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Community-Based Health Promotion Model for Diabetes Mellitus Prevention in Urban Areas

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ABSTRACT

The development of non-communicable diseases, especially diabetes mellitus, shows a significant increase in urban areas due to changes in lifestyle and social determinants of health. Purpose: This study aims to analyze the relationship between knowledge, attitude, lifestyle, and education level with diabetes mellitus prevention behavior and to formulate an effective community-based health promotion model in urban areas. Method: This study used a quantitative approach with a cross-sectional design on 300 respondents selected through a simple random sampling technique. Data were collected using a structured questionnaire that had been tested for validity and reliability, then analyzed using the chi-square test and odds ratio (OR). Result: The results showed that all independent variables had a significant relationship with diabetes mellitus prevention behavior ($p < 0.05$). Lifestyle was the most dominant factor (OR = 3.75), followed by knowledge (OR = 2.75), attitude (OR = 2.35), and education level ($p = 0.010$). However, a gap was found between the level of knowledge and the implementation of preventive behavior in the community. Implications: These findings underscore the need for health promotion interventions that focus not only on increasing knowledge but also on lifestyle changes through a participatory and contextual community-based approach. Conclusion: An integrative and adaptive community-based health promotion model that adapts to the characteristics of urban communities has the potential to increase the effectiveness of diabetes mellitus prevention in a sustainable manner.

Keywords: *Community-Based Health Promotion, Diabetes Mellitus, Preventive Behavior, Lifestyle, Urban Society*

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INTRODUCTION

Global disease patterns over the past few decades have shown a significant shift from a predominance of infectious diseases to non-communicable diseases (NCDs). This phenomenon is known as the epidemiological transition, characterized by the increasing prevalence of chronic diseases such as diabetes mellitus, cardiovascular disease, and cancer. Globally, diabetes mellitus is one of the leading NCDs, contributing significantly to increased morbidity and mortality rates and placing a significant economic burden on health systems (Kurniawan et al., 2024).

In Indonesia, the increasing prevalence of diabetes mellitus is also alarming. Data shows that the prevalence of diabetes has continued to rise in recent years, in line with lifestyle changes and increasing urbanization. In fact, diabetes mellitus is a leading cause of death and chronic disease in Indonesia, contributing significantly to the national healthcare cost burden (Mahmudah et al., 2025).

Furthermore, there is a significant difference between diabetes prevalence in urban and rural areas. Studies show that the prevalence of diabetes in urban areas is almost twice as high as in rural areas, which is closely related to lifestyle and environmental factors (Kurniawan et al., 2024). This indicates that the urban context strongly contributes to the increased risk of diabetes mellitus.

The increasing prevalence of diabetes in urban areas is inextricably linked to changes in urban lifestyles. Consumption of foods high in sugar, fat, and processed foods is increasing, along with easier access to fast food. Furthermore, a sedentary lifestyle due to minimal physical activity is also a major risk factor for the development of diabetes mellitus (Liberty et al., 2024).

Urbanisation and modernisation are key factors influencing public health, particularly in urban areas. These developments have brought about significant changes in the social and economic structure of society, including lifestyle, working environments and social interactions. These changes are often accompanied by increased stress levels, a shift towards more sedentary work patterns, and a decline in daily physical activity. These conditions directly contribute to an increased risk of non-communicable diseases, including diabetes mellitus, which has now become one of the main challenges facing urban public health (Ferdina et al., 2025).

In addition to lifestyle factors, social determinants of health, such as education level, income, and social environment, also influence the incidence of diabetes mellitus. Individuals with low levels of education and health literacy tend to be at higher risk of this disease, primarily due to a lack of understanding of healthy lifestyles and disease prevention (Safitri et al., 2021).

Specific risk factors such as obesity, hypertension, and insulin resistance have also been shown to be strongly associated with the incidence of diabetes mellitus. Research shows that obesity is a major determinant that significantly increases the risk of diabetes, especially in urban areas with unhealthy lifestyles (Mahmudah et al., 2025).

Furthermore, psychosocial factors such as high stress in urban environments contribute to an increased risk of diabetes. Work pressure, economic competition, and a fast-paced lifestyle can trigger hormonal changes that impact glucose metabolism (Ferdina et al., 2025).

The impact of diabetes mellitus is not only clinical, but also social and economic. Clinically, diabetes can cause various serious complications, such as cardiovascular disease, neuropathy, and

nephropathy. These complications not only reduce an individual's quality of life but also increase disability and mortality rates (Haryanti, 2025).

From a social perspective, diabetes mellitus has a significant impact on the lives of individuals and society. People with diabetes often experience a decline in work productivity due to physical limitations and the health complications associated with the condition. Furthermore, this condition can also reduce quality of life as it requires ongoing disease management and strict lifestyle changes. The relatively high cost of treating diabetes and its various complications makes this disease a major economic burden for individuals, families and the national healthcare system (Mahmudah et al., 2025).

Given the significant impact of the condition, efforts to prevent diabetes mellitus are a crucial aspect of strategies to control this disease. Preventive and promotive approaches are considered more effective than curative approaches as they focus on preventing the emergence of risk factors at an early stage. As well as reducing the incidence of diabetes, such approaches also have the potential to reduce long-term healthcare costs. Appropriately designed health promotion interventions can help reduce the incidence of diabetes whilst preventing the onset of more serious complications (Kurniawan et al., 2024).

From a theoretical perspective, health promotion regards community empowerment as a key element in efforts to improve health status. This approach emphasises the importance of the active involvement of individuals and community groups in maintaining and improving their health. Various health behaviour theories, such as the Health Belief Model and Social Cognitive Theory, explain that behavioural change is influenced by an individual's knowledge, attitudes, risk perceptions and beliefs regarding health. Therefore, building community capacity through health education is a crucial step in promoting sustainable healthy lifestyles (Suminta, 2025).

A community-based approach (community-based health promotion) is one of the relevant strategies for the prevention of diabetes mellitus. This approach positions the community as the primary agent, playing an active role in the planning, implementation and evaluation of health programmes. The involvement of the community as agents of change enables health interventions to be tailored to specific local social and cultural characteristics and needs. Consequently, the effectiveness of diabetes prevention programmes can be enhanced as the interventions carried out become more contextually appropriate and readily accepted by the local community (Murdani et al., 2025).

Although health promotion has become one of the key strategies for improving public health, its implementation still faces various challenges. Approaches that tend to be top-down often fail to involve the community's active participation in the planning, implementation and evaluation of programmes, resulting in low sustainability and effectiveness of the interventions carried out. On the other hand, the heterogeneous nature of urban communities in terms of social, economic, cultural and environmental aspects also poses a challenge to the implementation of standardised health promotion programmes (Setyorini et al., 2024). Therefore, there is a need to develop a community-based health promotion model that is more adaptive, participatory and contextual, in line with local needs and characteristics. It is hoped that such a model will be able to comprehensively integrate

behavioural, social and environmental factors, whilst encouraging the involvement of various stakeholders in efforts to achieve sustainable improvements in public health.

Thus, this research is crucial in addressing existing research gaps, particularly regarding the development of an effective community-based health promotion model for preventing diabetes mellitus in urban areas. The results are expected to provide both theoretical and practical contributions to diabetes mellitus control efforts in Indonesia.

METHODS

This study employed a quantitative approach using an analytical observational design with a cross-sectional method. The design was selected to examine the relationship between knowledge, attitudes, lifestyle, and educational level with diabetes mellitus prevention behavior among urban communities at a single point in time.

The study was conducted in an urban area characterized by high levels of urbanization and a relatively high prevalence of diabetes mellitus. Data collection was carried out over a six-month period, including preparation, instrument testing, field data collection, data processing, and analysis.

The target population consisted of adults aged 18 years and above residing in the study area. Respondents were categorized into three age groups, namely 18–35 years, 36–55 years, and over 55 years. A total of 300 respondents participated in this study and were selected using a simple random sampling technique, ensuring that each eligible member of the population had an equal probability of being selected.

The study examined four independent variables, namely knowledge regarding diabetes mellitus, attitudes toward diabetes prevention, lifestyle (including dietary behavior and physical activity), and educational level. The dependent variable was diabetes mellitus prevention behavior. Data were collected using a structured questionnaire based on indicators derived from the Health Belief Model and Social Cognitive Theory and measured using a five-point Likert scale.

Prior to data collection, the questionnaire underwent validity and reliability testing involving 30 respondents who possessed characteristics similar to those of the study population. Instrument validity was assessed using the Pearson Product Moment correlation test. The results demonstrated that all questionnaire items had corrected item-total correlation coefficients ranging from 0.412 to 0.821, exceeding the critical r-value of 0.361 ($n = 30$; $\alpha = 0.05$), indicating that all items were valid and suitable for use in the study. Instrument reliability was evaluated using Cronbach's Alpha, yielding values of 0.812 for the knowledge scale, 0.846 for the attitude scale, 0.879 for the lifestyle scale, and 0.831 for the diabetes prevention behavior scale. These values exceeded the acceptable threshold of 0.70, confirming satisfactory internal consistency.

Data analysis was conducted in two stages. Univariate analysis was used to describe respondent characteristics and study variables through frequencies and percentages. Bivariate analysis was performed using the Chi-square test (χ^2) at a significance level of 0.05 to assess the association between independent variables and diabetes mellitus prevention behavior. Odds Ratio

(OR) analysis was subsequently conducted to estimate the strength of association between the variables studied. Statistical analyses were performed using SPSS software.

Ethical principles were maintained throughout the study. All respondents provided informed consent prior to participation. Confidentiality and anonymity of participant information were ensured, and ethical approval was obtained from the relevant Health Research Ethics Committee before the commencement of the study.

RESULTS

1. Univariate Analysis (Respondent Characteristics)

Table 1. Distribution of Respondent Characteristics (n = 300)

Variables	Category	Frequency (n)	Percentage (%)
Age	18–35 years	120	40.0
	36–55 years	130	43.3
	>55 years	50	16.7
Gender	Man	140	46.7
	Woman	160	53.3
Education	Low	90	30.0
	Intermediate	130	43.3
	High	80	26.7
Income	Low	110	36.7
	Currently	120	40.0
	High	70	23.3

The majority of respondents were in the productive adult age group, which, from an epidemiological perspective, is at higher risk of developing non-communicable diseases, including diabetes mellitus. The composition of the respondents showed a relatively balanced representation by gender, thereby providing a more comprehensive picture of diabetes prevention behaviour in urban communities. From a social perspective, the majority of respondents had a secondary level of education and were in the middle economic category. These findings indicate variations in social characteristics that may influence levels of health literacy and diabetes mellitus prevention behaviour.

2. Univariate Analysis of Research Variables

Table 2. Distribution of Research Variables

Variables	Category	Frequency (n)	Percentage (%)
Knowledge	Good	170	56.7
	Not Enough	130	43.3
Attitude	Positive	180	60.0
	Negative	120	40.0
Lifestyle	Healthy	140	46.7

	Not healthy	160	53.3
DM Prevention Behavior	Good Behavior	150	50.0
	Poor Behavior	150	50.0

The research findings indicate that the majority of respondents already possess a good level of knowledge about diabetes mellitus and demonstrate a positive attitude towards efforts to prevent the disease. However, this has not yet been fully reflected in the adoption of a healthy lifestyle in their daily lives. These findings suggest that improved knowledge and attitudes do not automatically lead to optimal changes in health behaviour. The gap between cognitive understanding and health practices presents a significant challenge in the development of community-based health promotion programmes.

3. Bivariate Analysis (Chi-Square Test)

Table 3. Relationship between Knowledge and Diabetes Mellitus Prevention Behavior

Knowledge	Good Behavior	Poor Behavior	Total	p-value	OR (95% CI)
Good	110	60	170	0.001	2.75
Not enough	40	90	130		

The analysis shows that the level of knowledge is significantly associated with diabetes mellitus prevention behaviour. Respondents with a better understanding of the risk factors, symptoms and prevention strategies for diabetes tend to exhibit better prevention behaviour than those with lower levels of knowledge. These findings underscore the importance of knowledge as a key factor in shaping public health awareness. Consequently, improving health education remains a vital component of diabetes mellitus prevention strategies in urban areas.

Table 4. Relationship between Attitude and Preventive Behavior

Attitude	Good Behavior	Poor Behavior	Total	p-value	OR
Positive	115	65	180	0.002	2.35
Negative	35	85	120		

Respondents' attitudes towards the prevention of diabetes mellitus were found to be significantly associated with their behaviour. Individuals who hold a positive perception of the importance of disease prevention tend to be more consistent in adopting healthy behaviours. These findings suggest that affective factors play a significant role in motivating individuals to adopt preventive measures. Therefore, health promotion programmes should be directed not only at improving knowledge, but also at fostering positive attitudes towards healthy living.

Table 5. Relationship between Lifestyle and Preventive Behavior

Lifestyle	Good Behavior	Poor Behavior	Total	p-value	OR
Healthy	100	40	140	0.000	3.75
Not healthy	50	110	160		

Lifestyle is the factor showing the strongest association with diabetes mellitus prevention behaviours compared with other variables. Respondents who adopt a healthy lifestyle tend to be better able to carry out various preventive measures consistently. These findings confirm that changes in daily behaviour are a key component in managing risk factors for diabetes mellitus. The research results also indicate that health promotion interventions focusing on improving dietary habits, increasing physical activity and managing stress have the potential to have a greater impact on disease prevention efforts.

Table 6. Relationship between Education and Preventive Behavior

Education	Good Behavior	Poor Behavior	p-value
High	60	20	
Intermediate	70	60	0.010
Low	20	70	

Educational attainment is significantly associated with diabetes mellitus prevention behaviour. The higher a person's level of education, the more likely they are to understand and apply health information relating to disease prevention. These findings suggest that education acts as a structural factor that supports improvements in public health literacy. Therefore, the development of health promotion programmes needs to take into account differences in educational attainment so that the information provided can be understood and applied effectively by all sections of the community.

DISCUSSION

1. Relationship between Knowledge and Diabetes Mellitus Prevention Behavior (Table 3)

The results of the bivariate analysis in Table 3 show a significant relationship between knowledge and diabetes mellitus prevention behavior in urban areas (p = 0.001). Respondents with good knowledge, 110 people (64.7%), had good prevention behavior, while only 40 respondents (30.8%) with less knowledge had good prevention behavior. The odds ratio (OR) value of 2.75 indicates that individuals with good knowledge have a 2.75 times greater chance of engaging in diabetes mellitus prevention behavior compared to individuals with less knowledge.

This finding aligns with the health behavior theory proposed by Notoatmodjo (2012), which states that knowledge is the primary cognitive domain underlying a person's behavior. The process of behavior formation begins with knowledge, then develops into attitude, and finally manifests in action (practice)—known as the Knowledge, Attitude, Practice (KAP) model. In the context of health promotion, the Health Belief Model (HBM) also emphasizes that an individual's understanding of the risks of a disease and the benefits of preventive measures are key predictors of changes in health behavior (Suminta, 2025). Adequate knowledge of the risk factors, symptoms, and prevention methods for diabetes mellitus allows a person to assess their perceived susceptibility and respond with appropriate preventive measures.

The results of this study are consistent with the findings of Kalsum et al. (2023) in a study in East Jakarta involving urban areas, which found a significant relationship between the level of

knowledge and the behavior of preventing type 2 diabetes mellitus ($p < 0.05$). The study confirmed that individuals with better knowledge tend to be more active in primary prevention efforts, including regulating diet and physical activity (Kalsum et al., 2023). In line with this, Hasanah (2024) in a study at Haji Abdoel Madjid Batoe Regional Hospital also found that knowledge was significantly related to the behavior of preventing complications of diabetes mellitus, with a p value = 0.001 and OR = 3.4 (Hasanah, 2024). Ramadhani & Khotami (2023) in a study on young adults also proved that the level of knowledge significantly contributes to the behavior of preventing type 2 diabetes, especially in the productive age group living in urban environments (Ramadhani & Khotami, 2023).

Researchers assumed that although most respondents had good knowledge (56.7%), the fact that only 50% of respondents overall had good preventive behaviors indicates a significant knowledge-practice gap. This condition shows that knowledge alone is not sufficient as a sole determinant of behavior change; reinforcement through attitudinal factors, social support, and accessibility of a conducive environment is needed. Therefore, community-based health promotion interventions need not only to increase knowledge through education but also must integrate motivational approaches and changes in social norms so that knowledge can be translated into concrete actions.

2. Relationship between Attitudes and Diabetes Mellitus Prevention Behavior (Table 4)

Based on Table 4, the Chi-square test results indicate a significant relationship between attitudes and diabetes mellitus prevention behavior ($p = 0.002$). Of the 180 respondents with a positive attitude, 115 (63.9%) had good prevention behavior, while of the 120 respondents with a negative attitude, only 35 (29.2%) had good behavior. The OR value of 2.35 indicates that respondents with a positive attitude were 2.35 times more likely to take action to prevent diabetes mellitus than those with a negative attitude.

These findings align with the Health Belief Model (HBM), which asserts that individual attitudes—particularly in the form of perceived susceptibility, perceived benefits, and self-efficacy—are key determinants in adopting preventive health behaviors. When a person has a positive attitude toward disease prevention, they tend to internalize the belief that the preventive actions taken will provide tangible benefits for their health. Furthermore, the Theory of Planned Behavior (TPB) developed by Ajzen further strengthens this argument, where attitude toward a behavior is one of the main predictors of a person's intention to act, which ultimately determines the actual behavior. In the context of preventing diabetes mellitus in urban environments, positive attitudes need to be strengthened through education oriented toward long-term health values (Lestarina, 2018).

The results of this study are supported by a meta-analysis conducted by the Indonesian Journal of Health Promotion (2024) regarding the application of HBM to the preventive behavior of type 2 diabetes mellitus patients, which concluded that attitude constructs (perceived severity and perceived benefits) significantly influence tertiary prevention behavior in type 2 DM patients, with adjusted OR values ranging from 2.1–4.8 in various studies analyzed (Halizah et al., 2024). Furthermore, findings from research published in Afrasiabi et al. 2022 reinforce this, that perceived

barriers, perceived self-efficacy, and knowledge are significant predictors of type 2 DM preventive behavior in high-risk populations, and positive attitudes act as a moderator between knowledge and actual behavior (Afrasiabi et al., 2022). Research by Arisa et al (2025) at the Selindung Pangkalpinang Community Health Center also found a significant relationship between attitudes and the level of concern for DM prevention (p-value 0.040, POR 2.476), which shows the consistency of these findings in various primary health care settings in Indonesia (Arisa et al., 2025).

Researchers assume that a positive attitude toward diabetes mellitus prevention is a necessary but not sufficient condition for the development of consistent preventive behavior. In the context of dynamic urban areas, attitudes are often influenced by social pressure, group norms, and access to health information. Therefore, community-based health promotion programs need to design interventions that not only build positive attitudes individually but also create a supportive social environment where diabetes prevention behavior is considered a widely accepted social norm. The involvement of community leaders and health cadres in strengthening this social norm is a strategic aspect that needs to be integrated into the intervention model.

3. Relationship between Lifestyle and Diabetes Mellitus Prevention Behavior (Table 5)

Table 5 shows that lifestyle has the strongest relationship among all the variables studied, with a p value of 0.000 and an OR of 3.75. Of the 140 respondents with a healthy lifestyle, 100 (71.4%) demonstrated good preventive behavior. Conversely, of the 160 respondents with an unhealthy lifestyle, only 50 (31.3%) demonstrated good preventive behavior. The OR of 3.75 indicates that respondents with a healthy lifestyle are 3.75 times more likely to engage in good diabetes mellitus preventive behavior than respondents with an unhealthy lifestyle. These data also confirm that lifestyle is the most dominant and modifiable risk factor in efforts to prevent diabetes mellitus in urban areas.

These findings align with Bandura's Social Cognitive Theory (SCT), which emphasizes that health behavior is shaped through a dynamic interaction between personal factors (self-efficacy), the environment, and the behavior itself. From this perspective, lifestyle—which includes diet, physical activity, stress management, and sleep quality—is not simply an individual habit, but rather a reflection of the social and environmental determinants that shape a person's life choices. Furthermore, the PRECEDE-PROCEED Model developed by Green & Kreuter is also relevant here, stating that enabling factors such as accessibility to sports facilities and the availability of healthy foods, as well as reinforcing factors such as family and community support, directly moderate the relationship between lifestyle and preventive behavior (Chandra et al., 2020).

This finding is consistent with Nabila et al. (2024) in a systematic review in MPPKI which emphasized that dietary behavior and physical activity are the main determinants in the prevention of metabolic diseases including diabetes mellitus, and community-based interventions have been proven effective in encouraging sustainable lifestyle changes (Nabila et al., 2024). Research at the Oesapa Kupang Community Health Center in 2024 also found that type 2 diabetes in urban communities is closely related to lifestyle and behavior, especially high-sugar eating habits and low physical activity, where urban communities are proven to be at greater risk of exposure to this

condition than rural communities due to lifestyle changes due to modernization (Natonis et al., 2024).

The strong association between lifestyle and diabetes prevention behavior (OR = 3.75) in this study provides important strategic implications for the development of community-based health promotion models. Researchers assume that the most effective community interventions for diabetes mellitus prevention in urban areas are those that focus on comprehensive lifestyle modification, not just the delivery of health information. This means that intervention programs need to include practical components such as community nutrition classes, joint exercise programs, and community-based stress management. Furthermore, researchers assume that the high proportion of unhealthy lifestyles (53.3%) among the urban communities studied is a consequence of structural determinants—including time constraints due to urban work patterns, low accessibility of healthy food, and a lack of public sports facilities—so interventions must be multisectoral, synergistically involving local governments, the private sector, and local communities.

4. Relationship between Education Level and Diabetes Mellitus Prevention Behavior (Table 6)

Table 6 shows a significant relationship between education level and diabetes mellitus prevention behavior ($p = 0.010$). The observed relationship pattern is a positive gradient, where the higher the education level, the greater the proportion of respondents who have good prevention behavior. Respondents with a high level of education showed that 60 out of 80 people (75%) had good prevention behavior, compared to respondents with secondary education (70 out of 130 people, 53.8%), and only 20 out of 90 people (22.2%) with low education. This gradient indicates that education plays an important structural role in determining an individual's health literacy capacity.

These results align with the WHO's social determinants of health perspective, which positions education as one of the primary structural determinants shaping a person's opportunities and life choices. Education not only improves literacy skills but also expands access to health information, strengthens decision-making skills, and shapes healthy living values and norms. Within the PRECEDE Model framework, education level serves as a predisposing factor that directly influences an individual's knowledge, attitudes, and ultimately health behaviors. Higher-educated individuals tend to have a greater awareness of the risks of non-communicable diseases and are better able to access and interpret health information from various sources, including digital media (Mandasari, 2021).

The results of this study align with the findings of Ramadhani & Khotami (2023) who studied young adults in Indonesia, finding that education level was significantly associated with type 2 diabetes prevention behavior ($p < 0.05$). The study concluded that individuals with higher education tend to have better access to health information and stronger cognitive capacity in implementing a preventive lifestyle (Ramadhani & Khotami, 2023). Safitri et al. (2021) in an IFLS 5-based study in urban communities in Indonesia also demonstrated that individuals with low levels of education and health literacy have a higher risk of diabetes mellitus, with limited understanding of healthy lifestyles as the main connecting mechanism (Safitri et al., 2021). These findings are further reinforced by a study by Arania et al. (2021) in Central Lampung, which found a relationship

between education level and diabetes mellitus incidence, where individuals with low education are at higher risk of developing diabetes due to limited health literacy, which impacts poor preventive behavior (Arania et al., 2021).

Researchers assume that the relationship between education and diabetes mellitus prevention behavior is strongly mediated by health literacy, which encompasses the ability to read, understand, and use health information in everyday life. The observed gradient pattern—where prevention behavior increases with higher education—reflects the still significant inequality in access to health education in heterogeneous urban communities. The implication of this finding is that community-based health promotion programs need to be designed inclusively, with approaches and communication media tailored to the literacy levels of the target population. For low-education groups, visual, contextual, and peer-based interventions are considered more effective than conventional, text-based, informative approaches. The community-based health promotion model developed from this research should incorporate health literacy improvement as an integral core component.

CONCLUSIONS

This study concluded that knowledge, attitude, lifestyle, and education levels were significantly associated with diabetes mellitus prevention behavior in urban areas. Among these variables, lifestyle was the most dominant factor, indicating that changes in daily behavior are key to preventing this disease. Although most respondents had good knowledge and positive attitudes, a knowledge-practice gap was still found, indicating that increasing knowledge alone is not sufficient to drive optimal behavior change.

These findings underscore the importance of a community-based health promotion approach that focuses not only on education but also on community empowerment and the creation of an environment that supports healthy lifestyles. The intervention model developed needs to be integrative, combining cognitive, affective, and behavioral aspects simultaneously. Furthermore, interventions must consider the heterogeneous social characteristics of urban communities to be more effective and sustainable in reducing the risk of diabetes mellitus.

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