

Factor Influencing Willingness to Pay for Prediabetes Screening and Prevention Program: A Systematic Review

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ABSTRACT

Background: IDF, or The International Diabetes Federation predicts that by 2045, there will be 783 million adults (12,2%) with diabetes globally, up from 540 million (10,5%) in 2021 projects that by 2045, there will be 783 million adults (12,2%) with diabetes globally, up from 540 million (10,5%) in 2021. Research has shown that lifestyle modifications, such as changes in diet and exercise, can significantly reduce the chance that prediabetes patients will get diabetes.

Objectives: The aim of this systematic review was to examine the factor influencing willingness to pay (WTP) for prediabetes screening and prevention programs.

Methods: Between October and December 2023, relevant keywords were used to search Scopus, PubMed, Sage, and Web Science for articles published between 2006 and 2023. This provided the necessary information. The Quality assessment of the studies was assessed using JBI for Cross-Sectional studies.

Results: Finally, a total of eight studies were selected for review. Over 90% of the participants were men, and most had experience as health workers. Overall, respondents accepted it well with a positive prevalence of high willingness to pay, namely more than 78.9%. The most frequently used method for measuring WTP was CVM (25%) and DCM (25%).

Conclusion: Despite the fact that some people would prefer to pay more, the results demonstrated that WTP was comparatively high when screening tests and preventative were provided for free or at a reasonable cost. It is recommended to increase people's awareness and motivation for lay people with diabetes.

Keywords: Factor Influencing; Prediabetes; Prevention Program; Screening; Willingness to Pay

INTRODUCTION

Prediabetes, or (IFG) impaired fasting glucose, represents a transitional phase between typical blood sugar levels and diabetes. According to the American Diabetes Association (ADA), prediabetes signifies an intermediate stage of hyperglycemia lying between normal glucose tolerance and the onset of type 2 diabetes mellitus (T2DM).¹ In 1999, The World Health Organization (WHO) established prediabetes as having a fasting plasma glucose (FPG) concentration ranging from 110 to 125 mg/dL (6.1-6.9 mmol/L). Consequently, the ADA adopted 100 mg/dL (5.6 mmol/L) as the lower threshold for diagnosis.²

Prediabetes refers to the transitional phase of dysglycemia situated between normoglycemia and diabetes.³ It is diagnosed based on laboratory tests measuring fasting blood glucose (FBG), glycosylated hemoglobin (HbA1c), or blood glucose levels two hours after a meal (2HBG).³

According to the International Diabetes Federation (IDF), 10.5% of adults worldwide, or 540 million people, had diabetes in 2021. Without effective prevention strategies, this number is projected to rise to 783 million (12.2%) by 2045.⁴ Diabetes stands as a prominent factor contributing to morbidity, mortality, and shortened life spans.⁵

Prompt identification and timely intervention play vital roles in forestalling or postponing the emergence of type 2 diabetes among individuals diagnosed with prediabetes. Studies indicate that adopting lifestyle adjustments, such as dietary alterations and increased physical activity, can notably mitigate the likelihood of diabetes onset in those with prediabetes. Consequently, screening for prediabetes has emerged as a critical approach to pinpointing high-risk individuals and instituting suitable interventions.⁶

Several screening techniques have been employed to detect individuals with prediabetes, encompassing fasting plasma glucose, oral glucose tolerance tests, and levels of glycated hemoglobin (HbA1c). The objective of these screening methods is to pinpoint individuals at elevated risk of developing diabetes, enabling the implementation of targeted interventions to forestall or postpone its onset.⁷

Recently, there has been an increasing fascination with prediabetes screening and its efficacy in pinpointing individuals at risk. Research has concentrated on assessing the precision and dependability of various screening techniques, alongside the cost-effectiveness of integrating prediabetes screening initiatives. The objective is to ascertain the most optimal and streamlined screening approaches that can be readily adopted within clinical environments.⁸

WTP, or willingness to pay, is a consumer-oriented method that gauges preferences by assessing their potential purchasing behavior. The perceived value of a healthcare benefit is a key determinant in establishing the maximum WTP. In this method, patients are presented with hypothetical situations and queried about the amount they would be willing to spend to avert harm or enhance their health.⁹

The consideration of Willingness to Pay (WTP) holds significance in the implementation of prediabetes screening initiatives. WTP encompasses the perspective of potential recipients regarding diabetes prevention programs, as well as the costs associated with offering these programs from the viewpoint of community health centers and local health departments. The research indicated that WTP for diabetes prevention programs fluctuates based on the delivery method and the attributes of the respondents.¹⁰

In this study, the author will review the literature on prediabetes screening, focusing on studies conducted from 2006 to 2023. By examining the latest research findings and advancements in the field, we can gain insights into the most effective strategies for identifying individuals with prediabetes and implementing appropriate interventions to prevent or delay the onset of type 2 diabetes.

This study is the first systematic review of willingness to pay for prediabetes screening. Unlike prior systematic reviews that primarily focused on cost-effectiveness¹¹, this study uniquely addresses factor influencing WTP, bridging a significant gap by analyzing preferences across diverse demographic and socioeconomic backgrounds. This approach provides actionable insights for designing targeted intervention strategies.

METHODS

Study design

The articles were collected in this systematic review with 8 cross-sectional articles studies.^{9,10,12–17}

Search strategy

The Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines were followed in the conduct of this systematic review, articles were systematically selected based on inclusion criteria, focusing on studies evaluating WTP for prediabetes screening using Contingent Valuation Method (CVM), Discrete Choice Methods (DCM) and other stated-preference methods. A number of health databases, such as Web of Science, Sage, PubMed, and Scopus, were thoroughly searched. In order to ensure the preservation of crucial data or the possibility of conducting additional relevant, the WHO database, government reports, discussion papers, gray literature, and references from the extracted articles were also searched. The following keywords were chosen using the Medical Subject Headings (Mesh) from the US National Library of Medicine: (“Willingness to Pay” AND “Prediabetes Screening” AND “Estimating for Prediabetes” AND “Willingness to Pay for diabetes” AND “Early detection for prediabetes” AND “Early detection prediabetes”).

Eligibility criteria

The studies that examined people’s willingness-to-pay (WTP) for prediabetes or diabetes screening tests using various prediabetes test methods and published up until April 2023 were included in this systematic review most of the contingent valuation studies. The studies were conducted exclusively in English.

Studies that only defined prediabetes and diabetes, did not state willingness to pay value, did not receive sufficient scores on quality assessment, and whose full text was not available were all excluded.

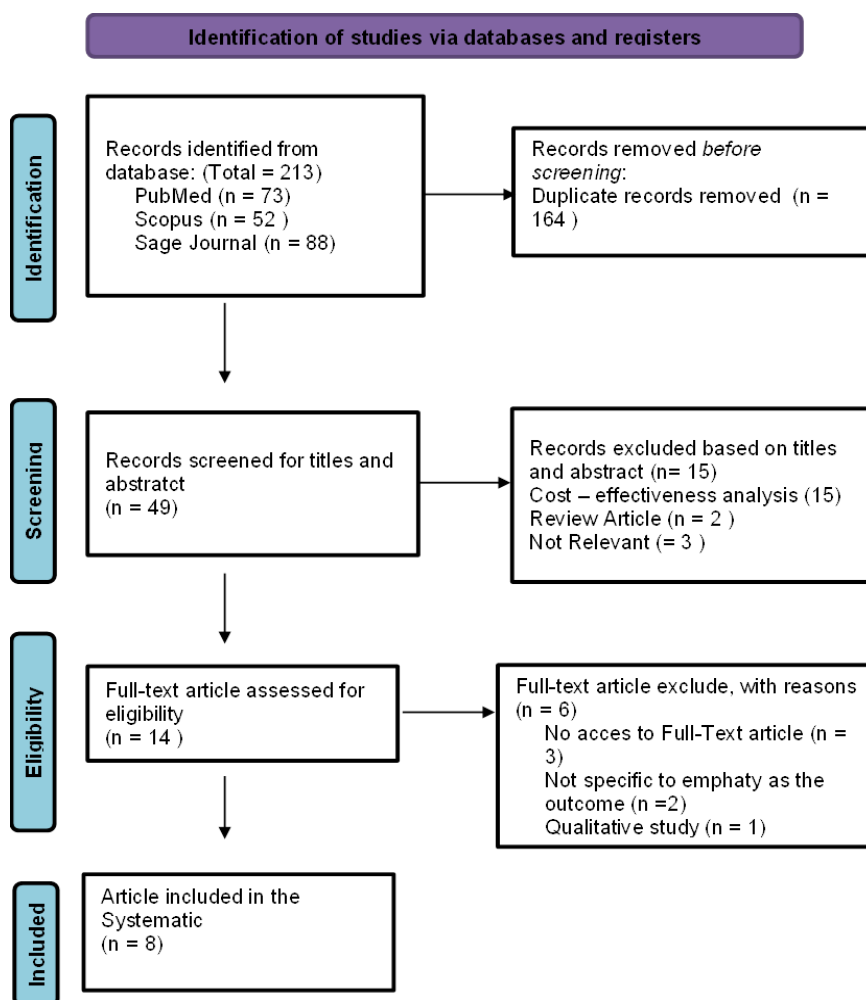


Figure 1. PRISMA flow diagram for study selection

The Joanna Briggs Institute's (JBI) evaluation tool was used to conduct quality assessments, ensuring the reliability and validity of included studies. The quality assessment involves an analysis of various aspects, including research methodology, clarity of research questions, participant selection, study design, data analysis, as well as the interpretation and conclusion of the result. This evaluation process aims to ensure that the research methodology used in this journal meets the quality standards set by JBI so that the research findings are reliable and relevant for clinical practice.

Data Analysis

The included studies were arranged using Mendeley Desktop V1.19.8 software following a resource search. Studies whose titles and abstracts did not match the inclusion requirements were initially eliminated. The author then went back and went through the remaining articles' full texts, extracting data.

To extract data, a table form is created. Data reflecting survey participants estimated WTP values for prediabetes screening and prediabetes and diabetes prevention programs, as well as the methods used to measure WTP, were collected. Other relevant information regarding various dimensions was collected for each study, including (1) research objectives, (2) target population, (3) WTP assessment methods (survey method, respondents, sample size, and assessment format), and (4) influencing factors willingness to pay. All reported WTP values are adjusted to 2023 United States Dollars (USD) to allow cross-study comparison. The author makes

assumptions regarding the currency year or survey year when such information is available. After summarizing all the data in tabular form, it was possible to find all eligible clinical trials (reporting factors associated with receipt of prediabetes screening and prediabetes and diabetes prevention programs), as well as trials that did not fit the requirements for inclusion.

Search strategy result

A PRISMA diagram illustrating the search process for this review is presented in Figure. 1. A total of 213 Studies that were associated with the search were found. The search was conducted without any disagreements. 73 articles were found using PubMed, 52 articles were found using Scopus, and 88 articles were found using Sage Journal. A total of 164 duplicates or non-relevant articles were removed because they were duplicates. After the removal of duplicate articles, titles, and abstracts were assessed to determine whether the articles were related to this systematic review. The majority of the articles did not fit the requirements for inclusion. Only 14 publication articles were evaluated to determine their eligibility, and 6 of those were rejected because of the following findings: their full text was not accessible, they did not fit the requirements inclusion criteria, and they were qualitative articles. Finally, the systematic review included 8 articles.

Data Extraction

Table I. Characteristic of ncluded studies shows that all the final studies that were chosen were published within the last 17 years (from 2006 to 2023). Rarely do research on willingness to pay regarding prediabetes so the existing articles are limited in number and not enough if only limited to the last 10 years. These studies were carried out in a variety of countries, including (China, Iran, Greece, North Carolina, USA, Kenya, Taiwan, and Georgia).^{9,10,12-17} One study was carried out in a lower-middle-country¹⁵, three studies were conducted in a lower-middle-income country (3 countries)^{9,12,17}, and four studies were conducted in high-income countries.^{10,13,14,16} The categorization is based on the New World Bank Country Classification by Income Level 2023.

The articles were divided into two categories based on their goals: three articles dealt with willingness to pay for prediabetes screening, while most of them, five, concentrated on willingness to pay for programs that prevent prediabetes.

The studies that were included were all cross-sectional and employed the questionnaire method. Most of them used a structured questionnaire (5), and others used face-to-face interviews, online questions, and closed-ended questions.

RESULTS AND DISCUSSION

Result

WTP for Prediabetes Screening and Prevention Program

In assessing the extracted WTP statistics, the study shows, in Table II, different average WTP values that are not comparable due to currency differences between the countries studied. Comparisons can be made after converting certain discounts. Since the latest study is for 2023, all WTP studies were converted to 2023 US dollars. The review found disparities in WTP by geographic and economic categories. Respondents from high-income countries reported higher WTP compared to those from low- and middle-income countries. This highlights the need for targeted strategies to address affordability in resource-constrained settings.

Among the 8 articles examined in the research, 2 studies employed the Contingent Valuation Method (CVM) to assess WTP, while 2 studies utilized the Discrete Choice Method (DCM), 1 study used the State-Choice Method (SCM), 1 study used the Payment card method, 1 study used Score-chart and one left study was compared between payment cards method vs. Structured Method). Most participants thought that prediabetes and other diabetes diseases such as diabetic retinopathy and diabetic neuropathy could be prevented. The willingness to pay for the lifestyle intervention was higher than for the medication intervention.¹⁷ Diabetic patients were willing to pay the most for a prevention package that reduces the chance of blindness.⁹ Diabetics who suffered from DM for more than 10 years were willing to pay a higher percentage of their monthly income to reduce the risk of DNP and DNU.¹³

On average, articles do not mention reasons for not being willing to pay for prediabetes screening and prevention programs. Some lack motivation, some consider prediabetes and diabetes trivial and unimportant. There is only one article that mentions the reason for no WTP, namely because no respondents answered no to the question of enrolling in a free program, lack of funding and limited capacity to offer free programs, and financial limitations and insufficient motivation constituted significant obstacles to participation.¹⁰

Table I. Characteristics of included studies

No	Author, Year	Country	Study Aim	Setting	Study Design	Number of Respondents	Instrument Studies	WTP Method
1	(Xiao et al, 2023) ¹²	China	The purpose is to Find out whether individuals with diabetes mellitus are willing to pay for a diabetic retinopathy test and what factors influence that willingness.	The study was conducted in Qujiang District of Shaoguan City, Guangdong. With Ten primary health centers	Cross-sectional	545	Questionnaire	Payment cards of differing amounts
2	(Ghahramani et al., 2022) ⁹	Iran	The aim of this study was to calculate the WTP for a one-year preventive package to lower the risk of diabetic foot, cardiovascular, kidney, and ocular problems.	This cross-sectional research is from two cities in Iran.	Cross-sectional	557	Questionnaire	Score Chart
3	(Vlachou & Katostaras, 2020) ¹³	Greece	To determine how much diabetes patients value reducing the risk of diabetic neuropathy and diabetic nephropathy, as well as the maximum amount of money they are willing to pay to do so.	The study was conducted in Greece	Cross-sectional	419	Interviews	CVM, Open-ended questions
4	(Alva et al., 2017) ¹⁰	North Carolina	To determine how much potential recipients would be willing to pay to participate in DPPs under 3 different models: delivered by registered professionals (traditional model), by community health workers, or online.	The study was conducted in North Carolina.	Cross-sectional	214	Questionnaire	CVM (Double-bounded model maximum likelihood)
5	(Jackson et al., 2017) ¹⁴	USA	To test the hypothesis that a 50-g oral glucose challenge test with 1-h glucose measurement would have superior performance compared with other opportunistic screening methods.	This research was conducted for the Veteran's Health Administration (VA) in the USA	Cross-sectional	1535	Questionnaires	Discrete-choice Method

Table I. Continue

No	Author, Year	Country	Study Aim	Setting	Study Design	Number of Respondents	Instrument Studies	WTP Method
6	(Kangethe et al., 2016) ¹⁵	Kenya	The objective of this study was to compare the theoretical validity of two willingness-to-pay (WTP) methods, the commonly used payment card (PC) and the recently developed structured haggling (SH), for estimating the potential benefits of a diabetes prevention program in rural Kenya.	The study was conducted in Kiambu, a rural county in Kenya.	Cross-sectional	376	Closed-ended questionnaires	payment card and structured haggling method
7	(Rothman, 2007) ¹⁶	Taiwan	To explore the WTP values for screening for diabetic retinopathy (DR) associated with varying degrees of DR among persons with type 2 diabetes in Kinmen, Taiwan.	The study was conducted in Kinmen, Taiwan. - It was a community-based study.	Cross-sectional	725	Questionnaire	Discrete-choice Method
8	(Johnson et al., 2006) ¹⁷	Georgia	The purpose of this study was to estimate how much at-risk individuals are willing to pay for type 2 diabetes primary prevention programs.	The study was conducted in Kiambu, a rural county in Georgia	Cross-sectional	582	Online Surveys	Stated-Choice Method

Table II. values WTP of included studies

No	Author, Year	Country	Demographics Characteristics Of Participants	% Of Positive WTP	WTP (Currency in USD)	Factor Influencing In WTP
1	(Xiao et al, 2023) ¹²	China	Mean age of participants: 64.6 years (SD±10.4) - 40.7% of participants were men. Participants were from lower-income families - Some participants were covered by employer-linked insurance	60%	There are three levels of WTP: USD1.38 – USD4.15, USD5.54 – USD6.92, and USD11.07 – USD116.61	People living in rural areas; lower-income families; gender (men); urban residents; those covered by employer; linked insurance
2	(Ghahramani et al., 2022) ⁹	Iran	Diabetic participants from two cities in Iran, the Mean age of participants was 47.54 years	80%	WTP varied from USD169.4 to USD374.5	Wealth, Location of study; Marital status; Attitude toward special training
3	(Vlachou & Katostaras, 2020) ¹³	Greece	The study was conducted among diabetic patients aged ≥60 years.	30%, 60%, 90%	For a risk reduction of 30%, they were willing to pay \$46.05 (mean) or 2.994% (mean) of their income. For a risk reduction of DNU from 90% to 60%, elderly diabetics were willing to pay \$33.55 (mean) or 2.218% (mean) of their monthly family income.	Time since the onset of diabetes
4	(Alva et al., 2017) ¹⁰	North Carolina	Participants had low to middle-income levels based on employment and education. The Majority of participants reported owning a computer (84%)	95%	WTP per month was \$39 (95% confidence interval [CI], \$33–\$44) if the DPP was led by a registered professional, \$31 (95% CI, \$26–\$36) if led by a CHW, and \$19 (95% CI, \$15–\$23) if administered online.	Socioeconomic status (measured by education and employment); age
5	(Jackson et al., 2017) ¹⁴	USA	Mean age of participants: 56 years with BMI 30.3 kg/m ²	95%	\$42 from a Veterans Affairs perspective, and \$55 from a US Medicare perspective	Lack of routine screening for preDM and early DM; older age, overweight, minority groups, and lower socio-economic status in VA population; Increased risk of cardiovascular disease associated with preDM and early DM; progression of glucose intolerance unchecked without screening; Importance of early detection for preventive management with lifestyle change or medication; Recommendations for systematic screening by

						US Preventive Services Task Force
No	Author, Year	Country	Demographics Characteristics Of Participants	% Of Positive WTP	WTP (Currency in USD)	Factor Influencing In WTP
6	(Kangethe et al., 2016) ¹⁵	Kenya	A convenience sample of adult residents from a rural county in Kenya (Kiambu), with no history of diabetes.	95%	SH resulted in a higher annual mean WTP than PC, Ksh504.05 (USD7.25) versus Ksh619.95 (USD5.90)	Socioeconomic status (income); Gender (for PC method); Employment status (for both PC and SH methods); Education level (for SH method); Ownership of a vehicle (for SH method); Having distant relatives with diabetes (for PC method)
7	(Rothman, 2007) ¹⁶	Taiwan	participants with type 2 diabetes attended the survey.	65.3%	The overall mean WTP value was New Taiwan Dollars 468.9±327.7 (USD14.3±10.0).	Degree of diabetic retinopathy (DR); Age; Severity of DR
8	(Johnson et al., 2006) ¹⁷	Georgia	respondents by age (≥ 45 years)years),	82.7%	Respondents were willing to pay \$1.500 over 3 years (\$42/Month)	Individuals' self-assessed risk of developing diabetes; better risk communication by physicians; Patient education; Potential benefits and costs of implementing diabetes prevention programs; Value individuals place on the Benefits of diabetes prevention program

Factor Influencing for WTP Prediabetes Screening and Program Prevention

Understanding the factors that impact individuals' willingness to pay (WTP) for prediabetes screening is essential for both financing mass screening initiatives and shaping future research strategies. Various factors affecting willingness to pay (WTP) were analyzed in all final studies. Factors such as age, gender, income level, and education level have a significant influence on WTP in high-income countries. Individuals in high-income countries may exhibit higher levels of WTP compared to lower-middle-income countries.^{10,13,14,16} Factors influencing willingness to pay (WTP) include employment status, where employed individuals have a higher WTP compared to unemployed individuals due to access to more stable financial resources and awareness of the importance of health to maintain productivity and attendance at work. Gender differences are also noted, as men are anticipated to have higher WTP than women for preventive program access.¹⁵ Men tend to be more open to allocating resources for disease prevention and health services. Men who work have more stable incomes, making it easier to pay for health services¹⁸. Socioeconomic status, as measured through indicators such as education, employment, and vehicle ownership, has a positive effect on WTP. Individuals with higher education tend to be more connected to information about the risks and importance of preventing prediabetes. Individuals who have private vehicles find it easier to access health services and prevention programs.¹⁵ Higher income levels correlate with a greater WTP for quality-adjusted life year diabetics. Patients with specific health issues like ischemic problems may have a lower likelihood of investing in preventive packages.⁹

Discussion

The studies reviewed include averages from all continents including the Asian continent, the American continent, the European continent, and the African continent. Although each continent represents only one or

two studies. Where diabetes is a global disease in which many people suffer from this disease on every continent. Apart from causing complications, diabetes can also cause death.

Table III. Factors Influencing willingness to pay for prediabetes screening

Significant Factor	Greece ¹³	Kenya ¹⁵	Georgia ¹⁷	USA ¹⁴	Taiwan ¹⁶	Iran ⁹	China ¹²	Carolina ¹⁰
Patients with Diabetes Type	v	-	-	-	-	-	-	-
Duration of Diabetes (<10 years)	v	-	-	-	-	-	-	-
Degree of diabetic retinopathy	-	-	-	-	v	-	-	-
Social Economic	-	v	-	-	-	-	-	-
Sex	-	v	-	-	-	-	v	-
Level Education	-	v	-	-	-	-	v	v
Age	-	-	-	-	v	-	-	v
Lifestyle	-	-	v	-	-	-	-	-
Health Insurance	-	-	-	-	-	-	v	-
Large Weight Loss	-	-	v	-	-	-	-	-
Marital Status	-	-	-	-	-	v	-	-
Risk Reduction	-	-	v	-	-	-	v	-
Medication use	-	-	v	-	-	-	-	-
Being Educated	-	v	-	-	-	-	-	-
Employed	-	v	-	-	-	-	-	-
Owning a vehicle	-	v	-	-	-	-	-	-

The results we found were that the level of acceptance of early prediabetes screening and prevention programs was high (average above 78.9%). The results also show a willingness to pay for prediabetes screening and prediabetes prevention programs if offered for free or at a reasonable price, some are even willing to pay more than usual, such as prevention and screening for diabetes neuropathy factors due to the long duration of diabetes mellitus (more than 10 years). This is likely due to the high prevalence of diabetes globally.

WTP (Willingness to Pay) for prediabetes screening and prevention programs is positive among surveyed respondents, indicating a recognition of the value of early detection and prevention in reducing the prevalence of diabetes and associated treatment costs. Policymakers can consider providing different screening and prevention packages for different income groups when designing prediabetes screening programs. The impact of health insurance, employment, subjective health assessments, and history of prediabetes screening on WTP for prediabetes programs requires further research.

Factors that significantly influence willingness to pay (WTP) include employment status, gender, and education level. In addition, socio-economic status, such as income such as employment, and private vehicle ownership, greatly influence WTP. Understanding diabetes, for example having a distant relative who suffers from diabetes, increases WTP significantly.¹³ Health status, the severity of diabetes, and early identification and costs associated with the condition also play an important role in influencing health-to-pay (WTP).¹⁵ Factors that were found not to significantly influence WTP were the duration of suffering from diabetes. Patients with certain health conditions, such as ischemic problems (heart and brain), may be less likely to spend on prevention packages.¹⁵ Sociodemographic factors play a crucial role in influencing how people make decisions regarding health services and care. Studies have shown that age, education level, income, and racial background influence how individuals view their health, how they use health services, and how they make decisions regarding care. The results showed that visits to health facilities were more frequent among individuals who perceived their health to be worse, with income playing a role in linking these factors.¹⁹ Not only that, in this study it is stated that economic and social factors in certain areas can also influence the duration of a patient's stay in hospital, emphasizing how social disadvantage in a community can impact health care outcomes.²⁰

All the reviewed studies utilized Internet and web-based approaches for distributing and completing their questionnaires. Employing face-to-face methodologies for data collection appears to enhance the reliability of study findings.

Despite the limited number of studies included in the final analysis, it is feasible to draw valid conclusions regarding certain influencing factors and establish a reasonable ran for WTP. However, it is not feasible to

generalize the findings to all countries since the majority of the studies were conducted in developed nations, with minimal research available for low and middle-income countries. Therefore, it is imperative to conduct new studies tailored to the unique characteristics of developing countries.

However, this research has several limitations. First, exclusive reliance on English-language literature may introduce language bias, potentially ignoring valuable insights in non-English publications. Additionally, this research largely draws on research conducted in developed countries, resulting in a gap in understanding the willingness to pay for prediabetes screening in developing countries and countries classified as lower-middle to upper-middle-income countries. The dearth of research in these areas limits the generalizability of findings and hinders a comprehensive understanding of the cultural, economic, and healthcare access factors that influence individuals' readiness to invest in prediabetes screening. Additionally, the lack of research on willingness to pay for prediabetes screening poses a significant limitation, hindering robust analysis of global patterns and trends in this important area of health care.

CONCLUSION

Health systems need to consider prediabetes screening to reduce the risk of diabetes with early detection. Level education, age, and gender are the most influential factors in determining the willingness to pay (WTP) for prediabetes screening and diabetes prevention programs, where older individuals show a tendency to have a higher WTP. In addition, education level and previous diabetes diagnosis have a positive and significant influence on WTP. High-income countries have the highest WTP level compared to lower-middle-income countries. Further research is needed to better understand the factors influencing WTP and identify effective strategies to increase participation in prediabetes screening and prevention programs.

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CONFLICT OF INTEREST

The author of this study has declared that there are no conflicts of interest or personal relationships that could have influenced the work reported in this study.

STATEMENT OF ETHICS

Not Applicable for statement of ethics

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