

A Scoping Review of Possible Solutions for Decreasing Socioeconomic Inequalities in Type 2 Diabetes Mellitus

Abstract

Background: As socioeconomic inequalities are key factors in access and utilization of type 2 diabetes (T2D) services, the purpose of this scoping review was to identify solutions for decreasing socioeconomic inequalities in T2D. **Methods:** A scoping review of scientific articles from 2000 and later was conducted using PubMed, Web of Science (WOS), Scopus, Embase, and ProQuest databases. Using the Arksey and O'Malley framework for scoping review, articles were extracted, meticulously read, and thematically analyzed. **Results:** A total of 7204 articles were identified from the reviewed databases. After removing duplicate and nonrelevant articles, 117 articles were finally included and analyzed. A number of solutions and passways were extracted from the final articles. Solutions for decreasing socioeconomic inequalities in T2D were categorized into 12 main solutions and 63 passways. **Conclusions:** Applying identified solutions in diabetes policies and interventions would be recommended for decreasing socioeconomic inequalities in T2D. Also, the passways could be addressed as entry points to help better implementation of diabetic policies.

Keywords: Health policy, scoping review, socioeconomic inequality, thematic analysis, type 2 diabetes

Introduction

Type 2 diabetes (T2D) mellitus is one of the most prevalent diseases and the leading cause of years of life lived with disease worldwide.^[1] Diabetes is among the top 10 leading cause of death in most countries.^[2] Diabetes has the highest burden of noncommunicable diseases worldwide.^[3] Just over 1 in 10 people in the world have diabetes.^[4] There has been a rising trend in T2D prevalence turning it into a growing global epidemic. As recently estimated by the International Diabetes Federation, the number of people diagnosed worldwide will increase from 463 million in 2019 to 700 million in 2045, leading to a 51% increase in 26 years.^[5,6]

However, the relatively high prevalence of T2D is not distributed equally among different socioeconomic groups. Socioeconomic inequalities exist in T2D, with individuals from lower socioeconomic status (SES) groups being more affected.^[7] Not only are there socioeconomic variations in the prevalence of T2D, but also inequalities are evident in disease management, chronic complications,^[8] and

mortality.^[9] Lack of knowledge on the disease condition and also unavailability of healthcare services worsen health outcomes. Timely intervention and medication are required to prevent complications, but most patients are unable to access quality health care to manage diseases.^[10] Previous studies have found that people prefer hospital services based on their income, SES, and health status. Patients choose healthcare services for diabetes according to the quality of provided care.^[11] Observational data over 40 years have shown consistent differences in diabetes outcomes across populations, where socioeconomically disadvantaged populations, in terms of lower education and income levels, experience less access to care and preventive services.^[12] Lower rates of diagnosis, poorer health behaviors and control,^[13] worse cardiometabolic outcomes,^[14] and shorter life expectancy are more common for individuals from disadvantaged populations compared to those from higher socioeconomic status.^[15] These findings suggest that diabetes is not a purely biological issue; its onset and progression are heavily influenced by the broader socioeconomic context.^[16]

Therefore, this study aimed to identify solutions for decreasing socioeconomic

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inequality in T2D. This study expands on the literature by exploring how countries can decrease socioeconomic inequality for diabetic patients through evidence-based solutions and passways.

Methods

Study design

We conducted a scoping review to identify solutions for decreasing socioeconomic inequality in T2D. The five stages of the framework proposed by Arksey and O'Malley were used for scoping review,^[17] including identifying the research question, identifying relevant studies, study selection, data collating, summarizing, and reporting results.

In this study, we used scientific articles from five databases from 2000 and later. The information extracted from 117 studies that helped answer the research questions. The solutions for decreasing socioeconomic inequalities in T2D were categorized into 12 main solutions and 63 passways.

Search strategy and selection of the literature

The search was conducted on December 29, 2021, by one of the authors (LG). The databases used were PubMed, Web of Science (WOS), Scopus, Embase, and ProQuest. The keywords (Diabetes OR NIDDM OR MODY) AND (“Socioeconomic Factor*” OR “socio-economic factor*” OR “socio-economic inequalit*” OR “socioeconomic inequalit*” OR “Social Inequalit*” OR “Healthcare Disparit*” OR “Health care disparit*” OR “Health Care Inequalit*” OR “healthcare inequality*”)

were determined after an initial broad search of the literature and consultations with a librarian and an expert on literature reviews. Search strategies by databases are shown in Table 1. We decided to use a relatively narrow defined search string because the numerous irrelevant studies would outweigh the studies concerning socioeconomic inequality in the utilization of T2D services. All studies written in English language and any countries were included. We included scientific articles from 2000 and later. The inclusion and exclusion criteria and the search strategy are shown in Table 2. This table also shows that post hoc exclusion criteria were developed after a first review round and then applied in a second round. The development of such “post hoc” criteria is central to the scoping review process as it is unlikely that researchers will be able to identify parameters for exclusion at the outset.^[18] Articles that were not related to the research questions, not suggested solutions for reducing inequality in T2D, or proposed solutions for general inequality were regarded as nonrelevant articles. The selection method and search flow are represented in Figure 1.

Data extraction

To organize data related to a study's research questions a spreadsheet was created. The spreadsheet includes information about the publication information, choice situation, study sample, country, and provider type. This process was initially conducted by one of the authors (LG) and finalized by other researchers. During team meetings, the authors discussed the different factors that emerged from the literature, shared their own perspectives and

Table 1: Search strategies by databases

Database	Search strategy	Documents	Date of search
PubMed	(Diabetes[tiab] OR NIDDM[tiab] OR MODY[tiab]) AND (“Socioeconomic Factor*”[tiab] OR “socio-economic factor*”[tiab] OR “socio-economic inequalit*”[tiab] OR “socioeconomic inequalit*”[tiab] OR “Social Inequalit*”[tiab] OR “Healthcare Disparit*”[tiab] OR “Health care disparit*”[tiab] OR “Health Care Inequalit*”[tiab] OR “healthcare inequality*”[tiab])	1190	December 29, 2021
WOS	TS = (Diabetes OR NIDDM OR MODY) AND TS = (“Socioeconomic Factor*” OR “socio-economic factor*” OR “socio-economic inequalit*” OR “socioeconomic inequalit*” OR “Social Inequalit*” OR “Healthcare Disparit*” OR “Health care disparit*” OR “Health Care Inequalit*” OR “healthcare inequality*”)	1513	December 29, 2021
Scopus	TITLE-ABS (Diabetes OR NIDDM OR MODY) AND TITLE-ABS (“Socioeconomic Factor*” OR “socio-economic factor*” OR “socio-economic inequalit*” OR “socioeconomic inequalit*” OR “Social Inequalit*” OR “Healthcare Disparit*” OR “Health care disparit*” OR “Health Care Inequalit*” OR “healthcare inequality*”)	1058	December 29, 2021
Embase	(Diabetes: ti, ab OR NIDDM: ti, ab OR MODY: ti, ab) AND (“Socioeconomic Factor*”:ti, ab OR “socio-economic factor*”:ti, ab OR “socio-economic inequalit*”:ti, ab OR “socioeconomic inequalit*”:ti, ab OR “Social Inequalit*”:ti, ab OR “Healthcare Disparit*”:ti, ab OR “Health care disparit*”:ti, ab OR “Health Care Inequalit*”:ti, ab OR “healthcare inequality*”:ti,ab)	1424	December 29, 2021
Proquest	noft((Diabetes OR NIDDM OR MODY)) AND noft (“Socioeconomic Factor*” OR “socio-economic factor*” OR “socio-economic inequalit*” OR “socioeconomic inequalit*” OR “Social Inequalit*” OR “Healthcare Disparit*” OR “Health care disparit*” OR “Health Care Inequalit*” OR “healthcare inequality*”))	2019	December 29, 2021

Table 2: Inclusion and exclusion criteria

Inclusion criteria	- Written in the English language -Articles from 2000 and later -Qualitative and quantitative studies
Exclusion criteria	- Written in the non-English language - Reports and commentaries - Articles without or nonaccessible full text

interpretations, and worked together to develop an overall perspective on the key factors that related to decreasing socioeconomic inequalities in T2D. Disagreements were discussed until a consensus was reached.

Data analysis

This study used thematic analysis. To conduct thematic analysis, a guide proposed by Braun and Clarke^[19] was applied. For familiarization, the text data were reviewed several times for inferring a list of inductive themes. The authors independently coded the text data collected. They read and reread the information. In the next step, primary themes were extracted from the obtained data and reviewed by the team members and initial names were assigned to the themes. The team members held a meeting to elaborate on conflicts and controversial points and reach an agreement on themes. They continued the discussion until addressing all the controversies. Then, themes and subthemes were specified. In the next step, team members reviewed, modified, and collated coded statements, finalized the names of themes and subthemes, and finally wrote the scholarly report.

Results

The solutions for decreasing socioeconomic inequalities in T2D were categorized into 12 main solutions and 63 passways, which are shown in Table 3.

Main solutions

1) Improving health literacy (HL) for all

Improving preliminary prevention for society is one of the solutions for decreasing socioeconomic inequalities in T2D. For this purpose, studies have expressed different educational and awareness-related passways across society as follows.

Provide appropriate health information on diabetes: Some studies referred to the provision of appropriate health information.^[11,20-26]

Update diabetic educational content: The results of some studies have shown that there are shortages in diabetes updated knowledge. Skillful updated knowledge to respond and educate the patient precisely as well as having sufficient knowledge, experience, and skill related to diabetes education and its complications are necessary.^[11,20-25,27-33]

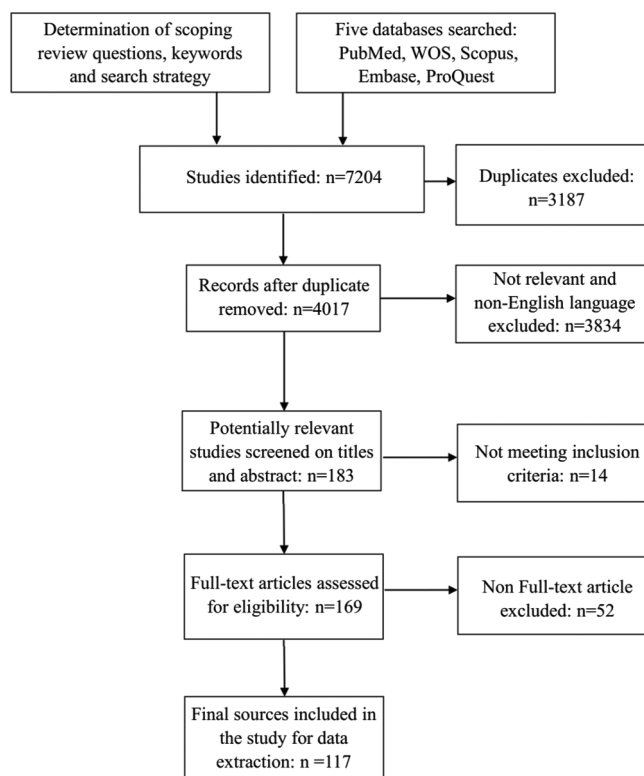


Figure 1: Flow diagram of study selection and screening

Introducing reliable sources and channels about diabetes: Studies emphasized that information sources used by diabetic patients should be among the most reliable sources of health information.^[34-41]

Creating a user-friendly platform for accessing diabetic content: Studies have shown that providing T2D patients with online access to their needed health information can help to improve accessing to diabetes care information. This is particularly important in settings where the health information system is fragmented and distributed.^[32,42-47]

Develop a purposeful strategy in providing knowledge and skills tailored to the HL of individuals: The results of research in the world suggested that providing HL should be customized for different groups in society.^[6,11,22-26,30,34,35,37-41]

Intersectoral educational cooperation for diabetes: Researchers said that intersectoral collaborative action is a beneficial and cost-effective strategy in improving health literacy, and multilevel, comprehensive literacy health interventions are increasingly used to prevent T2D.^[23,48-52]

Disseminate reliable diabetic content: The results of some studies confirmed that disseminating reliable diabetic content can improve HL and increase public awareness of diabetes and reduce inequality in all population strata.^[11,20-25]

Resource management for HL in diabetes: It is categorized into three different sectors, including database

Table 3: Main solutions and passways for decreasing socioeconomic inequalities in T2D

Main solutions	Passways	References
Improving health literacy for all	Provide appropriate health information about diabetes	[11,20-26]
	Update diabetic educational content	[11,20-25,27-33]
	Introducing reliable sources and channels about diabetes	[34-41]
	Creating a user-friendly platform for accessing diabetic content	[32,42-47]
	Develop a purposeful strategy in providing knowledge and skills based on the health literacy of target groups	[6,11,22-26,30, 34,35,37-41]
	Intersectoral educational cooperation for diabetes	[23, 48-52]
	Disseminate reliable diabetic content	[11,20-25]
	Resource management for health literacy in diabetes	[11,20-25]
	Environmental advertising about diabetes	[11,20-22,29-33, 43,49,50,53]
	Increased public awareness of diabetes	[11,21-25,27-41]
	Group training for society	[11,20-25,27-41, 43,49,50,53]
	Using different educational resources for the public	[11,20-25,27-41]
	Education through media	[11,20-22,29-33, 43,49,50,53]
	Educational follow-up by phone	[34-38,43,49,50,53]
Primary prevention	Educational booklets sent via email to individuals	[34-38,43,49,50,53]
	Group training for endangered people	[11,20-25,29-38,43,50]
	Individual counseling	[20-23,25,27,29,33,35,42,45,46,49,50, 54-63][11,22-24,29,31,35,51,52,56-58]
	Using team base and agile education model	[43,49,50,53]
	Equal policymaking for healthy foods	[25,35,43,46,50,56]
	Encouragement to increase physical activity	[25,46,50,64]
	Training to change lifestyle	[25,64,65]
	Efforts to food security in vulnerable people	[34,49,50,66,67]
	Increase availability and proximity to health facilities	[32,42-47]
	Secondary prevention	Implementation of community-based screening programs
Outcome-based treatment goals for T2D patients		[27,34,45,46,50,55]
Informing about the proportion and distribution of undiagnosed diabetics among socioeconomic strata		[50,73-77]
Risk-based affirmative healthcare action		[78]
Healthcare management and control on medical services for T2D		[20-23,27,33,40,49,50,78-80]
Tertiary prevention	Prolonged follow-up on the complications of diabetes	[78,80]
	Counseling for self-care management for diabetic complications	[28,36,81-83]
	Provide rehabilitation services for vulnerable and affected diabetic patients	[34,45,46]
Addressing socioeconomic determinants	Paying attention to socioeconomic factors in planning	[48-50,79,84-86]
	Paying attention to socioeconomic factors in providing resources	[35,47,77,87-89]
	Paying attention to socioeconomic factors in targeting services	[65,76]
Quality improvement of diabetic services	Standardization of care for T2Ds	[27,43,55,90]
	Improving assessment systems for quality care at different levels	[42,46,48,63,79]
	Improving continuous surveillance systems	[30,56,63,91]
Improvement diabetic services delivery	Diabetes rapid access program	[92]
	Providing cost-effective services	[78]
	Trying to reduce indirect costs of services delivery	[34,78]
	Affordability of services	[32]
Financial supports	Providing diabetic services based on demand and need in the target area	[93,94]
	Subsidize the treatment and care of T2D	[23]
	Government subsidies for low-income households	[83,85,95]
	Financial protection of T2D in public hospitals	[74,86,96]
	Designing a financial supportive package for patients	[50,71,97,98]
	Increase insurance coverage	[50,71,96,98]
	Designing support programs to reduce socioeconomic inequality in disadvantaged areas	[55,57,74,75,77,99]

Contd...

Table 3: Contd...

Main solutions	Passways	References
Development of digital infrastructure	Development of information infrastructure	[27,43,55,90]
	Outreach of telemedicine	[43,100]
	Local digital inclusion	[101]
Collaboration	Sustainable intersectoral collaboration	[23,52,84]
	Holistic approach	[23,52,84]
	Joint efforts	[48-50]
Improve comprehensive perspectives in strategies	Racial differences	[25,40,74,78,80,82,97,98,102,103]
	Ethnic perspective	[25,40,74,78,80,82,97,98,102,103]
	Perspective of class differences	[40,82,98,102,103]
	Fender perspective	[82,104]
	Age perspective	[44,45,95]
Service providers	Improve diabetes management skills for providers and physicians through education	[20-23,27,34,42,65,78,80,90,100,101,105]
	Financial and nonfinancial incentives for service providers	[24,74,75,106]
	University and in-service training	[34,65,80,100,101,105]

management, record management, and data processing management in research.^[11,20-25]

Environmental advertising about diabetes: Studies indicated that environmental advertising is a specific type of communication designed toward promoting social, economic, and environmental benefits of products to form responsible values and behavior of consumers. It is possible that well-devised and deployed environmental advertising can provide opportunities for healthcare providers to improve their chances of successfully engaging current and future patients, hastening exchange, and building market share.^[11,20-22,29-33,43,49,50,53]

Increasing public awareness of diabetes: Studies have shown that increasing public awareness of diabetes through immediate planning and implementation of public health measures and individual interventions is an important component of preventing the occurrence and complications of T2D.^[11,21-25,27-41]

Group training for society: Some evidence revealed that group-based education programs for society might increase diabetes knowledge, self-empowerment, quality of life, and self-management skills.^[11,20-25,27-41,43,49,50,53]

Using different educational resources for the public: Educational resources in the health domain can include a wide range of learning, teaching, and research materials, such as textbooks, videos, podcasts, and online courses. In several studies mentioned that educational resources permit no cost access, reuse, repurpose, adaptation and redistribution by others.^[11,20-25,27-41]

Education through social media: Researchers pointed out that the use of social media in public health education due to its ability to remove physical barriers that traditionally impede access to healthcare support and resources can improve the level of HL among the general public.^[11,20-22,29-33,43,49,50,53]

Educational follow-up by mobile phone: The results of various studies indicated that the use of mobile applications in the health education area has the potential to improve HL outcomes.^[34-38,43,49,50,53]

Sending educational booklets via email: The results of various studies have shown that educational booklets sent via email to individuals are one of the ways for improving HL outcomes.^[34-38,43,49,50,53]

2) Primary prevention:

Primary prevention is one of the solutions for decreasing socioeconomic inequalities in T2D. We identified different passways for decreasing socioeconomic equality through primary prevention, which includes the following.

Group training for endangered people: Group training is instruction that takes place in groups of people—typically five or more. Some evidence suggested that group training for endangered people is more effective than individual training for people at risk.^[11,20-25,29-38,43,50]

Individual counseling: Some studies referred to counseling approaches, whether used alone or in combination, that have the potential to facilitate positive changes in a range of health behaviors among various individuals.^[20-23,25,27,29,33,35,42,45,46,49,50,54-63]

Using team base and agile education model: The study results emphasized that moving from the traditional scripted diabetes education model to a more team-based and agile model can optimize the provision of diabetic educations for individuals with significant barriers and improve quality measures.^[43,49,50,53]

Equal policymaking for healthy foods: Studies shown that evaluating innovative policy approaches to change the availability of healthy foods through incentives and taxation, or efforts to improve food through neighborhood

and urban planning have been limited, and relatively scattered.^[25,35,43,46,50,56]

Encouragement to increase physical activity: The results of studies indicated that physical activity plays a major role in the development and potential prevention of T2D and diabetes complications. Policy, planning, legislative, and community-based initiatives that alter the built environment to enhance physical activity levels may play a large role in affecting diabetes risk at the individual and population levels.^[25,46,50,64]

Training to change lifestyle: The results of the studies emphasized that prevention efforts for target lifestyle factors can decrease socioeconomic inequalities in T2D.^[25,64,65]

Efforts to food security in vulnerable people: Research indicated that food security exists when all people at all times have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of food security are as follows: food availability, access to food, utilization, and stability. The disruption of food intake or eating patterns because of a lack of money and other resources is one of the reasons for socioeconomic inequalities in T2D.^[34,49,50,66,67]

Increase availability and proximity to health facilities: Several studies found that increasing the availability and the proximity of health facilities could facilitate access to T2D management services for lower socioeconomic groups.^[32,42-47]

3) Secondary prevention:

Secondary prevention is another solution for decreasing socioeconomic inequalities in T2D, and it is declared in different studies as follows.

Implementation of community-based screening programs: Several studies suggested that programs to improve the implementation of community-based screening programs for early detection of cases are urgently needed, especially in high-risk population subgroups.^[30,44,47,68-72]

Outcome-based treatment goals for T2D patients: Outcome-based treatment, as the name implies, is the treatment that focuses upon the desired outcome, and mentioned in several studies as a passway for decreasing socioeconomic inequalities in T2D.^[27,34,45,46,50,55]

Informing about the proportion and distribution of undiagnosed diabetics among socioeconomic strata: Studies have found that targeted strategies for screening and prevention can inform us to diagnose diabetics in terms of proportion and distribution among different T2D socioeconomic groups.^[50,73-77]

Risk-based affirmative healthcare action: The results of a study showed “this strategy has the potential not only to improve diabetes outcomes among all patients irrespective of SES, but simultaneously to reduce socioeconomic disparities.”^[78]

Healthcare management and control on medical services for T2D: Healthcare management and control will be effective on a socioeconomic gap in healthcare systems.^[20-23,27,33,40,49,50,78-80]

4) Tertiary prevention:

The passways of tertiary prevention as one of the main solutions for decreasing socioeconomic inequality in T2D patients are mentioned as follows.

Prolonged follow-up on the complications of diabetes: Longer follow-up will be needed to examine the effects on disparities in diabetes outcomes that take longer to manifest. Therefore, as a passway, two studies pointed out prolonged follow-up for reducing social and economic inequality in T2D.^[78,80]

Counseling for self-care management for diabetic complications: Some studies pointed out that passways should be considered for designing self-management interventions in healthcare centers, particularly in socioeconomically disadvantaged settings.^[28,36,81-83]

Provide rehabilitation services for vulnerable and affected diabetic patients.^[34,45,46]

5) Addressing socioeconomic determinants:

Some studies found that if local socioeconomic determinants and especially local demographics are taken into account in the planning, and targeting the organizing of local health services, the productivity of the health system can be raised and the evidence–treatment gap could shrink geographically. For achieving these endeavors, studies mentioned passways including focusing on socioeconomic factors in planning,^[48-50,79,84-86] socioeconomic factors in providing resources,^[35,47,77,87-89] and socioeconomic factors in targeting services.^[65,76]

6) Quality improvement of diabetic services:

The quality improvement of diabetic services for decreasing socioeconomic inequality in T2D patients’ passways is mentioned in studies as follows.

Standardization of care for T2Ds: The results of some studies confirmed that standardization of accepted care practices for patients with diabetes improved compliance with diabetic care bundle completion and patient outcomes in the primary care setting, and it can reduce inequality in all population strata.^[27,43,55,90]

Improving assessment systems for quality care at different levels: Studies have reported that combining the regional patient database with geospatial modeling makes it possible to develop systems for the assessment of the quality of care at different levels.^[42,46,48,63,79]

Improving continuous surveillance systems: The findings of some studies showed that programs to improve surveillance systems for early detection of diabetes cases

are urgently needed, especially in high-risk population subgroups.^[30,56,63,91]

Diabetes Rapid Access Program (DRAP): The results of a cross-sectional study with the aim of improving access to healthcare providers through the medical home model showed that the DRAP—as a community base health initiative for supporting and improving the primary care infrastructure—is an effective intervention to decreasing healthcare disparities in T2D patients.^[92]

7) Improvement in diabetic service delivery:

Improving the provision of services to diabetic patients is also one of the main solutions for decreasing socioeconomic inequality in diabetic patients. The passways are mentioned as follows.

Providing cost-effective services: A study found that there is an immediate need to strengthen the healthcare delivery system to generate awareness and for the prevention, early detection, and cost-effective management of patients with diabetes, with a focus on people belonging to the lower SES.^[78]

Trying to reduce indirect costs of service delivery: The research results showed that affordability of services could be improved by reducing the indirect and opportunity costs of T2D-related health care with a focus on people belonging to the lower SES. Reducing disparities is important not only for social justice, but would benefit everyone by lowering costs^[34,78] and affordability of services.^[32]

Providing diabetic services based on demand and need in the target area: Studies emphasized that targeting healthcare services based on demand and need by area, and then the use of internally valid small-area-based (individual-level and area-based SES) data can be an effective approach to improving health outcomes.^[93,94]

8) Financial supports:

Another main solution that various studies have pointed for decreasing T2D socioeconomic inequality is financial supports.^[25,52,57,59,73,76,77,79,85,87,88,97-101]

9) Development of digital infrastructure:

Trying to improve the digital infrastructure is another main solution for decreasing socioeconomic inequality of T2D, which has different passways as follows.

Development of information infrastructure: Studies showed that the percentage of undiagnosed patients with diabetes will decrease with the improvement of healthcare information infrastructure.^[27,43,55,90]

Outreach of telemedicine: Studies have shown that the use of telemedicine, particularly through the outreach of media devices such as cellphones, can increase access to healthcare and help to level the playing field treatment-

wise, particularly by increasing penetration of digital devices in all socioeconomic and sociocultural levels.^[43,100]

Local digital inclusion: It could be used for screening and helping T2D with lower SES to obtain low-cost Internet service, equipment, and basic digital skill training.^[101]

10) Collaboration:

The results of the research showed that the methods to facilitate and improve collaboration also be effective for decreasing socioeconomic inequality of T2D patients, which includes various passways as follows.

Sustainable intersectoral collaboration: Studies indicated that sustainable intersectoral collaboration and partnerships among relevant public institutions, private enterprises, and civil society organizations engaged in social development and health promotion should be facilitated.^[23,52,84]

Holistic approach: Some studies emphasized that policymakers at national and local levels should adopt holistic approaches to prevent socioeconomic inequalities through additional and better-integrated resources for essential quality diabetes care in clinics.^[23,52,84]

Joint efforts: It could be attained through involving public, private, and nongovernmental organizations^[48] or combined efforts from patients, family members, healthcare professionals, government, and nongovernmental organizations (NGOs).^[49,50]

11) Improve comprehensive perspectives in strategies:

The research results showed that comprehensive perspectives involving biological and nonbiological factors in strategies have the potential not only to improve diabetes outcomes among all patients irrespective of race/ethnicity/class differences/gender differences/age differences, but simultaneously to reduce disparities.^[27,42,46,47,76,80,82,84,97,99,100,104,105,106]

12) Service providers:

Different studies showed that service providers played a vital role in decreasing the socioeconomic inequality of T2D patients. Also, passways to improve the situation of service providers are mentioned as follows.

Improve diabetes management skills for providers and physicians through education.^[20-23,27,34,42,65,78,80,90,100,101,105]

Financial and nonfinancial incentives for service providers: Various studies have found that policymakers should consider offering better incentives for healthcare providers to practice in rural areas.^[24,74,75,106]

University and in-service training: Some studies found that revising the content of training based on the socioeconomic inequalities and community-based educational model for service provider seems very necessary to improve their skills for reducing inequality in service delivery.^[34,65,80,100,101,105]

Discussion

In this study, we extracted solutions to reduce the socioeconomic inequality of T2D patients from the results of 117 different studies that were conducted on T2D patients.

In developing countries, studies found that most of the inequalities are caused by the lack of education and health literacy, and most of the studies emphasized the promotion of public education and the promotion of HL and increased availability and proximity to health facilities for solutions to reduce social and economic inequalities in T2D.^[11-51]

While in advanced countries, studies emphasize improving comprehensive perspectives in strategies for racial differences and the development of digital infrastructure.^[80-100]

Regarding improving health literacy for all Michou *et al.*'s study about socioeconomic inequalities in relation to health and nutrition literacy in Greece shown that improving HL has an effect on health behaviors and outcomes and decreasing socioeconomic inequalities.^[107] The study by King *et al.*, highlights the potential of community-based approaches, particularly global youth-engaged citizen science Community-engaged Participatory Action Research (CEPAR), to address health inequities and foster environmental justice. The study showed that by harnessing diverse resident insights and perspectives, community-based approaches such as CEPAR can help to inform and drive more relevant and sustainable solutions for healthier communities both now and in the future.^[108] The study by Petrovic *et al.* encourages the implementation of interventions targeting health behaviors, as they reduce socioeconomic inequalities in health and increase population health.^[109] In the study by Larsen *et al.*, highlighted the importance of behavioral change campaigns focused on lifestyle changes for reducing socioeconomic inequity in health outcomes.^[110]

Regarding the solution of primary prevention, Lockyer and Spiro's study highlighted the need for primary prevention policies to take into account socio-economic factors in order to address widening inequalities in rates of obesity, particularly among low-income population groups. Also, they suggested that policies enacted to improve the nutrition environment and increase opportunities for physical activity in four US sites as part of the Childhood Obesity Declines project.^[111] A systematic review study about the contribution of health behaviors to socioeconomic inequalities in health by Petrovic *et al.* emphasized that it should be encouraged the implementation of interventions targeting health behaviors, as such interventions reduce socioeconomic inequalities in health and increase population health.^[109]

According to the secondary prevention solution, a study by Feller *et al.*, emphasized the importance of secondary prevention strategies, such as colorectal cancer (CRC)

screening for reducing disparities in CRC outcomes, and also the need for public health strategies to ensure equal access to screening and optimal CRC care for all social groups and regions in Switzerland.^[112]

Regarding to tertiary prevention, Hinde *et al.* emphasized for increasing cardiac rehabilitation uptake is cost-effective and can also be implemented to reduce known socioeconomic inequalities.^[113]

According to addressing socioeconomic determinants, the study by Bilal *et al.* found that solutions to socioeconomic inequalities combine tailored health promotion and management interventions.^[114]

Quality improvement of diabetic services is one of the main solutions, and the study by Bray *et al.* revealed that socioeconomic disparities in first stroke incidence reduce interventions to improve the quality of acute stroke care and address disparities in cardiovascular risk factors present before stroke.^[115]

In relation to improvement diabetic services delivery, Griffith *et al.* found that the affordable care act reduced socioeconomic disparities in healthcare access.^[116]

Financial support is another main solution that Erwin *et al.*'s study emphasized that identifying financial avenues, such as financial assistance programs in addition to county funds, can overcome financial barriers to improving socioeconomic inequity.^[117] In Chirwa *et al.*'s study, the results suggest that there may be a need for the provision of more subsidies to vulnerable households.^[118]

Findings by Muhammad *et al.* in Nigeria showed that the disparities could be reduced through free service expansion by targeting people from low SES.^[119] Rocha *et al.* found that existing socioeconomic inequalities have affected the course of the coronavirus disease 2019 (COVID-19) epidemic; thus, targeted policies and actions are needed to protect those with the greatest socioeconomic vulnerability.^[120]

Wang *et al.*, conducted a study in China. The study aimed to reduce inequity in catastrophic health expenditure through the reform of integrating health insurance. They found that more targeted solutions are needed to achieve enhanced equity, particularly for the most vulnerable populations. The study suggested that promoting more precise insurance intervention for the most vulnerable population, such as low-income households and those with chronic diseases, can help to reduce inequity in catastrophic health expenditure. The study also highlights the importance of comprehensive strategies, such as favorable targeted benefits packages or job creation, for addressing health inequities among the disadvantaged groups.^[121] In a study by Homaie Rad *et al.*, highlighted economic inequalities in dental care utilization in Iran and suggested that increasing the coverage of dental insurance can be a solution to decrease inequality

in dental care utilization.^[122] Moor *et al.* emphasized that strategies for reducing inequalities in self-rated health should focus on material or structural living conditions as they shape conditions of psychosocial resources and health behavior.^[123]

In emphasizing the development of digital infrastructure as a solution for decreasing socioeconomic inequalities, Jaffe *et al.* revealed that the use of remote healthcare services, or telehealth, in the COVID-19 pandemic is a promising solution for providing health care to those unable to access care in person easily and thus helping to reduce health inequalities.^[124] The study by Qureshi *et al.* offered ways in which socioeconomic inequities can be overcome through mobile health applications, which show ways of addressing the digital divide and poverty mapping and how digital startups and the use of mobile phones empower entrepreneurs.^[125]

Regarding collaboration, Garzón Orjuela *et al.*, in a study emphasized that the importance of collaboration as the main solution for reducing health inequalities and highlighted that strategies to reduce health inequalities must be intersectoral and multidisciplinary in nature, involving all sectors of the health system. It is essential to continue generating interventions focused on strengthening health systems to achieve adequate universal health coverage, with a process of comprehensive and quality care.^[126]

Also about improve comprehensive perspectives in strategies, in a study by Lindley *et al.* emphasized that the impact of socioeconomic determinants of health on cardiovascular outcomes in women and suggested that optimizing care access via policy change and improving physical access to care can help to mitigate these barriers, particularly for women with geographic or transportation limitations. Addressing structural racism through policy change and bolstering structured community support systems will be key to reducing adverse cardiovascular outcomes among women of racial and ethnic minorities.^[127]

In addition, a study by Balan *et al.*, revealed that racial disparities in colorectal cancer for black patients, which have led to a significant mortality difference compared to white patients, and suggested that systemic racial inequities in insurance, socioeconomic status, and healthcare resources are contributing factors. Disparities impact nearly every point along the colorectal cancer care continuum and include barriers to screening, surgical care, oncologic care, and surveillance. Healthcare systems should strive to correct these disparities through both cultural competency at the provider level and public policy change at the national level.^[128] The study by Machón *et al.* indicated that there are socioeconomic inequalities in health among the elderly population. The increase in educational level and the maintenance of sufficient pensions can be key policies that contribute to the reduction in inequalities in this population group.^[129]

Consistent with the solution of service providers, the study in China referred to increasing incentives for providers can decrease socioeconomic inequalities in inefficiencies, poor quality, and unaffordable health care.^[130]

Limitations

One of the inclusion criteria was the articles in English language, so those articles in non-English language were not reviewed. Also, the full text of a limited number of articles was not accessible and consequently excluded from this study.

Conclusions

In general, reducing the factors affecting the creation of socioeconomic inequality in T2D patients can also apply to closing health inequalities in other diseases. In particular, applying identified solutions in diabetes policies and interventions would be recommended for decreasing socioeconomic inequalities in T2D. Also, the passways could be addressed as entry points to help better implementation of diabetic policies. As identified solutions and passways are related to all health and non-health sectors and authorities, intersectoral collaboration should be considered in diabetes policies to reduce socioeconomic inequalities in T2D, more successfully.

Ethics approval

This study received the required ethics approval from the Research Ethics Committee of Isfahan University of Medical Sciences, Isfahan, Iran with ethics code: IR.MUI.NUREMA.REC.1401.033.

Authors' Contributions

LG contributed in concept, study selection and screening and wrote the manuscript draft; MAR contributed to the development of the study protocol, abstracted and analyzed the articles, and critically revised the manuscript; AT conceived of the study, participated in its design and contributed in analyzing the articles. SK developed the original idea and analyzed data. All authors read and approved the final article.

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Conflicts of interest

There are no conflicts of interest.

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