to improve glycemic control in patients with type 2 diabetes.

First, Seligman and colleagues conducted a pre-post intervention across three state food pantries where 687 patients with type 2 diabetes received food boxes, tailored to be appropriate for diabetes related diet recommendations [71]. Food boxes were given 1-2 times per month depending on family size. Patients also received referrals to primary care providers, diabetes specific support and diabetes education as needed. At 6-months, average HbA1c among participants decreased significantly from 8.11% to 7.96% (0.15 pp) [71]. For patients who had an elevated HbA1c of greater than 9%, average HbA1c decreased by 0.5 pp at follow-up [71].

Second, in a randomized controlled trial by Seligman et al, also conducted in food pantries, the 6-month intervention components not only included the provision of food for individuals with diabetes; but also included diabetes self-management education tailored to meet literacy and other participant-specific needs (i.e., numeracy, transportation barriers, food insecurity) based on the American Association of Diabetes Educators Self-Care curriculum and utilized patient empowerment strategies [72]. Results showed decrease in food insecurity (RR 0.85; 95%CI 0.73, 0.98), food instability (RR 0.77; 95%CI 0.64, 0.93) and consumption of fruits and vegetables (RD 0.34; 95%CI 0.34, 0.34) among participants, however no significant difference in HbA1c were observed (RD 0.24; 95%CI -0.09, 0.58) between the intervention and usual care groups [72].

The third study to address food insecurity examined the impact of a farmers' market voucher and a 1-hour group education sessions taught by a physician or trained medical student using materials from the American Diabetes Association focused on maintaining a healthy diet, BMI, and glycemic control [73]. Education sessions were conducted with 3-5 participants and included a discussion of myths and facts about barriers to fruit and vegetable consumption, and an activity incorporating a visual tool

encouraging participants to create healthy plates when preparing meals [73]. Participants in the intervention arm also received $6 in farmers' market vouchers for the purchase of fresh fruits and vegetables [73]. A significantly larger percentage of participants in the intervention reported ever purchasing fruits and vegetables from the farmers' markets compared to usual care at 12 weeks (I: 81% vs UC: 48%; p=0.003). There was also a decrease in the percentage of participants reporting difficulty affording fruits and vegetables (55% at 12 weeks vs 74% at baseline; p=0.008) in both groups, however, the difference was not significant between study arms [73]. Improvement in glycemic control at the 12-week follow-up visit was observed in both groups (HbA1C decreased by 0.8 pp from 9.2% at baseline in the intervention group; and by 0.9 pp from 9.4% at baseline in the usual care group); however, between group differences were not statistically significant [73].

Housing Stability. Only one study examined the impact that a housing intervention had on diabetes related outcomes [53]. Ludwig and colleagues randomly assigned 4,498 women and their families living in public housing within high poverty neighborhoods to 1 of 3 groups. The first group received housing vouchers to move to low poverty neighborhoods, the second group received general vouchers not tied to housing but that could be used to also relocate to low poverty neighborhoods, and the third group served as a control group and did not receive any form of voucher. The housing voucher group also received moving specific counseling to support the process of identifying a new neighborhood. While this study examined multiple social risk outcomes over time, only the diabetes related outcomes are reported in this review. Overall, at 10-15 years follow-up, participants in the housing voucher group had a significantly lower prevalence of type 2 diabetes based on HbA1c of less than 6.5% compared to the control group. There were no significant differences in type 2 diabetes prevalence based on HbA1c between the group that received traditional vouchers and the control group [53].

Built Environment. One study tested an intervention that included factors related to the built environment [79]. Mayberry and colleagues used a text messaging intervention to provide strategies to overcome various barriers to medication adherence that may impact glycemic control. Daily text messages were sent that were tailored to specific barriers patients were experiencing, as well as a weekly call to problem solve and provide strategies to overcome barriers that were specified by individual patients. Participants included adults aged 18 years and older with type 2 diabetes. Most participants were low income and uninsured. Specific barriers included challenges getting to the pharmacy, fear and perceptions, and cost. At 3-month follow-up, no reduction in HbA1c was found, however when looking at the impact of the intervention among participants who completed each assessment time point, a significant reduction in HbA1c was found at both 2 and 3 months [79].

Integrated Medical and Non-Medical Care. Interventions that integrated medical care with non-medical care were included if there was purposeful integration of the social or non-medical aspects of a patient's lived experience, that impact disease management, into the medical intervention. Two studies examined the efficacy and effectiveness of a collaborative care model and medication planning tool incorporated into the electronic medical record on improving glycemic control in patients with type 2 diabetes.

First, Chwastiak and colleagues (2014) used a randomized controlled study design to examine the impact of a Collaborative Care Team that included a nurse care manager, psychiatrist, advanced practice registered nurse, and endocrinologist consultant on glycemic control among patients with mental illness [78]. Collaborative care is defined as an integrated care model based on the principles of the chronic care model which includes an evidence-based team approach to population-based care [80-81]. In the randomized controlled trial conducted by Chwastiak et al, patients randomized to the intervention received six biweekly (every other week for 12 weeks), chronic disease self-management education sessions followed by monthly visits for up to 6 months, provided by a multidisciplinary care team [78]. In addition to tailoring sessions to meet the specific needs of patients with psychosis, providers used motivational interviewing and behavioral activation approaches to encourage behavior change. A key component of integration of medical with non-medical care was the use of motivational interviewing and

behavioral activation to specifically navigate barriers to engagement in self-management experienced in the daily lives of patients. Patients in the intervention arm had a statistically and clinically significant decrease in mean HbA1C from 9.4% to 8.3% (p=0.049), a 1.1 pp drop [78].

The second integrated care study by Graumlich and colleagues, also a randomized controlled trial, utilized the Medtable tool implemented within the Epic electronic medical record in outpatient clinics [77]. The Medtable tool facilitated the organization of collaborative patient and provider interactions for medication reconciliation, review, and education [77]. This three-step intervention included, 1) nurses loading patient medication lists from the EMR and utilization of the tool to customize language based on patient health literacy; 2) reviewing and reconciling the medication list with the patient and nurse during the patient encounter; and 3) patient and nurse creating a medication schedule using the tool [77]. Specifically, this tool integrated the clinical management of medication management with patient education designed to address patient literacy barriers to medication management. Patients in the intervention arm had increased knowledge about medication indication (p<0.0001), increased satisfaction with information provided about medications (p<0.0001), and consistent medication adherence overtime compared to decreased adherence in the usual care group (p=0.0268) [77]. Results showed a statistically significant decrease in mean HbA1C (0.12 pp) for all patients regardless of intervention group [77].

Financial Incentives to Improve Outcomes. Financial incentives have been used to address financial instability, poverty, chronic financial stress, or social isolation as a strategy to improve diabetes outcomes. Three studies used financial incentives as an intervention to improve glycemic control in patients with type 2 diabetes [74-76].

First, Long and colleagues examined whether peer mentoring or the use of financial incentives would effectively improve glycemic control compared to usual care. This study enrolled African American veterans aged 50-70 with elevated HbA1c [75]. Most participants had less than a high school education, had been living with type 2 diabetes for more than 10 years, and were experiencing diabetes related complications. Participants in the peer mentoring group received tailored phone calls from their peer mentor to set goals according to individual health goals. Participants in the financial incentive group did not receive peer calls or education/skills training and only received an incentive of up to $200 at 6 months for decreasing HbA1c. This study found that the use of financial incentives showed a decrease in HbA1c of 0.5 pp compared to usual care, however this decrease was not statistically significant. The peer mentoring, however, did result in statistically significant reductions in HbA1c compared to the usual care group with a statistically significant reduction of 1.07 pp [75].

Second, Egede and colleagues examined the impact of financial incentives combined with education and skills training [74]. Participants in this study included African American adults aged 21 years and older with HbA1c of 8% or higher. Participants were on average low income and had been living with type 2 diabetes for approximately 17 years. This study examined 3 separate incentive structures on HbA1c at 3 months, with the incentives targeting key behaviors related to diabetes self-management and glycemic control, allowing for up to $300 to be earned in incentives over a 3-month period [74]. Findings showed statistically significant reductions in HbA1c from baseline across each study group using a pre-post design, including a 1.25 pp reduction for group 1 receiving single incentive (p<0.05), a 1.73 pp reduction for group 2 receiving a 2-part incentive (p<0.001), and a 1.74 pp reduction for group 3 receiving a 3-part incentive (p<0.001) [74].

Third, Sen and colleagues randomized 75 adults between the ages of 18 and 80 to one of three study arms: 1) high incentives, 2) low incentives, 3) no incentives. The high and low incentive groups were offered lottery-based financial incentives based on daily use and upload of readings from a glucometer, blood pressure monitor, and scale [76]. The average daily reward for individuals in the high incentive arm was $2.80 whereas the average daily reward for participants randomized to the low incentive group was $1.40 [76]. Participants in the incentive arms received daily text and/or email messages notifying them of their incentive for the day, with those who did not use the devices and upload results receiving a notification of how much they would have received had they used the devices [76]. Participants were also able to access their measurements online and readings were shared with a clinician

at the study site [76]. There were no significant differences between groups for systolic blood pressure or BMI; and while HbA1C decreased by 1.5 pp across all groups, there was no significant difference between groups [76].

Appendix D Search Terms

Neighborhood and Physical Environment	Food Environment	Historical Redlining and Zoning Policies	Integration of Medical Care	Diabetes
MeSH Term with Entry Terms (Keyword)				

• Built Environment
  ○ Built Environments
• Housing Instability
  ○ Instability, Housing
  ○ Housing Insecurity
  ○ Housing Insecurities
  ○ Insecurities, housing
  ○ Insecurity, Housing
• Housing Quality
  ○ Housing Qualities
  ○ Quality, Housing
  ○ Housing Conditions
  ○ Condition, Housing
  ○ Conditions, Housing
  ○ Housing Condition
• Home Environment
  ○ Environment, Home
  ○ Environments, Home
  ○ Home Environments
  ○ Social Housing Conditions
  ○ Condition, Social Housing
  ○ Conditions, Social Housing
  ○ Housing Condition, Social
  ○ Housing Conditions, Social
  ○ Social Housing Condition
  ○ Living Alone
• Poverty
  ○ Extreme Poverty
  ○ Poverty, Extreme
  ○ Absolute Poverty
  ○ Poverty, Absolute
  ○ Indigents
  ○ Indigent
  ○ Indigency
  ○ Federal poverty Threshold
  ○ Poverty, Threshold, Federal
  ○ Poverty Thresholds, Federal
	• Access to Healthy Foods
	  ○ Healthy Food Availability
	  ○ Availabilities, Healthy Food
	  ○ Availability, Healthy Food
	  ○ Food Availabilities, Healthy
	  ○ Food Availability, Healthy
	  ○ Healthy Food Availabilities
	  ○ Access to Health Food
	• Food Deserts
	  ○ Food Desert
	• Food Security
	  ○ Security, Food
	• Food Assistance
	  ○ Assistance, Food
	  ○ Food Assistance Programs
	  ○ Assistance Program, Food
	  ○ Assistance Programs, Food
	  ○ Food Assistance Program
	  ○ Program, Food Assistance
	  ○ Programs, Food Assistance
	  ○ Food Aid Program
	  ○ Food Aid Programs
		• Racism
		  ○ Racial Prejudice
		  ○ Prejudice, Racial
		  ○ Prejudices, Racial
		  ○ Racial Prejudices
		  ○ Racial Bias
		  ○ Bias, Racial
		  ○ Everyday Racism
		  ○ Racism, Everyday
		  ○ Racial Discrimination
		  ○ Discrimination, Racial
		  ○ Discriminations, Racial
		  ○ Racial Discriminations
		  ○ Covert Racism
		  ○ Racism, Covert
		• Systemic Racism
		  ○ Racism, Systemic
		  ○ Institutionalized Racism
		  ○ Institutionalized Racisms
		  ○ Racism, Institutionalized
		  ○ Institutional Racism
		  ○ Racism, Institutional
		  ○ Structural Racism
		  ○ Racism, Structural
		  ○ Structural Racisms
		• Social Segregation
		  ○ Segregation, Social
		  ○ Racial Segregation
		  ○ Racial Segregations
		  ○ Segregation, Racial
		• Legislation
		  ○ Laws and Statutes
		  ○ Statutes and Laws
		  ○ Health Legislation
			• Community Health
			  ○ Community Health Service
			  ○ Health Service, Community
			  ○ Service, Community Health
			  ○ Services, Community Health
			  ○ Health Services, Community
			  ○ Community Health Care
			  ○ Care, Community Health
			  ○ Health Care, Community
			  ○ Community Healthcare
			  ○ Community Healthcares
			  ○ Healthcare, Community
			  ○ Healthcares, Community
			• Services
			• Safety-net Providers
			  ○ Provider, Safety-net
			  ○ Providers, Safety-net
			  ○ Safety net Providers
			  ○ Safety-net Provider
			  ○ Safety-net Clinics
			  ○ Clinic, Safety-net
				• Diabetes Mellitus, Type 2
				  ○ Diabetes Mellitus, Noninsulin-Dependent
				  ○ Diabetes Mellitus, Ketosis-Resistant
				  ○ Diabetes Mellitus, Ketosis Resistant
				  ○ Ketosis-Resistant Diabetes Mellitus
				  ○ Diabetes Mellitus, Non Insulin Dependent
				  ○ Diabetes Mellitus, Non-Insulin-Dependent
				  ○ Non-Insulin-Dependent Diabetes Mellitus
				  ○ Diabetes Mellitus, Stable
				  ○ Stable Diabetes Mellitus
				  ○ Diabetes Mellitus, Type II
				  ○ NIDDM
				  ○ Diabetes Mellitus, Noninsulin Dependent
				  ○ Diabetes Mellitus, Maturity-Onset
				  ○ Diabetes Mellitus, Maturity Onset
				  ○ Maturity-Onset Diabetes Mellitus
				  ○ Maturity Onset Diabetes Mellitus
				  ○ MODY
				  ○ Diabetes Mellitus, Slow-Onset
				  ○ Diabetes Mellitus, Slow Onset

Neighborhood and Physical Environment	Food Environment	Historical Redlining and Zoning Policies	Integration of Medical Care	Diabetes
MeSH Term with Entry Terms (Keyword)				
○ Thresholds, Federal Poverty ○ Low-Income Population ○ Low-Income Populations ○ Population, Low-Income ○ Populations, Low-Income ○ Low Income Population ○ Low Income Populations ○ Population, Low Income ○ Populations, Low Income • Poverty Areas ○ Area, Poverty ○ Areas, Poverty ○ Poverty Area ○ Slums ○ Slum ○ Ghettos ○ Ghetto • Financial Stress ○ Financial Stresses ○ Stress, Financial ○ Stresses, Financial ○ Financial Pressures ○ Financial Pressure ○ Pressure, Financial ○ Pressures, Financial ○ Financial Toxicity ○ Financial Toxicities ○ Toxicities, Financial ○ Toxicity, Financial ○ Financial Challenges ○ Challenge, Financial ○ Challenges, Financial ○ Financial Challenge ○ Economic Burden ○ Burden, Economic ○ Burdens, Economic ○ Economic Burdens ○ Financial Burden ○ Burden, Financial ○ Burdens, Financial	○ Aid Program, Food ○ Aid Programs, Food ○ Program, Food Aid ○ Programs, Food Aid ○ Supplemental Nutrition Assistance Program ○ SNAP Program ○ Program, SNAP ○ Programs, SNAP ○ SNAP Programs ○ Food Stamps ○ Food Stamp ○ Stamp, Food ○ Stamps, Food ○ Women, Infants, and Children Program ○ Special Supplemental Nutrition Program for Women, Infants, and Children (U.S.) ○ WIC Program ○ Program, WIC ○ Programs, WIC ○ WIC Programs ○ Food Stamp Program ○ Food Stamp Programs ○ Program, Food Stamp ○ Programs, Food Stamp	○ Health Legislation as Topic ○ Legislation, Health ○ Constitutional Amendments ○ Amendment, Constitutional ○ Amendments, Constitutional ○ Constitutional Amendment ○ Model Legislation ○ Legislation, Model ○ Population Law ○ Law, Population ○ Laws, Population ○ Population Laws • (Redlining) • (Housing Covenants) • (Zoning Policy)	○ Clinics, Safety-net ○ Safety net Clinics ○ Safety-net Clinic ○ Safety-net Hospitals ○ Hospital, Safety-net ○ Hospitals, Safety-net ○ Safety net Hospitals ○ Safety-net Hospital • Community Networks ○ Community Network ○ Network, Community ○ Networks, Community ○ Community Care Networks ○ Care Network, Community ○ Care Networks, Community ○ Community Care Network ○ Network, Community Care ○ Networks, Community Care ○ Community Health Networks ○ Community Health Network ○ Health Network, Community ○ Health Networks, Community	○ Slow-Onset Diabetes Mellitus ○ Type 2 Diabetes Mellitus ○ Noninsulin-Dependent Diabetes Mellitus ○ Noninsulin Dependent Diabetes Mellitus ○ Maturity-Onset Diabetes ○ Diabetes, Maturity-Onset ○ Maturity Onset Diabetes ○ Type 2 Diabetes ○ Diabetes, Type 2 ○ Diabetes Mellitus, Adult-Onset ○ Adult-Onset Diabetes Mellitus ○ Diabetes Mellitus, Adult Onset

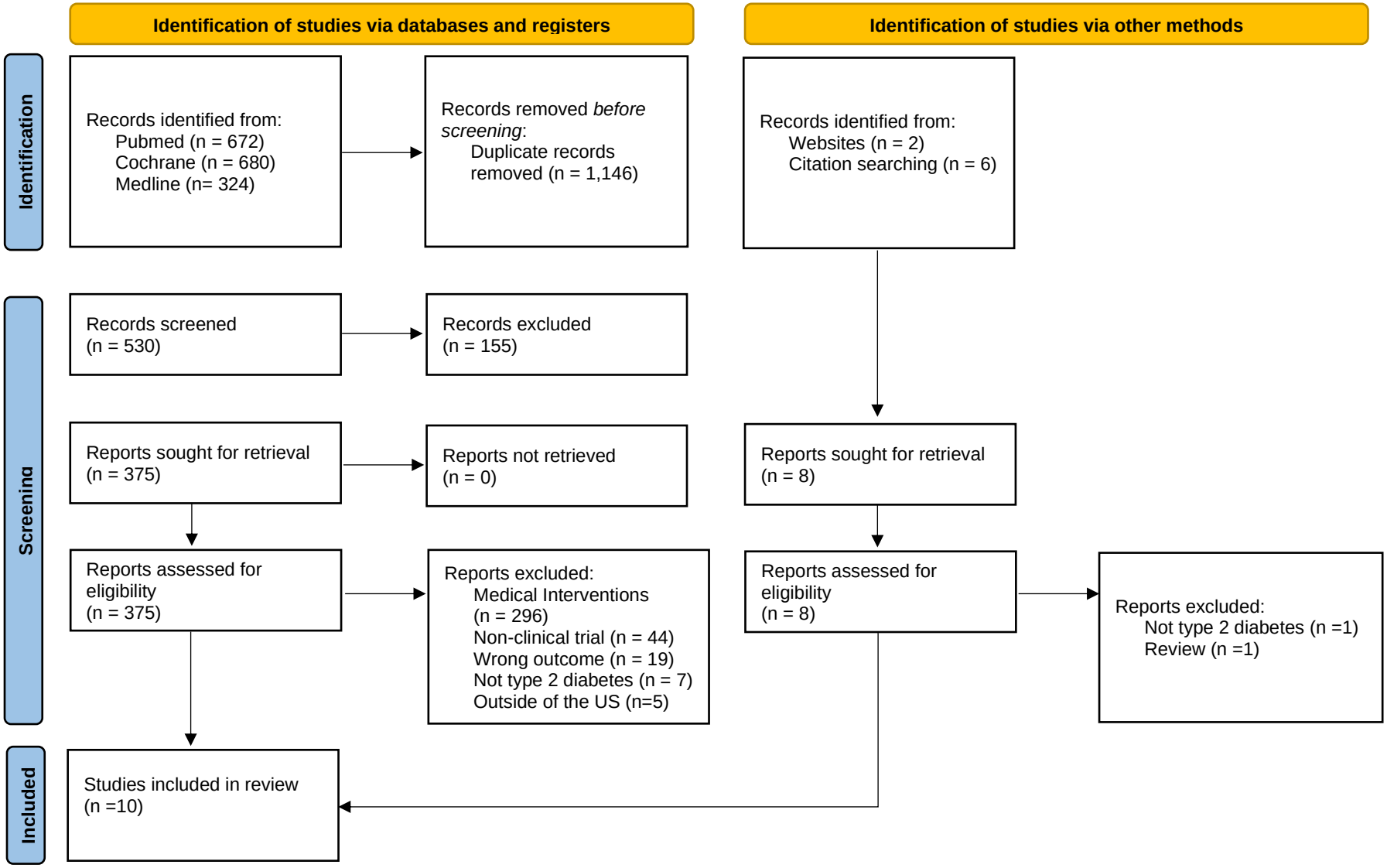
Neighborhood and Physical Environment	Food Environment	Historical Redlining and Zoning Policies	Integration of Medical Care	Diabetes
MeSH Term with Entry Terms (Keyword)				
○ Financial Burdens ○ Financial Hardship ○ Financial Hardships ○ Hardship, Financial ○ Hardships, Financial ○ Economic Hardship ○ Economic Hardships ○ Hardship, Economic ○ Hardships, Economic ○ Environment, Home ○ Environments, Home ○ Home Environments ○ Social Housing Conditions ○ Condition, Social Housing ○ Conditions, Social Housing ○ Housing Condition, Social ○ Housing Conditions, Social ○ Social Housing Condition ○ Living Alone • Stress, Psychological ○ Psychological Stresses ○ Stresses, Psychological ○ Life Stress ○ Life Stresses ○ Stress, Life ○ Stresses, Life ○ Stress, Psychologic ○ Psychologic Stress ○ Stressor, Psychological ○ Psychological Stressor ○ Psychological Stressors ○ Stressors, Psychological ○ Psychological Stress • Occupational Stress ○ Occupational Stresses ○ Stress, Occupational ○ Stresses, Occupational ○ Job Stress ○ Job Stresses ○ Stress, Job	○ Stamp Program, Food ○ Stamp Programs, Food ○ Security, Food • Hunger		○ Network, Community Health ○ Networks, Community Health	

Neighborhood and Physical Environment	Food Environment	Historical Redlining and Zoning Policies	Integration of Medical Care	Diabetes
MeSH Term with Entry Terms (Keyword)				
○ Stresses, Job ○ Work-related Stress ○ Stress, Work-related ○ Stresses, Work-related ○ Work related Stress ○ Work-related Stresses ○ Workplace Stress ○ Stress, Workplace ○ Stresses, Workplace ○ Workplace Stresses ○ Work Place Stress ○ Stress, Work Place ○ Stresses, Work Place ○ Work Place Stresses ○ Professional Stress ○ Professional Stresses ○ Stress, Professional ○ Stresses, Professional ○ Job-related Stress ○ Job related Stress ○ Job-related Stresses ○ Stress, Job-related ○ Stresses, Job-related ○ Workplace Bullying ○ Bullying, Workplace ○ Workplace Abuse ○ Abuse, Workplace ○ Abuses, Workplace ○ Workplace Abuses • Social Class ○ Class, Social ○ Classes, Social ○ Social Classes ○ Socioeconomic Status ○ Status, Socioeconomic ○ Middle Class Population ○ Class Population, Middle ○ Class Populations, Middle ○ Middle Class Populations ○ Population, Middle Class				

Neighborhood and Physical Environment	Food Environment	Historical Redlining and Zoning Policies	Integration of Medical Care	Diabetes
MeSH Term with Entry Terms (Keyword)				
○ Populations, Middle Class ○ Caste ○ Castes • Socioeconomic Factors ○ Factor, Socioeconomic ○ Socioeconomic Factor ○ Factors, Socioeconomic ○ Standard of Living ○ Living Standard ○ Living Standards ○ Land Tenure ○ Tenure, Land ○ Social Inequality ○ Inequalities, Social ○ Inequality, Social ○ Social Inequalities ○ High-Income Population ○ High Income Population ○ High-Income Populations ○ Population, High-Income ○ Populations, High-Income				

Appendix E

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers and other sources



Appendix F Descriptive summary of articles included in the review

Author, year	Study Design	Study Category	Objective	Sample Size	Sample Population	Impact on Outcome
Chwastiak, 2018	RCT	Integrated Care	To evaluate the preliminary effectiveness of a collaborative care model for patients with diabetes and mental illness on health outcomes	35	Adult mental health patients with T2DM and HbA1C >8% or BP >140/90	I: *HbA1C* – decreased (from 9.4% to 8.3%; p=0.049) *BMI* – decreased (-1kg/m^2; p=0.04) UC: *BMI* – decreased (-0.9kg/m^2; p=0.04)
Egede, 2021	RCT	Financial Incentives	To evaluate the impact of 3 financial incentive structures on glycemic control	60	African American adults with T2DM and HbA1C >=8%.	I: Group 1 (single incentive) mean HbA1C decreased 1.25 pp (p<0.05) Group 2 (2-part equal incentive) mean HbA1C decreased 1.73 pp (p<0.001) Group 3 (3-part equal incentive) mean HbA1C decreased 1.74 pp (p<0.001)
Graumlich, 2016	RCT	Integrated Care	To evaluate the effectiveness of an EMR medication-planning tool to improve medication knowledge, adherence, and glycemic control among patients with T2DM	674	Adults aged >=40 with T2DM and HbA1C >=7.0%; post recruitment challenges HbA1C >=6.0%	I: *HbA1C* – decreased across groups (p<0.0001) but did not differ between groups (HbA1c difference 0.12 pp, p=0.61) *Knowledge about medication indication* – Increased (p<0.0001) *Satisfaction with information about medication* – Greater satisfaction compared to UC (p=0.0161) *Medication adherence* – remained consistent over time, but decreased in UC (p=0.0268) UC: *HbA1C* – decreased (p<0.0001)

Author, year	Study Design	Study Category	Objective	Sample Size	Sample Population	Impact on Outcome
Long, 2012	RCT	Financial Incentives	To evaluate whether financial incentives or peer mentoring improves glycemic control compared to usual care	118	African American veterans with T2DM aged 50-70 years and HbA1c >=8%.	I: (Peer mentoring) significantly reduced HbA1c by 1.07 pp ($p<0.05$) at 6 months compared to control I (Financial incentives) reduced HbA1c by 0.5 pp, however not statistically significant ($p=.29$)
Ludwig, 2011	RCT	Housing	Evaluated the longitudinal impact of neighborhood reassignment using vouchers to move to low poverty neighborhoods on diabetes related outcomes	4498	Adult women living in public housing and poverty, no disease conditions	I: At 10-15 years follow up, women who received vouchers to move to low poverty housing had significantly reduced risk of diabetes compared to the control group. Women who received vouchers were significantly more likely to have an HbA1c of less than 6.5% compared to women in the control group (-4.31%, 95% CI -7.82 to -0.80; $p=0.02$)
Mayberry, 2017	Pre-Post	Built Environment	To evaluate if text messages to target barriers to diabetes medication adherence - including physical/transportation barriers improves medication adherence and glycemic control	80	Low-income adults aged 18 or older with T2DM	I: In the full study sample, medication adherence improved overall but no overall improvement in HbA1c. Subgroup of participants who participated across all time points, barrier reduction was associated with lower HbA1c, average change –0.22 pp ($p<0.05$)
Seligman, 2015	Pre-Post	Food	To evaluate the impact of diabetes specific food boxes on glycemic control among food insecure adults with type 2 diabetes	687	Adults with T2DM experiencing food insecurity	I: In the study sample, from baseline to follow up there was significant improvement in HbA1c (-0.15 pp; $p<0.01$). For participants with uncontrolled HbA1c (-0.48 pp; $p<0.001$)

Author, year	Study Design	Study Category	Objective	Sample Size	Sample Population	Impact on Outcome
Seligman, 2018	RCT	Food	To determine whether diabetes self-management support and healthy foods for patients with diabetes provided by a food bank improves glycemic control	568	Adults aged 18 and older with T2DM or elevated fasting glucose; HbA1C $\underline{\geq}$ 7.5%; existing or new food pantry client	I: Food security – improved (RR 0.85; 95%CI 0.73, 0.98) Food stability – improved (RR 0.77; 95%CI 0.64, 0.93) Fruit and Vegetable Intake – improved (RD 0.34; 95%CI 0.34, 0.34) HbA1C – no difference (RD 0.24; 95%CI -0.09, 0.58)
Sen, 2014	RCT	Financial Incentives	To test the effectiveness of financial incentives on improving adherence to remote-monitoring among patients with poorly controlled diabetes	75	Adults aged 18 – 80; HbA1C >=8.0%; lowered to $\underline{\geq}$ 7.5% to accelerate recruitment	*HbA1C* – decreased across all groups, no significant difference between groups *SBP* – no significant differences between groups *BMI* – no significant differences between groups
Weinstein, 2014	RCT	Food	To test the impact of distributing farmer's market coupons and an educational intervention on fruit and vegetable purchase and consumption in adults with T2DM	78	Adults aged >=18 years with T2DM; BMI >25; HbA1C >7.0%	I: Participants in the intervention group showed a decrease in HbA1c by 1.8 pp at 12 weeks follow up UC: Participants in control group showed a decrease in HbA1c by 1.6 pp, at 12 weeks follow up. No significant difference between groups (p=.76)

NOTES: RCT: Randomized Controlled Trial; T2DM: Type 2 Diabetes Mellitus; I: Intervention; UC: Usual Care; HbA1C: Hemoglobin A1C; BP: Blood Pressure; BMI: Body Mass Index; pp: percentage points

Appendix G Summary of intervention components of articles included in the review

Author, Year	Statistically Significant Diabetes Clinical Outcomes	Length of Intervention	Interventionist	Intervention Components	Tailoring
Chwastiak, 2018	x	6 months	Collaborative Care Team (nurse care manager, psychiatrist, advanced practice registered nurse, endocrinologist consultant)	1. Initial 60-minute health assessment with nurse care manager 2. 6 biweekly, 30-minute chronic disease self-management visits (diet, exercise, medication adherence). 3. 3 monthly self-management visits after the 1st 12 weeks.	Diabetes education was tailored to meet the needs of patients with psychosis.
Egede, 2021	x	3 months	Nurse case manager	1. Home telemonitoring 2. Telephone delivered diabetes education with nurse case manager 3. Financial incentives for completing one or more target behaviors for improving glycemic levels	Tailoring of education based on home telemonitoring results monitored by nurse case manager
Graumlich, 2016	x		Outpatient clinic nurse	1. Tool implemented within EMR in outpatient clinics 2. Step 1 – prior to patient visit, nurse loads patient medication list from EMR; use tool to customize language based on patient health literacy 3. Step 2 – during the patient encounter, patient reviews medication list and reconciles list with the nurse 4. Step 3 – patient and nurse create a medication schedule using the tool	Language selected based on patients' health literacy
Long, 2012		6 months	Peer mentoring group – Peers Financial incentive group – None	1. Peer mentoring: Telephone call once per month using motivational interview strategies for setting goals to improve health. 2. Financial incentive group: Participants did not receive education or skills, only received incentive of up to $200 at 6 months for decreasing HbA1c	Peers tailored conversations around desired goals for health improvement

Author, Year	Statistically Significant Diabetes Clinical Outcomes	Length of Intervention	Interventionist	Intervention Components	Tailoring
Ludwig, 2011	x	15 years	None	1. Neighborhood reassignment through housing vouchers allowing participants to move to a low poverty neighborhood based on census tract. 2. Counseling on moving	None
Mayberry, 2017	x	3 months	IVR Technology	1. Text messages sent to address barriers specified by patients. 2. Nightly reminder text to take diabetes medication. 3. Weekly IVR problem solving call	Content tailored to specific barriers that patients identified
Seligman, 2015	x	6 months	Food bank	1. Diabetes specific food boxes delivered monthly or 2x per month including recipes. 2. Referral to primary care providers and diabetes specific support.	Food boxes tailored to be appropriate for living with diabetes
Seligman, 2018		6 months	Food bank staff and food pantry volunteers	1. Glucose and HbA1C testing at 3- and 6-months 2. Referral to PCP 3. Diabetes self-management classes (2 – 2 hour sessions during 1st month, optional monthly, 1-hour session) with 1-on-1 check-ins with educators 4. Written diabetes education materials at each food distribution 5. Twice monthly food packages with diabetes appropriate foods	DSME was tailored by study staff (nurse, diabetes educator, dietician, physician) to address participant challenges with self-management (literacy, numeracy, transportation, food insecurity)

Author, Year	Statistically Significant Diabetes Clinical Outcomes	Length of Intervention	Interventionist	Intervention Components	Tailoring
Sen, 2014		12 weeks		1. 2 Intervention arms: Arm 1 (High incentive) – average daily reward of $2.80; Arm 2 (Low incentive) – average daily reward of $1.40 2. Participants received rewards if they checked their glucose, BP, and weight, and transmitted results to the study website 3. Participants received daily text or email notifying them of their incentive for the day; those who did not use the devices received a notification of how much they would have received had they used the devices 4. Participants had online access to their measurements online and readings were shared with a clinician at the study site	
Weinstein, 2013		12 weeks	Physician or trained medical student at health center	1. 1-hour long group education session for diet and healthy eating based on ADA and ACP guidelines 2. $6 in farmers market vouchers for the purchase of fresh fruits and vegetables	None

Appendix H. Summary of clinical outcome measures for articles included in the review

Author, Year	Outcome Measure			Change in Outcome Measure		
	HbA1c	Blood Pressure	LDL	HbA1c	Blood Pressure	LDL
Chwastiak, 2018	x	x	x	∗+	ϕ	⊥
Egede, 2021	x	--	--	∗+	--	--
Graumlich, 2016	x	--	--	∗	--	--
Long, 2012	x	--	--	ϕ	--	--
Ludwig, 2011	x	--	--	∗	--	--
Mayberry, 2017	x	--	--	∗	--	--
Seligman, 2015	x	--	--	∗	--	--
Seligman, 2018	x	--	--	ϕ	--	--
Sen, 2014	x	x	--	∗+	ϕ	--
Weinstein, 2013	x	--	x	ϕ	--	⊥

x=Measured
⊥=No change noted
ϕ=Non-statistically significant change noted
∗=Statistically significant change noted
∗+=Statistically significant, as well as clinically meaningful (defined as 0.5 percentage points or greater) changes noted (HbA1c only)

Appendix References

1. Center for Disease Control and Prevention. About Social Determinants of Health website. Available at: https://www.cdc.gov/socialdeterminants/about.html. Accessed January 28, 2022.
2. Hill-Briggs F, Adler NE, Berkowitz SA, Chin MH, Gary-Webb TL, Navas-Acien A, Thornton PL, Haire-Joshu D. Social determinants of health and diabetes: a scientific review. Diabetes Care. 2021 Jan 1;44(1):258-79.
3. World Health Organization. Social Determinants of Health. Available at: https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1. Accessed January 28, 2022
4. Solar O, Irwin A. A conceptual framework for action on the social determinants of health. WHO Document Production Services; 2010.
5. Alderwick H, Gottlieb LM. Meanings and misunderstandings: a social determinants of health lexicon for health care systems. The Milbank Quarterly. 2019 Jun;97(2):407.
6. Egede LE, Walker RJ. Structural racism, social risk factors, and Covid-19—A dangerous convergence for Black Americans. New England Journal of Medicine. 2020 Sep 17;383(12):e77.
7. Bailey ZD, Krieger N, Agénor M, Graves J, Linos N, Bassett, MT. Structural racism and health inequities in the USA: evidence and interventions. The Lancet. 2017 Apr 8;389(10077):1453–1463.
8. Paradies Y, Ben J, Denson N, Elias A, Priest N, Pieterse A, Gupta A, Kelaher M, Gee G. Racism as a determinant of health: a systematic review and meta-analysis. PloS one. 2015 Sep 23;10(9):e0138511.
9. Krieger N. Discrimination and health inequities. International Journal of Health Services. 2014 Oct;44(4):643-710.
10. Richardson J, Mitchell B, Edlebi J, Meier H, Lynch E. The Lasting Impact of Historic "Redlining" on Neighborhood Health: Higher Prevalence of COVID-19 Risk Factors. NCRC. 2020.
11. Diaz A, O'Reggio R, Norman M, Thumma JR, Dimick JB, Ibrahim AM. Association of Historic Housing Policy, Modern Day Neighborhood Deprivation and Outcomes After Inpatient Hospitalization. Annals of surgery. 2021 Dec 15;274(6):985-91.
12. Rothstein R. The color of law: A forgotten history of how our government segregated America. Liveright Publishing; 2017 May 2.
13. Faber JW. Redlined yesterday and redlined today: The Home Owners Loan Corporation's long shadow. 2017.
14. Mitchell B, Franco J. HOLC Redlining Maps: The persistent structure of segregation and economic inequality. NORC Report. 2020.
15. Aaronson D, Hartley D, Mazumder B. The effects of the 1930s HOLC" redlining" maps. American Economic Journal: Economic Policy. 2021 Nov;13(4):355-92.
16. Benns M, Ruther M, Nash N, Bozeman M, Harbrecht B, Miller K. The impact of historical racism on modern gun violence: Redlining in the city of Louisville, KY. Injury. 2020 Oct 1;51(10):2192-8.
17. Jacoby SF, Dong B, Beard JH, Wiebe DJ, Morrison CN. The enduring impact of historical and structural racism on urban violence in Philadelphia. Social Science & Medicine. 2018 Feb 1;199:87-95.
18. Lynch EE, Malcoe LH, Laurent SE, Richardson J, Mitchell BC, Meier HC. The legacy of structural racism: Associations between historic redlining, current mortgage lending, and health. SSM-population health. 2021 Jun 1;14:100793.
19. Nardone A, Chiang J, Corburn J. Historic redlining and urban health today in US cities. Environmental Justice. 2020 Aug 1;13(4):109-19.

20. McClure E, Feinstein L, Cordoba E, Douglas C, Emch M, Robinson W, Galea S, Aiello AE. The legacy of redlining in the effect of foreclosures on Detroit residents' self-rated health. Health & place. 2019 Jan 1;55:9-19.
21. Krieger N, Van Wye G, Huynh M, Waterman PD, Maduro G, Li W, Gwynn RC, Barbot O, Bassett MT. Structural racism, historical redlining, and risk of preterm birth in New York City, 2013–2017. American journal of public health. 2020 Jul;110(7):1046-53.
22. Hollenbach SJ, Thornburg LL, Glantz JC, Hill E. Associations between historically redlined districts and racial disparities in current obstetric outcomes. JAMA network open. 2021 Sep 1;4(9):e2126707-.
23. Nardone A, Casey JA, Morello-Frosch R, Mujahid M, Balmes JR, Thakur N. Associations between historical residential redlining and current age-adjusted rates of emergency department visits due to asthma across eight cities in California: an ecological study. The Lancet Planetary Health. 2020 Jan 1;4(1):e24-31.
24. Bertocchi G, Dimico A. COVID-19, race, and redlining. SSRN. 2020.
25. Choi Y, Unwin J. Racial impact on infections and deaths due to COVID-19 in New York City. arXiv preprint arXiv:2007.04743. 2020 Jul 9.
26. Gucciardi E, Vahabi M, Norris N, Del Monte JP, Farnum C. The intersection between food insecurity and diabetes: a review. Current nutrition reports. 2014 Dec 1;3(4):324-32.
27. Thomas MK, Lammert LJ, Beverly EA. Food Insecurity and its Impact on Body Weight, Type 2 Diabetes, Cardiovascular Disease, and Mental Health. Current Cardiovascular Risk Reports. 2021 Sep;15(9):1-9.
28. Te Vazquez J, Feng SN, Orr CJ, Berkowitz SA. Food Insecurity and Cardiometabolic Conditions: a Review of Recent Research. Current Nutrition Reports. 2021 Jun 21:1-2.
29. US Department of Agriculture (USDA). *Food Security in the US*. Available at: https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/ Accessed on January 28, 2022.
30. Kirby JB, Bernard D, Liang L. The Prevalence of Food Insecurity Is Highest Among Americans for Whom Diet Is Most Critical to Health. Diabetes Care. 2021 Jun 1;44(6):e131-2.
31. Maddigan SL, Feeny DH, Majumdar SR, Farris KB, Johnson JA. Understanding the determinants of health for people with type 2 diabetes. American journal of public health. 2006 Sep;96(9):1649-55.
32. Berkowitz SA, Berkowitz TS, Meigs JB, Wexler DJ. Trends in food insecurity for adults with cardiometabolic disease in the United States: 2005-2012. PloS one. 2017 Jun 7;12(6):e0179172.
33. Walker RJ, Garacci E, Ozieh M, Egede LE. Food insecurity and glycemic control in individuals with diagnosed and undiagnosed diabetes in the United States. Primary Care Diabetes. 2021 May 15.
34. Lytle LA, Sokol RL. Measures of the food environment: A systematic review of the field, 2007–2015. Health & place. 2017 Mar 1;44:18-34.
35. Ahern M, Brown C, Dukas S. A national study of the association between food environments and county-level health outcomes. The Journal of Rural Health. 2011 Sep;27(4):367-79.
36. den Braver NR, Lakerveld J, Rutters F, Schoonmade LJ, Brug J, Beulesn JW. Built environmental characteristics and diabetes: A systematic review and meta-analysis. Diabetes: Prevention, management and treatment, 16 (1), 12-37.
37. Tabaei BP, Rundle AG, Wu WY, Horowitz CR, Mayer V, Sheehan DM, Chamany S. Associations of residential socioeconomic, food, and built environments with glycemic control in persons with diabetes in New York City from 2007–2013. American journal of epidemiology. 2018 Apr 1;187(4):736-45.
38. Walker RJ, Knapp RG, Dismuke-Greer CE, Walker RE, Ozieh MN, Egede LE. Lowering the impact of food insecurity in African American adults with type 2 diabetes mellitus (LIFT-DM)–Study protocol for a randomized controlled trial. Contemporary Clinical Trials. 2020 Dec 1;99:106206.

39. Smalls BL, Gregory CM, Zoller JS, Egede LE. Effect of neighborhood factors on diabetes self-care behaviors in adults with type 2 diabetes. Diabetes Res Clin Pract. 2014;106(3):435-442.
40. Billimek J, Sorkin DH. Self-reported neighborhood safety and nonadherence to treatment regimens among patients with type 2 diabetes. J Gen Intern Med. 2011;27(3):292-296.
41. Barnard LS, Wexler DJ, DeWalt D, Berkowitz SA. Material need support interventions for diabetes prevention and control: a systematic review. Curr Diab Rep. 2015;15:2.
42. Gary TL, Safford MM, Gerzoff RB, Ettner SL, Karter AJ, Beckles GL, Brown AF. Perception of neighborhood problems, health behaviors, and diabetes outcomes among adults with diabetes in managed care: the translating research into action for diabetes (TRIAD) study. Diabetes Care. 2008;31(2):273-278.
43. Brown AF, Ettner SL, Piette J, Weinberger M, Gregg E, Shapiro MF, Karter AJ, Safford M, Waizfedler B, Prata PA, Beckles GL. Socioeconomic position and health among persons with diabetes mellitus: a conceptual framework and review of the literature. Epidemiologic Reviews. 2004;26:63-77.
44. Smalls BL, Gregory CM, Zoller JS, Egede LE. Assessing the relationship between neighborhood factors and diabetes related health outcomes and self-care behaviors. BMC Health Services Research 2015;15:445.
45. Strom JL & Egede LE. The impact of social support on outcomes in adult patients with type 2 diabetes: a systematic review. Curr Diab Rep. 2012:12(6):769-781.
46. Egede JK, Campbell JA, Walker RJ, Egede LE. Percieved stress as a pathway for the relationship between neighborhood factors and glycemic control in adults with diabetes. American Journal of Health Promotion. 2021; 0(0):1-10.
47. Smalls BL, Gregory CM, Zoller JS, Egede LE. Direct and indirect effects of neighborhood factors and self-care on glycemic control in adults with type 2 diabetes. Journal of Diabetes and Its Complications. 2014;29:186-191.
48. Grintsova O, Maier W, Mielck A. Inequalities in health care among patients with type 2 diabetes by individual socio-economic status (SES) and regional deprivation: a systematic literature review. International Journal for Equity in Health. 2014;13:43.
49. Dendup T, Feng X, Clingan S, Astell-Burt T. Environmental risk factors for developing type 2 diabetes mellitus: a systematic review. International Journal of Environmental Research and Public Health. 2018;15:78.
50. Twohig-Bennett C & Jones A. The health benefits of the great outdoors: a systematic review and meta-analysis of greenspace exposure and health outcomes. Environmental Research. 2018;166:628-637.
51. De la Fuente F, Saldias MA, Cubillos C, Mery G, Carvajal D. Bowen M, Bertoglia MP. Green space exposure association with type 2 diabetes mellitus, physical activity, and obesity: a systematic review. International Journal of Environmental Research and Public Health. 2021;18:97.
52. Cloostermans L, Wendel-Vos W, Doombos G, Howard B, Craig CL, Kivimaki M, Tabak AG, Jefferis BJ, Ronkainen K, Brown WJ, Picavet SHSJ, Ben-Shlomo Y, Laukkanen JA, Kauhanen J, Bemelmans WJE. Independent and combined effects of physical activity and body mass index on the development of type 2 diabetes – a meta-analysis of 9 prospective cohort studies. International Journal of Behavioral Nutrition and Physical Activity. 2015; 12:147.
53. Ludwig J, Sanbonmaatsu L, Gennetian L, Adam E, Duncan GJ, Katz LF, Kessler RC, Kling JR, Tessler S, Whitaker RC, McDade TW. Neighborhoods, obesity, and diabetes – a randomized social experiment. N Engl J Med. 2011;365(16):1509-1519.
54. Lim S, Liu SY, Jacobson MH, Poirot E, Crossa A, Locke S, Brite J, Hamby E, Bailey Z, Farquhar. Housing stability and diabetes among people living in New York city public housing. SSM – Population Health. 2020; 11: 100605.
55. Keene DE, Guo M, Murillo S. "That wasn't really a place to worry about diabetes": housing access and diabetes self-management among low-income adults. Soc Sci Med. 2018;197:71-77.

56. Keene DE, Henry M, Gormley C, Ndumele C. 'Then I found housing and everything changed': transitions to rent-assisted housing and diabetes self-management. Cityscape. 2018;20(2):107-118.
57. Mosley-Johnson E, Walker RJ, Thakkar M, Campbell JA, Hawks L, Pyzyk S, Egede LE. Relationship between housing insecurity, diabetes processes of care, and self-care behaviors. BMC Health Services Research. 2022;22:61.
58. Vasanth R, Ganesh A, Shanker R. Impact of stress on type 2 diabetes mellitus management. Psychiatr Danub. 2017;29(3):416-421.
59. Chaufan C, Davis M, Constantino S. The twin epidemics of poverty and diabetes: understanding diabetes disparities in a low-income Latino and immigrant neighborhood. J Community Health. 2011;36:1032-1043.
60. Hsu CC, Lee CH, Wahlqvist ML, Huang HL, Chang HY, Chen L, Shih SF, Shin SJ, Tsai WC, Chen T, Huang CT, Cheng JS. Poverty increases type 2 diabetes incidence and inequality of care despite universal health coverage. Diabetes Care. 2012;35(11):2286-92.
61. Hilliard ME, Yi-Frazier JP, Hessler D, Butler AM, Anderson BJ, Jaser S. Stress and A1c among people with diabetes across the lifespan. Curr Diabetes Rep. 2016;16(8):67.
62. Amin L, Shah BR, Bierman AS, Lipscombe LL, Wu CF, Feig DS, Booth GL. Gender differences in the impact of poverty on health: disparities in risk of diabetes-related amputation. Diabet. Med. 2014;31:1410-1417.
63. Bachrach D, Pfister H, Wallis K, Lipson M. ADDRESSING PATIENTS'SOCIAL NEEDS. Commonwealth Fund. 2014:1-36.
64. Bradley EH, Canavan M, Rogan E, Talbert-Slagle K, Ndumele C, Taylor L, et al. Variation in health outcomes: the role of spending on social services, public health, and health care, 2000–09. Health Affairs. 2016;35(5):760-8.
65. Dzau VJ, McClellan MB, McGinnis JM, Burke SP, Coye MJ, Diaz A, et al. Vital directions for health and health care: priorities from a National Academy of Medicine initiative. Jama. 2017;317(14):1461-70.
66. Bhattacharyya O, Shaw J, Sinha S, Gordon D, Shahid S, Wodchis WP, et al. Innovative Integrated Health And Social Care Programs In Eleven High-Income Countries: Study reports on thirty health and social care programs in eleven high-income countries that delivered care in innovative ways. Health Affairs. 2020;39(4):689-96.
67. Bosetti R, Tabatabai L, Naufal G, Brito R, Kash B. New model of integrated care for uncontrolled type 2 diabetes in a retrospective, underserved adult population in the USA: a study protocol for an effectiveness and cost-effectiveness analysis. BMJ open. 2020;10(7):e038084.
68. Levengood TW, Peng Y, Xiong KZ, Song Z, Elder R, Ali MK, et al. Team-based care to improve diabetes management: a community guide meta-analysis. American journal of preventive medicine. 2019;57(1):e17-e26.
69. National Academies of Sciences, Engineering, and Medicine 2019. Integrating Social Care into the Delivery of Health Care: Moving Upstream to Improve the Nation's Health. Washington, DC: The National Academies Press.
70. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71
71. Seligman HK, Lyles C, Marshall MB, et al. A Pilot Food Bank Intervention Featuring Diabetes-Appropriate Food Improved Glycemic Control Among Clients In Three States. *Health Aff (Millwood)*. 2015;34(11):1956-1963. doi:10.1377/hlthaff.2015.0641
72. Seligman HK, Smith M, Rosenmoss S, Marshall MB, Waxman E. Comprehensive Diabetes Self-Management Support From Food Banks: A Randomized Controlled Trial. *Am J Public Health*. 2018;108(9):1227-1234. doi:10.2105/AJPH.2018.304528
73. Weinstein E, Galindo RJ, Fried M, Rucker L, Davis NJ. Impact of a focused nutrition educational intervention coupled with improved access to fresh produce on purchasing behavior

and consumption of fruits and vegetables in overweight patients with diabetes mellitus. *Diabetes Educ*. 2014;40(1):100-106. doi:10.1177/0145721713508823
74. Egede LE, Campbell JA, Walker RJ, Dawson AZ, Williams JS. Financial incentives to improve glycemic control in African American adults with type 2 diabetes: a pilot randomized controlled trial. *BMC Health Serv Res*. 2021;21(1):57. Published 2021 Jan 13. doi:10.1186/s12913-020-06029-0
75. Long JA, Jahnle EC, Richardson DM, Loewenstein G, Volpp KG. Peer mentoring and financial incentives to improve glucose control in African American veterans: a randomized trial. *Ann Intern Med*. 2012;156(6):416-424. doi:10.7326/0003-4819-156-6-201203200-00004
76. Sen AP, Sewell TB, Riley EB, et al. Financial incentives for home-based health monitoring: a randomized controlled trial. *J Gen Intern Med*. 2014;29(5):770-777. doi:10.1007/s11606-014-2778-0
77. Graumlich JF, Wang H, Madison A, et al. Effects of a Patient-Provider, Collaborative, Medication-Planning Tool: A Randomized, Controlled Trial. *J Diabetes Res*. 2016; 2016:2129838. doi:10.1155/2016/2129838
78. Chwastiak LA, Luongo M, Russo J, Johnson L, Lowe JM, Hoffman G, McDonell MG, Wisse B. Use of a mental health center collaborative care team to improve diabetes care and outcomes for patients with psychosis. Psychiatric Services. 2018 Mar 1;69(3):349-52.
79. Mayberry LS, Mulvaney SA, Johnson KB, Osborn CY. The MEssaging for Diabetes Intervention Reduced Barriers to Medication Adherence Among Low-Income, Diverse Adults With Type 2. *J Diabetes Sci Technol*. 2017;11(1):92-99. doi:10.1177/1932296816668374
80. Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. *Milbank Q*. 1996;74(4):511-544.
81. Katon W, Unützer J, Wells K, Jones L. Collaborative depression care: history, evolution and ways to enhance dissemination and sustainability. *Gen Hosp Psychiatry*. 2010;32(5):456-464. doi:10.1016/j.genhosppsych.2010.04.001