ORIGINAL ARTICLE

Theory of Planned Behavior Constructs for Covid-19 Booster Dose Vaccination Among Malaysian Adults' Population: An Exploratory Analysis

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ABSTRACT

Introduction: The Theory of Planned Behavior (TPB) construct is recommended by the World Health Organization to assess intention for vaccination; however, there is yet a validated instrument in the context of booster dose Covid-19 vaccination in Malaysia. The purpose of the present study is to translate and investigate the factorial validity and internal reliability of the TPB construct for booster dose Covid-19 vaccination (TPB-BDV) questionnaire in Malaysia. **Materials and methods:** In the pre-testing of the study, five experts and 40 Malaysian adults respectively rated the content and validity index of all 11 items of the translated questionnaire in Malay version. Next, 160 Malaysian adults completed the Malay version of Theory of Planned Behavior- Booster Dose Vaccination (TPB-BDV) questionnaire via online. **Results:** In the pre-testing phase, Content Validity and Face Validity Index for 10 items in Malay version of TPB-BDV achieved cutoff mean score >3.0 for relevancy, clarity, ambiguity, and simplicity. Meanwhile, Item 8 scored low on relevancy. In the main study, exploratory factor analysis suggested three factors consisting of a final 10 items (without Item 8) which accounted for 74.0% of the total variance. The three factors were Attitude (5 items), Subjective Norms (3 items), and Perceived Behavioral Control (2 items). The internal reliability ranged from a = 0.83 to a = 0.93, with an overall value of a = 0.90. **Conclusion:** The findings suggest that the 10-items Malay version of TPB-BDV is valid and reliable to measure the individual decision in taking the Covid-19 booster-dose vaccine among Malaysian adult population.
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Keywords: Theory of Planned Behavior, Covid-19 vaccine, Booster dose, Validation, Health decision-making, Attitude, Questionnaire

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INTRODUCTION

The World Health Organization declared a public health emergency of international concern on January 30, 2020, upon the Coronavirus disease (Covid-19) outbreak, an infectious disease caused by the SARS-CoV-2 virus [1]. The challenge in mitigating the outbreak was that there was no cure for Covid-19, and the only option was prevention [2]. The deliveries of Covid-19 vaccination began on December 14, 2020 [3]. Starting from April 21, 2022, the Ministry of Health Malaysia outlines that the individual needs to complete two primary doses of Covid-19 to be considered fully vaccinated [4].

Failure to complete the Covid-19 vaccination would limit access to various services, such as dining at restaurants and using public transportation [4,5]. On October 13, 2021, the administration of the Covid-19 booster dose vaccine started to roll out in Malaysia [6]. However, different from the primary doses, where it is compulsory to complete the vaccination, the intake of Booster Dose of Covid-19 vaccination is voluntary [7]. While 98.2% of adults' Malaysian population completed two primary doses of the Covid-19 vaccine, only 59.0% of them took the booster dose [8]. A low acceptance rate of booster dose Covid-19 vaccination was found, particularly among Southeast Asian countries (52.0%), including Malaysia (43.0%) [9,10].

Since the Covid-19 booster dose vaccine is encouraged, but not deemed compulsory by the government [7], it is important to understand the complex interplaying

factors that influence one's decision to receive the vaccine to ensure booster dose vaccination coverage. Psychological variables of vaccination intention, particularly those based on the psychological theory of health behavior change, help in designing effective vaccination campaigns [11,12].

In learning about human health decision-making related to vaccination, the Strategic Advisory Group of Experts on Immunization (SAGE), a group of experts charged with advising the World Health Organization with overall global policies, strategies, research, and deliveries of vaccination, has recommended the use of the Theory of Planned Behavior (TPB) in understanding why some individuals agree to vaccination while others do not [12]. The TPB theorizes that people are more likely, if they have a positive view towards the behavior, experience social pressure (subjective norm), and perceive the opportunity and ability to overcome barriers to action [13,14].

The TPB is a classic psychological theory in health behavior and has been used to study health behaviors, including binge drinking, smoking, contraception, and immunization [15, 16, 17, 18]. Empirical evidence shows that the TPB model accounted for 54.0 to 54.3% of the variance in vaccination intention [14, 19]. Vaccination intention is an essential predictor of vaccination, and the intention is determined by attitude, social norms, and perceived behavioral control [13]. The SAGE Working Group proposed a questionnaire based on the variables in the Theory of Planned Behavior to understand the psychological variables of an individual's decision to vaccinate [12].

Various studies have been conducted to understand Malaysians' acceptance of Covid-19 booster dose vaccination; however, most studies are surveys based on a combination of fragmented descriptive variables [10, 20]. There is yet a valid and reliable instrument for measuring the complex psychological variables that may influence Malaysians' decisions to take the Covid-19 booster dose vaccine. The use of the Theory of Planned Behavior constructs for Vaccination (TPB-BDV) questionnaire recommended by the SAGE Working Group is appealing as it is based on a solid psychological theory and is brief with only 11 questions [12]. However, there is no existing data on its validity and reliability, especially among the Malaysian population, and in the context of Covid-19 booster dose vaccination. Hence, the present study aims to translate and validate the planned behavior theory-based questionnaire specifically for the Covid-19 Booster Dose Vaccination instrument in the Malay language version for further research and interventions among Malaysians.

MATERIALS AND METHODS

Study Design and Participants

The present study employed a cross-sectional study design involving two phases. The first phase focused on translation and establishing the content and face validity of the translated questionnaire, while the second phase investigated its factor structure and internal reliability.

In the first phase, backward and forward translation of the questionnaire was performed. Both versions were reviewed and revised for comparability to ensure the semantic consistency of the translated Malay version.

Next, to establish the content validity, five experts from the field of psychology, medicine, and public health were invited to rate the translated Malay version questionnaire's Content Validity Index (CVI). Meanwhile, to establish the face validity of the questionnaire a minimum number of 25 to 75 respondents were recommended at this stage [21]. Therefore, this study aimed to recruit 40 respondents for the Face Validity Index (FVI) to suit the study timeframe and participants' availability. In the second phase of the study, the recommended optimum sample size for EFA was 10 to 15 subjects per item [22]. Hence, the present study aimed to have 110 to 165 respondents for the 11 items questionnaire.

Purposive sampling was performed through an online survey using social media platforms such as Instagram and Facebook, as well as university group Telegram channel, to reach the targeted potential respondents who fulfill the inclusion and exclusion criteria. All participants were Malaysian adults (aged 18 years and above) who understood the Malay language and were reachable virtually during the data collection period were eligible. The study included only individuals who had completed the first and second doses of the Covid-19 vaccine. Individuals who were instructed by medical practitioners to avoid taking the Covid-19 booster dose vaccination were excluded from this validation study.

Measures

Content and Face Validity Index

The CVI and FVI are rating scales rating scale measuring the relevancy, clarity, simplicity, and ambiguity of the items in psychological instruments. Each instrument item was evaluated by more than one rater to determine whether it is relevant, clear, simple, and non-ambiguous for the demographic intended to be studied. The rating

was done on a 4-point Likert scale. An average score of below 3.0 indicates the need to revise the item [23].

Background Information Form

The background information form includes questions on respondents' sociodemographic and health-related information. The variables include gender, age, ethnicity, education, health status, personal experience of Covid-19, and Covid-19 vaccination history.

TPB Constructs for Vaccination (TPB-V)

The original validated TPB questionnaire is an 11-item measure of attitudes, subjective norms, and perceived behavioral control in English version, derived from Ajzen's (2005) Theory of Planned Behavior [13]. Examples of questions are "Vaccination against influenza is necessary" and "For me, vaccinating against influenza is possible". The response format is a 7-point Likert scale ranging from "Totally Disagree" to "Totally Agree". Three constructs measured in the questionnaire are attitude, subjective norm, and perceived behavioral control related to vaccination. The World Health Organization recommends the use of these items to study vaccination intention [12]. Even though the TPB questionnaire was initially created for influenza vaccination [12], it can be modified to suit other vaccinations, akin to the present study of how the questions were adapted to fit the Covid-19 booster dose vaccination perspective.

Procedure

All procedures performed in this study have been reviewed by the UniSZA Human Research Ethics Committee (Approval Code: UniSZA/UHREC/2022/392) that were in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Phase 1: Translation and Pre-Testing

An original English version of the TPB-BDV questionnaire was forward translated into Malay by two translators. One of the translators is a medical expert, while another is a bilingual person who has no prior knowledge about the context of the questionnaire. Next, the translated version was back-translated into English by an independent translator who is a native Malay speaker and knowledgeable in the English language. Finally, a panel of translators consisting of the two forward translators, a medical expert, and the researcher reviewed, amended, and finalized the Malay version of TPB-BDV questionnaire.

Next, an in-depth discussion on the clarity, ambiguity, and simplicity of the translated questionnaire was done and rated by five experts in the field of medicine, psychology, and public health to establish its content validity. A total of 40 pre-testing respondents were conveniently sampled to rate the FVI which measures the relevancy, clarity, ambiguity, and simplicity of the Malay version of TPB-BDV questionnaire to establish its face validity [23]. The cut-off FVI for each item criteria were set at 3.0 and above, to be decided as satisfactory [23].

Phase 2: Exploratory Factor Analysis (EFA) and Internal Reliability

To establish factorial validity and internal consistency, 160 respondents answered the translated Malay version of the instrument. The data collection period was from May 30, 2023, to July 24, 2023. All participation was voluntary and implied consent was given by the participants before they answered the online questionnaire.

Statistical Analyses

The R Studio version 1.4.1106 statistical software was used to analyze the data in the study. Descriptive statistics such as mean and percentage were used for demographic and pre-testing information. Preliminary analyses for EFA include the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMOS), Bartlett's Test of Sphericity, and inter-item correlation [24,25,26]. The number of factors retained in EFA was based on Scree Test, Horn's Parallel Analysis, and significant factor loading was set of over 0.32 [26]. Finally, Cronbach's Alpha coefficients were computed to evaluate the internal consistency of the questionnaire.

RESULTS

Phase 1: Translation and Pre-testing

Content Validity

To establish the content validity, five experts in the field of psychology (n = 2), medicine (n = 2), and public health (n = 1) evaluated the CVI and discussed the appropriateness of the translated questionnaire's content in measuring health behavior decision-making related to Covid-19 booster dose vaccination among Malaysian adults' population. The mean score for the relevancy, clarity, simplicity, and ambiguity of all 11 items in the questionnaire was above 3.0. During the discussion with the experts, two of the experts questioned the relevancy of Item 8 ("The cost of the booster dose Covid-19 vaccine is a barrier to getting vaccinated."); however, all experts achieved a consensus that the contents of all 11 items in the Malay version of TPB-BDV are suitable in measuring decision to take Covid-19 booster dose vaccination among adult Malaysian population.

Face Validity

Forty Malaysians with a mean age of 30.52 years (SD = 5.22 years) participated in the pre-testing; 55% of the participants were female, while 45% were male. All the participants were Malay. To establish face validity, all participants rated the FVI of 11 items of the translated questionnaire. Except for Item 8, all other 10 items achieved a mean score of above 3.0 for relevancy, clarity, simplicity, and ambiguity criteria. While Item 8

received a mean score of 4.0 for clarity, simplicity, and ambiguity, its mean score for relevancy was 2.95. Table I presents the mean score of CVI and FVI for each item in the Malay version of TPB-BDV questionnaire.

Table I: Mean scores of Content Validity Index (CVI) and Face Validity Index (FVI) for the Malay version of TBP-BDV

Criteria	CVI Mean Score	FVI Mean Score
Item 1: Most people who are important to me think that I should get vaccinated against Covid-19.		
Relevancy	4.0	3.6
Clarity	4.0	3.5
Simplicity	4.0	3.6
Ambiguity	4.0	3.4
Item 2: It is expected of me that I will get vaccinated against Covid-19.		
Relevancy	3.2	3.4
Clarity	3.2	3.2
Simplicity	3.4	3.2
Ambiguity	3.2	3.1
Item 3: The people in my life whose opinions I value would want me to get vaccinated against Covid-19.		
Relevancy	4.0	3.3
Clarity	3.6	3.2
Simplicity	3.6	3.2
Ambiguity	3.6	3.1
Item 4: For me, vaccinating against Covid-19 is possible.		
Relevancy	4.0	3.5
Clarity	4.0	3.5
Simplicity	4.0	3.6
Ambiguity	4.0	3.5
Item 5: If I wanted to take booster dose Covid-19 vaccine in the next 6 months, it would be easy.		
Relevancy	3.8	3.4
Clarity	3.8	3.2
Simplicity	3.8	3.4
Ambiguity	3.8	3.3
Item 6: How much control do you have over the decision to get vaccinated against Covid-19?		
Relevancy	4.0	3.8
Clarity	4.0	3.7
Simplicity	4.0	3.8
Ambiguity	4.0	3.7
Item 7: It is mostly up to me whether or not I take booster dose Covid-19 vaccine.		
Relevancy	4.0	3.6
Clarity	3.8	3.6
Simplicity	4.0	3.6
Ambiguity	4.0	3.6
Item 8: The cost of the booster dose Covid-19 vaccine is barrier to getting vaccinated.		
Relevancy	2.8	3.0
Clarity	4.0	3.0
Simplicity	4.0	3.1
Ambiguity	4.0	3.0
Item 9: Taking booster dose Covid-19 vaccine is necessary.		
Relevancy	4.0	3.6
Clarity	4.0	3.7
Simplicity	4.0	3.7
Ambiguity	4.0	3.5
Item 10: Taking booster dose Covid-19 vaccine is a good idea.		
Relevancy	4.0	3.6
Clarity	3.8	3.5
Simplicity	4.0	3.6
Ambiguity	3.8	3.5
Item 11: Taking booster dose Covid-19 vaccine is beneficial.		
Relevancy	4.0	3.6
Clarity	4.0	3.6
Simplicity	4.0	3.6
Ambiguity	4.0	3.6

Phase 2: Exploratory Factor Analysis

A total of 160 respondents was included in the main study. The mean age was 31.3 years (SD = 8.91 years). Table II summarizes the demographic information of the participants. With regards to health status, 81.9% reported having no health issues, while 18.1% of the participants reported having various health issues such as asthma, obesity, heart disease, diabetes, herpes, and eczema. Half of the participants (51.9%) had experienced being tested positive for Covid-19. All participants completed two doses of Covid-19 vaccination.

Table II: Demographic information of the main study participants for EFA (*n* = 160)

Characteristics	n (%)
Gender	
Female	73.1
Male	26.9
Race	
Malay	93.1
Chinese	4.4
Indian	0.6
Other races	1.9
Employment Status	
Students	20.0
Unemployed	6.2
Employed	71.9
Retirees	1.9
Level of Education	
High School Diploma	3.1
College Diploma	34.4
Bachelor's Degree	45.6
Master / Doctorate	16.9
Marital Status	
Single	48.1
Married	51.3

CONTINUE

Table II: Demographic information of the main study participants for EFA (*n* = 160). (CONT.)

Characteristics	n (%)
Marital Status	
Divorced/Widowed	0.6
Experience with Covid-19	
Ever tested positive for Covid-19	51.9

Exploratory Factor Analysis

The main study investigated the factorial validity of the Malay version of TPB-BDV questionnaire. The 11 items of the TPB-BDV were included in the factor analysis with oblique factor rotation. Inter-item correlation was conducted; items with too low (0.30) or too high (0.90) in correlations with other items were potentially problematic and would be considered to be removed [26]. In the preliminary analysis for EFA, a significant number of inter-item correlations with values greater than 0.30 were found, which indicates the suitability of the existing items for factor analysis. However, Item 8 was identified to have an inter-item correlation of below 0.30 with all the other items; hence, it was eliminated from further analysis.

The values of KMOS (0.85) and Bartlett's Test of Sphericity ($p < .001$) indicate the favorability of the dataset with 10-items Malay version of TPB-BDV [24,25]. The number of factors to retain was decided based on several criteria: 1) Parallel Analysis Scree Plot, 2) result of Horn's Parallel Analysis, 3) factor loading of above 0.33 for items in each factor, and 4) meaningful interpretation of individual items and its respective factors [26]. Figure 1 illustrates the Parallel Analysis Scree Plot of the 10 items of Malay version of TPB-BDV.

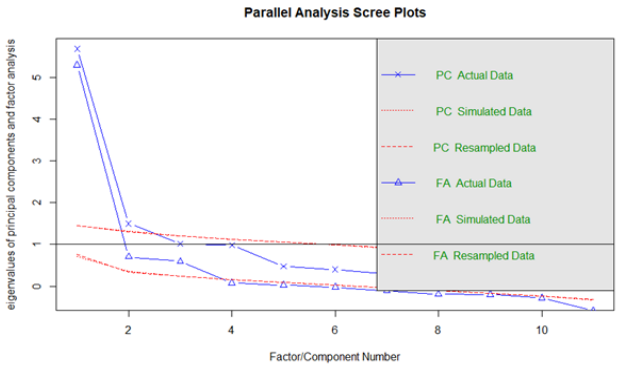

Figure 1: Parallel analysis scree plot of the Malay version of TPB-BDV

The EFA for the 10 items of Malay version of TPB-BDV yielded a three-factor structure, account for a substantial, overall 71% of the variance. Factor 1, which was labeled as Attitude accounted for 36% of the variance. Factor 2 which accounted for 23% of the variance was labeled as Subjective Norm. Finally, Factor 3, which accounted for 15% of the variance was labeled as Perceived Behavioral Control. Table III presents the factor loadings and internal consistency of the Malay version of TPB-BDV.

Table III: Factor loadings and internal consistency of the 10-items Malay version of TPB-BDV for booster dose Covid-19 vaccination (n=160)

No.	Item	Factor Loading	Cronbach's Alpha (*a*)	
	Factor 1 (Attitude)			
1.	For me, vaccinating against Covid-19 is possible (Item 4).	0.59	0.93	
2.	If I wanted to take booster dose Covid-19 vaccine in the next 6 months, it would be easy (Item 5).	0.63		
3.	Taking booster dose Covid-19 vaccine is necessary (Item 9).	0.77		
4.	Taking booster dose Covid-19 vaccine is a good idea (Item 10).	0.98		
5.	Taking booster dose Covid-19 vaccine is beneficial (Item 11).	0.99		
	Factor 2 (Subjective Norms)			
6.	Most people who are important to me think that I should get vaccinated against Covid-19 (Item 1).	0.95	0.88	**0.91**
7.	It is expected of me that I will get vaccinated against Covid-19 (Item 2).	0.70		
8.	The people in my life whose opinions I value would want me to get vaccinated against Covid-19 (Item 3).	0.70		
	Factor 3 (Perceived Behavior Control)			
9.	How much control do you have over the decision to get vaccinated against Covid-19? (Item 6)	0.82	0.83	
10.	It is mostly up to me whether or not I take booster dose Covid-19 vaccine (Item 7)	0.85		

Variance based on scree-plot: Factor 1 (36%), Factor 2 (23%), Factor 3(15%)
Bartlett's test are significant ($p<0.001$).

Internal Consistency

A Cronbach's Alpha analysis of the 10-item Malay version of TPB-BDV indicated that the instrument has a good internal consistency, with an overall value of 0.91. Generally, an alpha value of 0.70 and above is considered an indicator of adequate internal consistency [27]. The alpha values for Factor 1, Factor 2, and Factor 3 were 0.93, 0.88, and 0.83, respectively.

DISCUSSION

Overall, the findings serve as evidence to support the three-factor structure of the Malay version of TPB-BDV. The pre-testing of the translated questionnaire revealed that the Malay version of TPB-BDV has good content and face validity. Further, the EFA recommended three factors: Attitude, Subjective Norms, and Perceived Behavioral Control. The three-factor structure is comparable with the original English version of the questionnaire recommended by the WHO [12].

Nonetheless, different from the original TPB-BDV [12], the Malay version consists of only 10 items. One item, which was Item 8 ("The cost of the booster dose Covid-19 vaccine is a barrier to getting vaccinated"), was removed from the questionnaire due to a low inter-item

correlation with all other items in the questionnaire. The item also scored low on the relevancy criterion during the face validity testing. Two content validity experts also commented on the relevancy of Item 8 in the context of Covid-19 vaccination in Malaysia, considering the fact that the citizens may obtain the vaccine for free during the period of this study, which explains the low inter-item correlation.

The finding highlights the importance of conducting pre-testing and factorial validation before using a questionnaire on a new population since different publics have various settings that could affect their decisions in considering the booster dose for Covid-19 vaccination. Researchers from other countries who wish to translate or use the TPB-BDV questionnaire are encouraged to run a factor analysis on all 11 items, due to the the potential for differing national regulations regarding the enforcement of the Covid-19 vaccination and its subsidization.

While the present study found a three-factor structure like the original TPB-BDV, two items (Item 4 "For me, vaccinating against Covid-19 is possible." and Item 5 "If I wanted to take booster dose Covid-19 vaccine in the next 6 months, it would be easy."), were previously classified under the Perceived Behavioral Control factor in the original TPB-BDV, whereas in the Malay version of TPB-BDV, these mentioned items are sorted under the Attitude factor. Despite the being different than in the original study, the loadings' direction of the two questions related to the accessibility (Item 4) and easiness (Item 5) of engaging in the health behavior (i.e., taking a booster dose Covid-19 vaccine) in the Attitude factor are supported by a previous validation study on TPB, constructed for another health behavior (i.e., condom use) [28]. Confirmatory factor analysis and comparison of a set of logically nested models in Leach, Hennessy, and Fishbein's (2006) study suggested that an easy-difficult question is more suitable as an Attitude item [28].

Further findings in this study suggested that the Malay version of TPB-BDV has a good overall and individual factor internal consistency (0.90), which includes the great coherence of the Attitude, Subjective Norms, and Perceived Behavioral Control items and factors. Overall, the Cronbach alpha analysis of the Malay version of TPB-BDV suggested that the questionnaire is reliable for the Malaysian adult population, especially in the context of booster dose Covid-19 vaccination.

The present study has certain drawbacks. Most of the participants were Malay, which may cause the finding's generalizability to be constrained by the homogenous sample. Due to this, future studies may extend the validation on more diverse samples to produce more generalizable findings. Regardless, the present study is one of the first studies investigating the validity and reliability of the TPB constructs on the Covid-19 booster dose vaccination among the Malaysian population.

Exploring the construct validity of the Malay version of TPB-BDV allows for cross-cultural comparisons regarding Covid-19 vaccination intentions. Malaysia's collectivistic culture means that social norms within tight-knit communities can significantly impact vaccination decisions. Additionally, health decisions may be made collectively rather than individually, making it challenging to promote vaccination to entire groups [29]. Therefore, having a valid instrument that assesses the constructs of Subjective Norm and Perceived Behavioral Control among the Malaysian population may provide further insight into how these factors influence Covid-19 booster dose vaccination decisions. This, in turn, facilitates cross-cultural comparisons with other cultural contexts.

Another implication of the present study is the identification of an irrelevant item. Through the present study, it was found that Item 8 is extraneous in the context of Covid-19 vaccination in Malaysia, as the vaccines were offered at no cost to the public. Having an irrelevant item may compromise the content validity of the questionnaire. In addition, the irrelevant item may increase the length of the questionnaire and consequently increase respondent fatigue.

This study establishes a foundation for future research to further validate and enhance the assessment of vaccination intentions within the Malaysian context. Future studies may further establish the validity and reliability of the constructs explored in the present study through confirmatory factor analysis and concurrent validity. In addition, future studies may also consider adding items that are more culturally relevant to the Malaysian context such as religious and cultural beliefs that may fit into one of the constructs in the TPB-BDV questionnaire. Further validation and improvement of items may provide more insight into the credibility of the questionnaire among the population.

CONCLUSION

In conclusion, the findings suggested that the Malay version of TPB-BDV has good factorial validity and is reliable in measuring health decision-making, specifically in the context of taking a booster dose Covid-19 vaccine, at least among Malay adults in Malaysia.

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