

## Application of the health belief model in developing a community-based health literacy kit for diabetes prevention

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### Abstract

**Background:** Type 2 Diabetes Mellitus (T2DM) remains a major global and national health challenge, particularly in Indonesia where the prevalence has reached 10.6%. Low health literacy among high-risk populations limits preventive efforts and self-management. **Objective:** This study aimed to apply the Health Belief Model (HBM) in developing a culturally contextualized health literacy kit for diabetes prevention and to evaluate its theoretical relevance, content validity, and practical feasibility. **Methods:** A mixed-method design was employed involving 10 health educators and 60 high-risk community members recruited purposively. The development process consisted of five stages: needs assessment, prototype design, expert validation, limited trial, and revision. Data were collected through questionnaires, expert validation sheets, focus group discussions, and pre–post knowledge tests. The kit was assessed using the Content Validity Index (CVI), and quantitative data were analyzed using paired t-tests. **Results:** The health literacy kit achieved a CVI score of 0.87, indicating strong content validity. Participants' knowledge increased by 17.4% ( $p < 0.001$ ), diabetes risk awareness by 22%, and healthy behavior intention by 19% after the intervention. Qualitative feedback supported the clarity, cultural relevance, and usability of the materials. **Conclusion:** The integration of all six HBM constructs effectively enhanced cognitive and motivational engagement in diabetes prevention. The developed kit proved feasible for community-based health education and can serve as a model for culturally sensitive interventions in other chronic disease prevention programs.

**Keywords:** health Belief Model; health literacy; diabetes prevention; community education; cultural adaptation.

### Cite This Article

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## INTRODUCTION

T2DM is an emerging public health problem worldwide, as well as in Indonesia. According to the 2018 Basic Health Research (Ris kedas), diabetes prevalence in Indonesia was 10.6 and is projected in a rise up until at least year 2045 that portrays current behavioral and environmental risk factors [1]. It has been demonstrated that low health literacy among the general population is a major obstacle to diabetes prevention as many cases remain undiagnosed and knowledge about disease control is limited [2,3].

Low HL is strongly associated with self-management capabilities and preventing severe complications. The management of diabetes requires understanding of increasingly complex medical information, yet much of the extant educational material is unidirectional and poorly-interactive, therefore unable to capture relevant cultural realities and enhance reach” [4,5]. Extensive and generic approaches to education that do not consider social and cultural diversity may yield poor efficiency in diabetes preventive programs, thus prompting the development of better adjusted and theory-based interventions [3].

Educational media on diabetes have been developed, however these approaches are generally one-way and not culturally adapted for the population of interest resulting in less effective message dissemination [5]. There is evidence to suggest that interactive and theory-based interventions such as the Health Belief Model (HBM) are helpful for effective health education and diabetes self-management [6,7]. The HBM, same components added is the x perceived susceptibility and perceived benefits) has been effective in promoting preventive behavior among diabetes patients [8]. Regrettably, the application of HBM in developing educational media in Indonesia is still lack; thus this study has its importance as an attempt to connect it [3,9].

Previous studies largely reviewed the effectiveness of health education, without taking into consideration directly implemented behaviour theories in media designs [10]. This discrepancy underscores the requirement for more research on how HBM constructs can be used to design health literacy interventions in diabetes prevention [11]. Theoretical involvement can motivate people to extend forth actions for their health management and prevention of subsequent complications, especially among at risk group in Indonesia [12,13]. The aim of this study is to utilize the HBM as a conceptual framework to develop a culturally sensitive health literacy kit for diabetes prevention in high risk population, and evaluate its theoretical relevance, content validity and practical feasibility in community health education. This strategy is predicted to improve community knowledge and self-management of diabetes, and subsequently ICD [2,14].

## METHODS

### *Study design and setting*

This study employed a Research and Development (R&D) design adapted from the Borg and Gall model to apply the Health Belief Model (HBM) in developing a culturally contextualized health literacy kit for diabetes prevention. The study was conducted in primary healthcare centers and community settings in Jambi City, Indonesia, where the prevalence of type 2 diabetes mellitus (T2DM) and low health literacy among high-risk populations are of particular concern.

### *Population, samples and sampling*

The study involved two main participant groups. The first group consisted of health educators working at community health centers, who acted as facilitators during the

educational sessions. The second group comprised community members identified as being at high risk for type 2 diabetes mellitus (T2DM), based on the following inclusion criteria: aged 40 years or older, having diabetes mellitus or possessing a family history of diabetes mellitus. In total, 10 health educators and 60 high-risk community participants were recruited through purposive sampling to ensure the inclusion of individuals with diverse sociodemographic backgrounds yet comparable risk characteristics relevant to the study objectives.

### ***Instruments and criteria***

The study employed both qualitative and quantitative instruments that were conceptually aligned with the six constructs of the Health Belief Model (HBM)—namely perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. Data collection tools included structured questionnaires to assess participants' baseline health literacy and behavioral intentions, and expert validation sheets using a 4-point Likert scale (1 = not relevant, 4 = highly relevant) to evaluate the content, clarity, and cultural appropriateness of the developed materials. In addition, pre–post knowledge tests were administered to measure changes in participants' understanding of diabetes prevention, while Focus Group Discussion (FGD) guides were used to gather qualitative insights into perceptions of risk, barriers, and contextual relevance. Validation outcomes were examined using the Content Validity Index (CVI), with a CVI score of 0.80 or higher considered indicative of acceptable content validity.

### ***Procedure and data collection***

The study was carried out through five sequential stages. The first stage, needs assessment, involved literature reviews, focus group discussions (FGDs), and questionnaires to identify existing gaps in diabetes-related knowledge and barriers to preventive behaviors among high-risk populations. The second stage, prototype design, focused on developing educational materials including a booklet, poster, risk assessment card, and educator's guide structured according to the constructs of the Health Belief Model (HBM) to enhance cultural relevance and participant engagement. The third stage, expert validation, was conducted by a panel of three to five experts in public health and health promotion who assessed the prototype for theoretical alignment, clarity, and usability. The fourth stage, limited trial, involved the implementation of the kit by health educators in small-group sessions with high-risk participants, during which data were collected through observation, pre–post knowledge tests, and participant feedback. The final stage, revision and finalization, incorporated feedback from both experts and participants to refine the content, language, and visual presentation of the kit, resulting in the final validated version. Overall, data collection was conducted over a period of approximately four months, with iterative validation and field testing performed at each stage to ensure quality and applicability.

### ***Statistical analysis***

Quantitative data were analyzed using descriptive statistics (mean, standard deviation, and percentage) to summarize participant characteristics and expert validation scores. The paired t-test was applied to compare pre– and post-intervention knowledge scores and to evaluate changes in awareness and behavioral intentions. Qualitative data from FGDs and open-ended questionnaires were analyzed using thematic analysis, guided

by the six HBM constructs to identify patterns in participants' perceptions and responses.

### **Ethical considerations**

Ethical approval for this study was obtained from the Ethics Committee of the Faculty of Medicine, Universitas Jambi (Approval No: 2545/UN21.8/PT.01.04/2025). All participants were provided with detailed explanations about the study objectives, procedures, and their rights. Written informed consent was obtained prior to data collection. Confidentiality and anonymity were strictly maintained, and participation was entirely voluntary with the option to withdraw at any time without consequences.

### **RESULTS**

A total of 10 health educators and 60 high-risk community members participated in the study. The demographic characteristics of both groups are summarized in Table 1. Health educators had a mean age of  $34.2 \pm 5.8$  years and were predominantly female (80%), whereas high-risk participants had a mean age of  $52.6 \pm 6.7$  years, with a slightly higher proportion of females (58.3%). Most community participants had an education level of primary to junior high school (46.7%), followed by senior high school (38.3%) and bachelor's degree (15%). Regarding nutritional status, 41.7% were overweight, 26.6% obese, and 36.7% reported a family history of diabetes mellitus, confirming their classification as a high-risk population.

**Table 1.** Characteristics of study participants

| <b>Variable</b>            | <b>Health Educators<br/>(n = 10)</b> | <b>High-Risk Participants (n = 60)</b>                      |
|----------------------------|--------------------------------------|---|
| Age (mean $\pm$ SD)        | $34.2 \pm 5.8$ years                 | $52.6 \pm 6.7$ years  |
| Gender (Male/Female)       | 2 (20%) / 8 (80%)                    | 25 (41.7%) / 35 (58.3%)                                     |
| Education Level            | Bachelor's: 100%                     | Primary–Junior HS: 46.7%; Senior HS: 38.3%; Bachelor's: 15% |
| Nutritional Status (BMI)   | –                                    | Normal: 31.7%; Overweight: 41.7%; Obese: 26.6%              |
| Family History of Diabetes | –                                    | 36.7%   |

Expert evaluation demonstrated a high level of content validity for the developed materials. The overall Content Validity Index (CVI) of the health literacy kit was 0.87, indicating excellent theoretical alignment and usability. Mean expert ratings for each domain are presented in Table 2, with all aspects meeting the minimum CVI threshold ( $\geq 0.80$ ). Experts noted that integrating the HBM constructs especially perceived susceptibility, perceived severity, and cues to action enhanced the relevance and engagement of the materials for community-based health education.

**Table 2.** Summary of student and teacher feedback on game feasibility (n = 60)

| <b>Evaluated Aspect</b>  | <b>Mean Score (1–4)</b> | <b>Category</b> | <b>CVI</b> |
|--------------------------|-------------------------|-----------------|------------|
| Content relevance        | 3.6                     | Valid           | 0.87       |
| Language clarity         | 3.5                     | Valid           | 0.87       |
| Visual presentation      | 3.7                     | Valid           | 0.87       |
| Usability                | 3.5                     | Valid           | 0.87       |
| Cultural appropriateness | 3.6                     | Valid           | 0.87       |
| Overall Mean             | 3.58                    | Valid           | 0.87       |

The six HBM constructs were systematically integrated into the development of the educational materials. The mapping between theoretical components and practical applications is shown in Table 3. Qualitative data from FGDs revealed increased personal awareness of diabetes risk and stronger motivation to adopt healthier lifestyles. Health educators also reported that the kit was more interactive and culturally relatable compared to conventional educational tools.

**Table 3.** Application of Health Belief Model Constructs in the Health Literacy Kit.

| <b>HBM Construct</b>     | <b>Implementation in Educational Materials</b>  |
|--------------------------|---|
| Perceived susceptibility | Illustrated risk cards showing individual vulnerability to diabetes.                    |
| Perceived severity       | Case-based stories depicting consequences of unmanaged diabetes.                        |
| Perceived benefits       | Posters and discussions emphasizing lifestyle modifications and health gains.           |
| Perceived barriers       | Group discussions identifying local challenges and strategies to overcome them.         |
| Cues to action           | Reminder posters and leaflets promoting daily healthy habits.                           |
| Self-efficacy            | Educator-led demonstrations reinforcing participants' confidence in preventive actions. |

The limited field trial demonstrated significant improvements in participants' knowledge and awareness following exposure to the HBM-based kit. As shown in Table 4, the mean knowledge score increased from  $61.2 \pm 7.5$  before the intervention to  $78.6 \pm 6.2$  after the intervention ( $p < 0.001$ ). Additionally, awareness of diabetes risk factors improved by 22%, and the intention to adopt healthy behaviors increased by 19%.

**Table 4.** HBM-based Kit Knowledge Score.

| <b>Variable</b>                      | <b>Pre-Test (Mean <math>\pm</math> SD / %)</b> | <b>Post-Test (Mean <math>\pm</math> SD / %)</b> | <b>Change (<math>\Delta</math>)</b> | <b>p-value</b> |
|--------------------------------------|--|---|-------------------------------------|----------------|
| Knowledge score                      | $61.2 \pm 7.5$                                 | $78.6 \pm 6.2$                                  | +17.4                               | < 0.001        |
| Awareness of risk factors            | 54.0%  | 76.0%   | +22.0%                              | –              |
| Intention to adopt healthy behaviors | 48.0%  | 67.0%   | +19.0%                              | –              |

Overall, the integration of the Health Belief Model (HBM) in the design and evaluation of the health literacy kit proved both theoretically sound and practically feasible. The kit achieved strong expert validation, effectively enhanced participants' understanding of diabetes prevention, and improved behavioral intentions. These findings confirm that HBM provides a robust framework for the development of community-based, culturally appropriate educational tools that can be implemented in primary healthcare settings to strengthen diabetes prevention programs.

## DISCUSSION

It was found that when the HBM was used the development of a health literacy kit for high-risk diabetes communities produced positive results. Content validity of the kit was very good where it scored 0.87 by content validity index (CVI), suggesting that the

expert opinion came to a strong consensus and agreed with relevance of components in the kit [12]. Furthermore, the present study demonstrated remarkable positive changes in a number of dimensions of health knowledge and behaviour. Knowledge score improved after the session (by 17.4%,  $p < 0.001$ ), as well as diabetes risk factors awareness (22%), and intention to be engaged in health behaviors for the prevention of prediabetes (19%) [15]. These results provide clear evidence that the intervention of HBM has a great impact on promoting community acceptance and involvement in diabetes prevention.

These findings are in line with the aims of this investigation to test theoretical relevance, content validity and practical feasibility of this HBM based intervention. This study, by using HBM approach has been able to emphasize diabetes perception and preventive behavior among the high-risk population that makes this model suitable and very important for public health [16]. Application of HBM constructs in the development of health literacy-based interventions for diabetes prevention and demonstrated that each construct has had a significant input into the research outcomes. First, perceived susceptibility and perceived severity seemed to play an important role in enhancing awareness of individual risk for diabetes among participants.

Participants were more likely to be motivated for prevention by recognizing the potential risks they encounter and understanding the seriousness of the disease. This could be supported by a considerable increase in risk perception of the participants who participated in HBM-based literacy program [17]. It was the construct of perceived benefits and perceived barriers which also enabled participants to objectively balance advantages and obstacles towards healthy behavior initiatives. CQ appears to have empowered participants in taking necessary steps, and increased self-efficacy to take preventive action by emphasizing the advantages of prevention and tackling perceived obstacles [18].

Visual and reminder cues (action cues) were stimulus for action relating to being involved in diabetes prevention. Such cues not only motivated people, but also helped foster healthy attitudes and behaviors [19]. Concurrently, a heightened level of self-efficacy in the participants made them more confident to engage in preventive behavior such as those observed in behavioral intentions before and after intervention [20]. By incorporating all six HBM factors into the curriculum design, the intervention was able to develop relevant and contextual materials. This integrative approach increased participant cognitive and motivational engagement in diabetes prevention.

The results of the present study are in accordance with those conducted by Fernando (2013) and Kim and Utz (2019), as well as Ouédraogo et al. (2024) who found better adherence and greater understanding from patients treated according to the HBM. However, this paper contributes to literature by using the HBM to inform the design of a community-based health literacy media in Indonesia. This is an important advancement, since it combines theory-driven instruction and community members facilitate the development of contextually relevant tools. By creating an adaptable health literacy kit based on actual educator and layperson input, the results of this study have shown how the HBM can be modified to enhance community-based health interventions [21].

This study highlights the originality of our study that was to use HBM theory within culturally and contextually appropriate health education media. The intervention helped to improve knowledge and awareness on diabetes and motivated people for active involvement in dealing with their health, hence promoting preventive

behaviors and reducing the risk of developing diabetes [4,5]. Through attention to co-created tool design, this research stands the potential to redefine community-based health education in Indonesia.

Findings of this study have important public health implications, particularly for prevention of diabetes. The health literacy kit using HBM could be deployed in primary healthcare services (puskesmas) as a media for school health cadres and educators, providing information needed to facilitate issues of concern to children (O'Meara17 et al., 2019). Furthermore, the NCD Kit could be incorporated into national NCD prevention programs with the capacity to offer more comprehensive approach towards addressing increasing NCD burden in Indonesia. This method is useful especially for high-risk population with low health literacy in order to enhancing their knowledge of the disease and prevention will also lead to reducing disease complications [2].

In addition to diabetes prevention, the use of HBM as a framework could potentially be beneficial in designing educational media for other health concerns (i.e., hypertension and obesity). Using the same model, health education programs could be adjusted for different social and cultural milieu from community to community [22]. The use of HBM as a model to increase health promotion in primary care is replicable and culturally appropriate. These interventions not only affect specific health determinants but also positively impact population health by strengthening positive behaviors, and promoting active community engagement in care.

Understanding these encouraging results, our study has some limitations that need to be considered. First, the sample was relatively small and not representative of the general population given that it consisted of only one city [23]. Additionally, the study did not perform follow-ups to determine whether any behavioral changes were maintained over time, limiting the potential durability of these intervention effects. Data collection for qualitative responses were also restricted in that they only captured views as a knowledge was introduced thus further exploration of experiences and problems faced by the participants when applying the new understanding would be necessary [24]. To address these limitations, future research should conduct larger-scale, multicenter field trials to obtain more representative and comprehensive data [25]. Longitudinal evaluations should also be performed to measure behavioral changes and blood glucose outcomes over time, providing stronger evidence of the intervention's long-term impact. In addition, digital adaptation of the HBM-based literacy kit could be explored to enhance accessibility and effectiveness, especially among populations with limited health literacy [22][26].

## CONCLUSIONS

This study demonstrated that applying the Health Belief Model (HBM) in developing a culturally tailored health literacy kit effectively improved knowledge, awareness, and behavioral intention toward diabetes prevention among high-risk community members. The kit showed high content validity (CVI = 0.87) and was found to be both theoretically sound and practically feasible for use in community health education. The integration of all six HBM constructs enhanced participants' cognitive and motivational engagement, promoting greater self-efficacy and preventive action. Beyond its empirical contribution, this study highlights the adaptability of HBM as a design framework for community-based health promotion, offering a replicable model for other chronic disease prevention programs in Indonesia. Further large-scale and longitudinal studies are recommended to assess the long-term behavioral impact and explore digital adaptations to increase accessibility and sustainability.

### CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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### DECLARATION OF ARTIFICIAL INTELLIGENCE USE

This study utilized artificial intelligence (AI) tools during the manuscript preparation process. Specifically, ChatGPT (OpenAI, USA) was employed to assist with language refinement, including improving grammar, sentence structure, and readability of the manuscript, as well as for outline organization. Additionally, Canva Pro (Canva Pty Ltd, Australia) was used for visualization support, including the design enhancement of illustrative figures. We confirm that all AI-assisted processes were critically reviewed by the authors to ensure the integrity, accuracy, and reliability of the final content. The final decisions, interpretations, and conclusions presented in this article were made solely by the author.

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