ORIGINAL ARTICLE

Health Education for Diabetes Medication Adherence via the Whatsapp Messaging App (WEDMA) Module: A Content Validity Study

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ABSTRACT

Introduction: Medication non-adherence is still a substantial setback to better health outcomes for diabetic patients. Based on Health Belief Model (HBM) a practical health education module using WhatsApp messaging app called WEDMA was developed where the focus is on diabetes medication adherence among uncontrolled type II diabetes patients in Malaysia. This study aimed to examine the validity of the module content utilizing a systematic approach. **Methods:** The module for health education on diabetes medication adherence among uncontrolled type II diabetes patients consisted of 12 domains was systematically validated by a panel of experts for content validation in six consecutive steps. The proportion of experts who gave a rating of 3 or 4 was used to calculate the item content validity index (I-CVI). The I-CVIs were averaged to create the scale content validity index (S-CVI/Ave) and scale content validity index based on the universal agreement (S-CVI/UA) was used as a tool evaluate the module. **Results:** For all 36 items of the 12 domains of the WEDMA module, the I-CVIs ranged between 0.86 and 1.0, indicating an acceptable content validity. The S-CVI/Ave scored 0.98 and the S-CVI/UA scored 0.83 met acceptable values. **Conclusion:** The content validating study indicated that the newly developed WEDMA module is acceptable good module to be implemented for HBM based WhatsApp messaging app health education intervention to improve diabetes medication adherence in practical diabetes self-management.

Keywords: Content validity index; Diabetes health education; Health Belief Model; WhatsApp messaging app

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INTRODUCTION

The World Health Organization estimates that more than 346 million people globally have diabetes in 2018, and that if effective treatment measures are not taken, that figure is expected to quadruple by the end of 2030 (1). In line with the global trend, Malaysia's prevalence of type II diabetes mellitus (T2DM) rose from 11.6 to 17.5% over the past ten years, and by 2030, 2.48 million people in the country are anticipated to have the disease (2,3). Observational studies and meta-analyses have shown that people with uncontrolled diabetes (classified as HbA1c more than 6.5%) are more likely to develop cardiovascular disease and eventually death than those with managed diabetes (4).

The World Health Organization recommends health education to motivate and provide personalized training in the use of cognitive and behavioral strategies that support adherence behaviours in patients with chronic diseases (5). A strategy for promoting and reinforcing the understanding of moral concepts in the setting of treating diabetic patients is through education on disease management (6). According to studies, T2DM individuals don't comprehend their disease, which may affect how effectively the treatment plan is adopted and incorporated (6–8). It is crucial to remember that about 50% of people with chronic diseases do not adhere to their recommended medication treatments (9).

For individuals with chronic illnesses, medication non-adherence continues to be an important hindrance to improved health outcomes (10). One of the best strategies to health education is integrating the Health Belief Model (HBM), which focuses primarily on the adoption of behaviours to prevent illness as well as its complications (11). It has become one of the most important and accurate models used to

determine the relationship connecting health beliefs and behaviours. According to studies, the HBM and its components are associated to medication adherence by means of self-care practises (12,13).

There are currently a limited number of studies in Malaysia, especially in Sabah, that are aimed at self-care practises among T2DM patients (14). In order to enhance patients' quality of life, morbidity, and mortality, research is required on innovative approaches to health education. WhatsApp messaging apps, among numerous other messaging applications or "Messengers," enables users to converse while simultaneously passing along and receiving documents as well as multimedia material including picture, video, and sound recordings. In the age of the fourth industrial revolution, these latter qualities make the WhatsApp messaging app useful for distant sharing of information for health education. In this regard, a recently important study has emphasized the many advantages of using the WhatsApp messaging app as an adjunctive tool for mobile health (mHealth) (15–17).

Based on the HBM, a practical health education module via WhatsApp messaging app called WEDMA was created in this study with the goal of improving diabetes medication adherence among uncontrolled T2DM patients in Malaysia. The health education intervention will be sent each week to the patients using the WhatsApp messaging app for 12 weeks in a row. Information pertaining diabetes medication adherence will be disseminated via texts, infographics, and videos. The materials from Diabetes Education Manual 2020 by Malaysian Diabetes Educators Society have been modified and added to in this module as healthcare professionals are urged by the Malaysia Ministry of Health to make full use of this useful resource in order to raise the standard of Malaysia's diabetes education (18). The developed module needs to have its content validated by experts before it can be used in real-world settings, according to the study's target population and fulfilling the requirements for diabetes patients in Malaysia. The objective of this study is to assess the validity of the modules' content using a systematic process by engaging with a panel of subject matter experts.

MATERIALS AND METHODS

Development of the WEDMA Module
A panel of experts from the Ministry of Health and Universiti Malaysia Sabah were consulted in order to construct the intervention module. For its project to have the most beneficial effect and able to be sustained, it is intended to be integrated into the current frameworks already present in health clinics. The six core HBM components—perceived susceptibility, perceived severity, perceived benefits perceived

barriers, self-efficacy, and cues to action—have been incorporated into the intervention modules through the use of education and behavioural approaches to encourage sustainable behavioural change.

The content of the module consists of 12 domains which represent the 12 weeks of health education intervention that contain a total of 36 items. The development of the intervention module also taken into account the World Health Organization guidelines, the Center for Disease Control and Prevention guidelines, literature reviews and adaptation with adjustment from the Malaysian Diabetes Educators Society's Diabetes Education Manual 2020.

The Content Validity Process
We used an expert review as a validation approach for our study with the goal of validating the WEDMA module. An approach known as an expert review involves soliciting judgement and insights on a given concept from a number of subject matter experts (19). The quantitative approach was chosen for this investigation, and data collection was a survey. This approach was selected since all of the data analysis was done quantitatively. Using content validity index (CVI), we quantitatively assessed the WEDMA module's content validity (20). An instrument that was adopted from Yusoff (21) and used in the content validity test process. When evaluating expert opinions of the materials in the form of quantitative data, a questionnaire instrument is frequently utilized (22). As such, it has been hypothesized that using a questionnaire as the research tool for evaluating the WEDMA module's content validity is pertinent and acceptable for this study.

The evaluation for CVI was divided into six steps: the first step - developing a form for content validation, the second step - choosing expert review panels, the third step - carrying out content validation, the fourth step - reviewing domain and items, the fifth step – scoring for each item and the sixth step - calculating the CVIs (21).

First Step: Developing a Form for Content Validation
We developed a configured content validation form that made sure the review panel was made aware of expectations and that the required work was communicated clearly. The WEDMA module was briefly described along with concise descriptions of its constructs. A four-point Likert scale rating was used for the scoring of each item's relevance.

Second Step: Choosing Expert Review Panels
It is practical to have a panel of subject experts assess the content validity through reviewing each outlined item's relevance individually and critically (23,24). Yusof recommended a minimum of two and a maximum of nine experts (21). The recommendation for the quantity on the number of experts and their

Table I : The recommendation for quantity of experts and its implication on the acceptable cut-off score of CVI according to Yusoff (1)

Quantity of experts	Acceptable CVI values
Two	At least 0.80
Three to five	Exactly 1.0
At least six	At least 0.83
Six to eight	At least 0.83
At least nine	At least 0.78

effect on the CVI cutoff scoring are summarized in Table I. Given the need to assess the validity of the module's content, the experts were purposely picked through email invitations based on their knowledge, credentials, and scholarly works. For the content validation of this module, a panel of seven experts comprised of university lecturer, public health specialists, family medicine specialist, medical officer and pharmacist who have vast experience in handling patients with diabetes. To demonstrate the breadth of competence for the entire module's area, the backgrounds of the experts recruited for expert judgement review are presented in Table II. All subsequent communication with experts was done via email once they had confirmed and consented to take part in the study.

Third Step: Carrying Out Content Validation
After granting their consent, experts received the validation form and were informed of its contents. The WEDMA module's introduction, which covered the module's goals and learning objectives, was provided to the review panel of experts together with softcopies of the content validation forms to ensure that they would have established expectations and a grasp of the project.

Fourth Step: Reviewing Domain and Items
The experts were tasked to critically scrutiny the

domain and its items prior to evaluating every item. Experts are suggested to include written commentary to increase the items' relevance to the intended domain. The domain and its items are refined in response to any comments.

Fifth Step: Scoring for Each Item
All experts received an email requesting them to complete the item-level CVI (I-CVI) form (25). On a scale of one to four, the experts determined the significance of each item where 1 = not relevant, 2= somewhat relevant, 3 = quite relevant and 4 = highly relevant. Neutral response was completely ruled out with the usage of the four-point Likert scale approach, which within a small group of experts could have a significant buffering influence on the study's conclusions. Each expert gave a free-text comment and gave a relevancy score to each item. The CVI value of each item (based on individual items) was evaluated.

Sixth Step: Calculating the CVIs
The following steps were taken in the analysis of each expert response: (i) individual item scores were determined; and (ii) particular item ratings were used to determine the overall concept. The I-CVI and the Scale-level CVI (S-CVI) and are the two CVI types of that have been outlined (26). The S-CVI can be further calculated into the average of the I-CVI scores for all items (S-CVI/Ave) and S-CVI/UA. The relevance rating was formerly recorded as 1 (on a relevance scale of 3 or 4) or 0 (on a relevance scale of 1 or 2). The relevance ratings of the item scale given by the seven experts are displayed in Table III to demonstrate how the various CVI indices used in this study were calculated. The proportion of scale items that achieve a 3 or 4 on the relevance scale from all experts is known as the S-CVI/UA. The universal agreement (UA) score for an item is 1 when all experts agree on it. Otherwise, the UA value is 0 (21). We improved the items for each of the WEDMA module's 12 domains using the qualitative comments by the experts. Following this, all findings were

Table II : Expert's background

Expert's title/ Post		Institution	Expertise
E1:	Associate Professor	Universiti Malaysia Sabah (UMS), Sabah	Public Health; Non-communicable disease (NCD)
E2:	Health Education Officer	Ministry of Health (MOH), Malaysia	Health education; diabetes education
E3:	Public Health Physician	Ministry of Health (MOH), Malaysia	Public Health; NCD, Diabetes mellitus (DM)
E4:	Principle Assistant Director	Ministry of Health (MOH), Malaysia	Public Health; NCD, DM
E5:	Family Medicine Physician	Ministry of Health (MOH), Malaysia	Family Medicine, DM
E6:	Pharmacist	Ministry of Health (MOH), Malaysia	DM treatment pharmacology, Diabetes Medication Therapy Adherence Clinic (DMTAC)
E7:	Medical Officer	Ministry of Health (MOH), Malaysia	National Diabetes Registry (NDR) district champion, DM

Table III : CVI results

Item	Content	E1	E2	E3	E4	E5	E6	E7	Expert to Agreement	I-CVI*	UA
1	Knowing about diabetes medication adherence	1	1	1	1	1	1	1	7	1	1
2	The reason for diabetes medication adherence	1	1	1	1	1	1	1	7	1	1
3	Feeling the risk of non-adherence	1	1	1	1	1	1	1	7	1	1
4	Stating the consequences of non-adherence in the physical, psychological, social, and economic aspects	1	1	1	1	1	1	1	7	1	1
5	Highlighting the severity of the consequences of non-adherence	1	1	1	1	1	1	1	7	1	1
6	Identifying the benefits of diabetes medication adherence	1	1	1	1	1	1	1	7	1	1
7	Trying to persuade the reduction in perceived medication non-adherence	1	1	1	0	1	1	1	6	0.857143	0
8	Providing some educational solutions to minimize the perceived medication non-adherence	1	1	0	1	1	1	1	6	0.857143	0
9	Defining the meaning of the self-efficiency and its significance in diabetes medication adherence	1	1	1	1	1	1	1	7	1	1
10	Verbal encouragement to promote the feeling of efficiency	1	1	0	1	1	1	1	6	0.857143	0
11	Using the ways to enhance self-efficiency including simplifying the behaviour, others' experience on diabetes medication adherence	1	1	0	1	1	1	1	6	0.857143	0
12	Others' experience on diabetes medication adherence	1	1	1	1	1	1	1	7	1	1
13	Providing ways to control time and stress and its significance in promoting the sense of efficiency and diabetes medication adherence	1	1	0	1	1	1	1	6	0.857143	0
14	Acting according to the advice of the health experts to diabetes medication adherence	1	1	1	1	1	1	1	7	1	1
15	In this session, ask the patient to express their experience and consequences of diabetes medication adherence	1	1	1	1	1	1	1	7	1	1
16	Definition of healthy eating from MDES Diabetes Education Manual 2020	1	1	1	1	1	1	1	7	1	1
17	General recommendations of healthy eating adapted from MDES Diabetes Education Manual 2020	1	1	1	1	1	1	1	7	1	1
18	Definition of physical activity and exercise from MDES Diabetes Education Manual 2020	1	1	1	1	1	1	1	7	1	1
19	General recommendations of physical activity and exercise adapted from MDES Diabetes Education Manual 2020	1	1	1	1	1	1	1	7	1	1

20	Definition of medication from MDES Diabetes Education Manual 2020	1	1	1	1	1	1	1	7	1	1
21	General recommendations of medication adapted from MDES Diabetes Education Manual 2020	1	1	1	1	1	1	1	7	1	1
22	Definition of self-monitoring from MDES Diabetes Education Manual 2020	1	1	1	1	1	1	1	7	1	1
23	General recommendations of self-monitoring adapted from MDES Diabetes Education Manual 2020	1	1	1	1	1	1	1	7	1	1
24	Definition of risk reduction from MDES Diabetes Education Manual 2020	1	1	1	1	1	1	1	7	1	1
25	General recommendations of risk reduction adapted from MDES Diabetes Education Manual 2020	1	1	0	1	1	1	1	6	0.857143	0
26	Feeling the need to diabetes medication adherence.	1	1	1	1	1	1	1	7	1	1
27	Stating the consequences of non-adherence in the physical, psychological, social, and economic aspects,	1	1	1	1	1	1	1	7	1	1
28	the way of occurrence long-term and short-term complications,	1	1	1	1	1	1	1	7	1	1
29	highlighting the severity of the consequences of non-adherence.	1	1	1	1	1	1	1	7	1	1
30	Identifying the benefits of diabetes medication adherence.	1	1	1	1	1	1	1	7	1	1
31	Providing some educational solutions to minimize the perceived medication non-adherence,	1	1	1	1	1	1	1	7	1	1
32	Defining the meaning of the self-efficiency and its significance in diabetes medication adherence,	1	1	1	1	1	1	1	7	1	1
33	verbal encouragement to promote the feeling of efficiency,	1	1	1	1	1	1	1	7	1	1
34	providing ways to control time and stress and its significance in promoting the sense of efficiency and diabetes medication adherence	1	1	1	1	1	1	1	7	1	1
35	Acting according to the advice of the health experts to diabetes medication adherence,	1	1	1	1	1	1	1	7	1	1
36	In this session, ask the patient to express their experience and consequences of diabetes medication adherence	1	1	1	1	1	1	1	7	1	1

S-CVI/Ave*	0.97619	
S-CVI/UA*		0.833333

Proportion relevance	1	1	0.861111	0.972222	1	1	1		
S-CVI/Ave*	Average proportion of items judged as relevance across 7 experts							**0.976190476**	

Table IV : Summary of analysis of experts' comment

Comments from the experts
Adherence is important issue for oneself and consequences of it
Explanation to patients regarding the time allocation for physical exercise and its importance in diabetes medication adherence
To give examples of the recommended physical exercise
The general recommendations should be as simple and concise as possible
All items are relevant
To add individual monetary or financial loses as a result of non-adherence

Table V : Summary of the WEDMA intervention module

Week	Target construct	Content
1	Knowledge and perceived susceptibility	Knowing about diabetes medication adherence, the reason for diabetes medication adherence and feeling the risk of non-adherence.
2	Perceived severity and perceived benefits	Stating the consequences of non-adherence in the physical, psychological, social, and economic aspects, highlighting the severity of the consequences of non-adherence and identifying the benefits of diabetes medication adherence.
3	Perceived barriers and self - efficacy	Trying to persuade the reduction in perceived medication non-adherence, providing some educational solutions to minimize the perceived medication non-adherence, defining the meaning of the self-efficiency and its significance in diabetes medication adherence, verbal encouragement to promote the feeling of efficiency, using the ways to enhance self-efficiency including simplifying the behaviour, others' experience on diabetes medication adherence, others' experience on diabetes medication adherence, providing ways to control time and stress and its significance in promoting the sense of efficiency and diabetes medication adherence.
4	Cues to action	Acting according to the advice of the health experts to diabetes medication adherence, and in this session, ask the patient to express their experience and consequences of diabetes medication adherence.
5	Healthy eating	Definition and general recommendations of healthy eating adapted from MDES Diabetes Education Manual 2020.
6	Physical activity and exercise	Definition and general recommendations of physical activity and exercise adapted from MDES Diabetes Education Manual 2020.
7	Medication	Definition and general recommendations of medication adapted from MDES Diabetes Education Manual 2020.
8	Self-monitoring	Definition and general recommendations of self-monitoring adapted from MDES Diabetes Education Manual 2020.
9	Risk reduction	Definition and general recommendations of risk reduction adapted from MDES Diabetes Education Manual 2020.
10	Recap: Perceived susceptibility and perceived severity	Feeling the need to diabetes medication adherence, stating the consequences of non-adherence in the physical, psychological, social, and economic aspects, the way of occurrence long-term and short-term complications, and highlighting the severity of the consequences of non-adherence.
11	Recap: Perceived benefits and perceived barriers	Identifying the benefits of diabetes medication adherence and providing some educational solutions to minimize the perceived medication non-adherence,
12	Recap: Self – efficacy and cues to action	Defining the meaning of the self-efficiency and its significance in diabetes medication adherence, verbal encouragement to promote the feeling of efficiency, providing ways to control time and stress and its significance in promoting the sense of efficiency and diabetes medication adherence, acting according to the advice of the health experts to diabetes medication adherence and in this session, ask the patient to express their experience and consequences of diabetes medication adherence.

examined among the co-investigators, and a decision-making consensus was reached with a minimum CVI of 0.83 for acceptance regarding item removals, modifications, and additions (21,27).

RESULTS

The expert's results have produced good outcomes. All seven experts have participated to judge the

content validity of the module. The outcomes for each construct identified on the content validity form are presented in Table III. For all 36 items of the 12 domains of the WEDMA module, I-CVIs ranged between 0.86 and 1.0, indicative of an acceptable content validity. An item that received 100% expert agreement received a score of 1 for the universal agreement. Item 7, 8, 10, 11, 13 and 25 received a score of 0 for the universal agreement because not all experts agreed, and an I-CVI score of 0.86 was documented. The S-CVI/Ave scored 0.98 and S-CVI/UA scored 0.83, met acceptable CVI values. Based on these results, we concluded that I-CVI, S-CVI/Ave and S-CVI/UA achieved a satisfactory level. Thus, the validation of WEDMA module obtained an optimal level of content validity.

Expert comments have been collected and reviewed for the WEDMA module as shown in Table IV. Although the content validation of the module required no correction, the comments from the experts was still taken into consideration. To summarized, all 36 items were remained unchanged. Table V shows the final version of the module's content.

DISCUSSION

The study shows a demonstration of the content validity of the WEDMA module being successfully completed by a panel of experts through a robust procedure of content validation. This module also conforms to HBM, a behavioural theory to improve adherence to T2DM management. In addition, this module also obtains the views and agreement of experts in the design and development of WhatsApp messaging app's health education materials to help patients and medical practitioners achieve the desired diabetes treatment outcomes.

Content validity is the extent to which a measurement correctly represents the specific intended domain of content (22). According to Gaur & Gaur, in order to determine whether a module's content is valid, researchers must first identify the whole study domain that must be covered by experts before determining whether the module under consideration accurately represents that domain (28). A subject-matter expert, commonly referred to as a content specialist or subject-matter specialist, is someone who is knowledgeable about a specific content field. The information in Table II about the backgrounds of the experts demonstrates that the professional experience of the experts covered the topic area (content knowledge) of this current study, and they were also knowledgeable in evaluating the WEDMA module for education T2DM patients to adhere to diabetes treatment.

During the validity evaluating procedure, there are certain considerations that every researcher needs to keep in mind. This needs to be done in order for the built-in module to function as intended when the study is actually being conducted. One of the considerations to take into account is determining the validity domain of the module. The validity level of the module may be determined by gathering insight from experts and calculation of the content validity using the CVI. The effectiveness of the module must also be determined at the judgement evaluation step in order to identify how to improve the final product until it reaches the desired level of quality.

Routine use of educational tools and instructions aids patients in learning more about diabetes mellitus and serves as the foundation for a new self-care routine about the disease process and management, whereas inadequate information negatively impacts patients' compliance with treatment (29–31). Diabetes education was found to be crucial for diabetic patients managing their own care (32). A review of 12 studies found that self-care education programmes were effective in improving glycemic control, lipid profile, BMI, and blood pressure control, lowering the risk from developing diabetes complications, medication adherence, behaviour changes, and quality of life (33).

Health practitioners at public healthcare facilities are frequently under time pressure and find it challenging to give thorough patient education (34,35). This WEDMA module might lessen some of this burden because patients should have sufficient understanding and self-empowered to ask questions after getting the weekly WEDMA module via the WhatsApp messaging app. This would also save time for health practitioners' because they won't have to give patients all the information during appointments.

Mobile Health, or mHealth, is the effort that experts in the fields of health and technology make to create apps that can influence health, help patients, and enhance healthcare capabilities using mobile devices. A study in Brazil showed that most people do not use these types of apps (36). Duque starts from an existing app (i.e. WhatsApp messaging app) that is used by 99% of Brazilian smartphone users rather than creating a new app and attempting to persuade consumers to embrace it and her study shows how WhatsApp messaging app can be used to provide a platform for inclusive, effective, and ready-to-use medical practises in a straightforward and affordable manner (36). By using WhatsApp messaging app for health education practises, obstacles to learning and utilising new health apps are eliminated, but it also acknowledges the importance of its use by individuals.

In comparison to giving information on health presented as text messages, giving it to subjects with low health literacy through voice and video communication may be more effective at improving

memory for the knowledge and attitudes that will influence behavioural practices (37). If the video includes the written language of what the speakers are saying, the delivery of health information will be improved (38). Therefore, by integrating audio-visual materials in the health education module, improvement on patients' health, learning, and motivation, increased perceived benefits and decreased perceived barriers to self-care management can be observed (39).

Social media has evolved into a useful tool for individuals with diabetes to improve their capacity for self-management. Patients' adherence to diabetes medication are expected to actively participate in health decision-making and be motivated to maintain healthy behaviours in order to avoid complications from T2DM. The quality of life can be improved by extending and enriching them with effective delivery of practical knowledge that can be applied in their daily lives. Successful implementation at the primary healthcare level is interpreted as a practical health education intervention that can be replicated to promote diabetes medication adherence. Diabetes educators will need efficient tools to assist patients in following their prescription treatment as diabetes prevalence in Malaysia continues to rise.

CONCLUSION

The study's objective is to assess the validity of the module's content. The WEDMA module was developed in an effort to improve patients' diabetes medication adherence. We can conclude from the study's findings that the I-CVI, S-CVI/Ave, and S-CVI/UA all meet acceptable levels, indicating that the module's content validity is satisfactory. The findings of this study indicated that the WEDMA module appears to be an acceptable good module to implement for health education intervention in practical diabetes self-management. Based on expert scores, analysis results indicate that this module has very good validity. As a consequence of this, during the final phase of summative assessment, research on the successful implementation of this WEDMA module in the development of a health education intervention via the WhatsApp messaging app to improve diabetes medication adherence will be carried out in an actual clinical trial.

This study will offer findings that can lead to new information and innovative solutions about how to promote diabetes medication adherence not just in Malaysia but throughout the world by using a practical messaging platform like the WhatsApp messaging app. Present health programmes and policies across the nation and its adjacent countries place an emphasis on curative medicine. Due to demographic and epidemiological changes, there is a need for additional research on innovative and acceptable combinations of health services. This study fills in the gap of lack of evidence-base to help the government particularly in healthcare sector in response to future planning of healthcare services delivery.

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