Journal of Health and Nutrition Research
Vol. 4, No. 3, 2025, pg. 995-1004, https://doi.org/10.56303/jhnresearch.v4i3.503
Journal homepage: https://journalmpci.com/index.php/jhnr/index

e-ISSN: **2829-9760**

Construct Validity of Perceived Behavioral Control Instrument Among Patients with Coronary Artery Disease

Aan Nuraeni[1]*, Eka Sulistiani[2], Titin Sutini[3], Ristina Mirwanti[1], Ayu Prawesti Priambodo[1], Firman Sugiharto[4]

[1] Department of Medical Surgical and Critical Care Nursing, Faculty of Nursing, Padjadjaran University, Indonesia
[2] Faculty of Nursing, Padjadjaran University, Indonesia
[3] Department of Mental Health Nursing, Faculty of Nursing, Padjadjaran University, Indonesia
[4] Postgraduate Nursing Program, Faculty of Nursing, Padjadjaran University, Indonesia

Corresponding Author E-mail: aan.nuraeni@unpad.ac.id

ORIGINAL ARTICLES

Submitted: 10 June 2025

Accepted: 10 August 2025

Keywords:
Perceived behavioral control; Coronary heart disease; Rasch analysis; Construct validity; Psychometric instruments.

ABSTRACT

Perceived Behavioral Control (PBC) is a key construct in the Theory of Planned Behavior (TPB) that plays an important role in predicting adherence to lifestyle changes among patients with coronary artery disease (CAD). Although the role of PBC has been widely discussed in health behavior research, no instrument has been specifically developed and validated to measure PBC in patients with cardiovascular disease (CVD), particularly CAD. This study used the Rasch analysis approach to evaluate the construct validity and reliability of the Perceived Behavioral Control Scale Related to Cardiovascular Disease (PBCCVD). This was a cross-sectional study involving 92 post-hospitalization CAD patients selected through convenience sampling. The PBCCVD instrument consists of 22 items using a 4-point Likert scale, developed based on TPB theory and previous studies and validated by experts. Data analysis was conducted using Winsteps software, covering reliability, separation, fit statistics, and unidimensionality. The instrument demonstrated high reliability (Cronbach's alpha = 0.86; item reliability = 0.94; person reliability = 0.86). The item and person separation indices were 4.18 and 2.74, respectively. All items met the fit criteria. The explained variance was 34.9%, and the eigenvalue of the first contrast was 2.6054, indicating a possible additional subdimension. The PBCCVD is a reliable and reasonably valid instrument for measuring perceived behavioral control in CAD patients. Although there is an indication of another underlying dimension, the instrument can still be effectively used in both clinical and research settings.

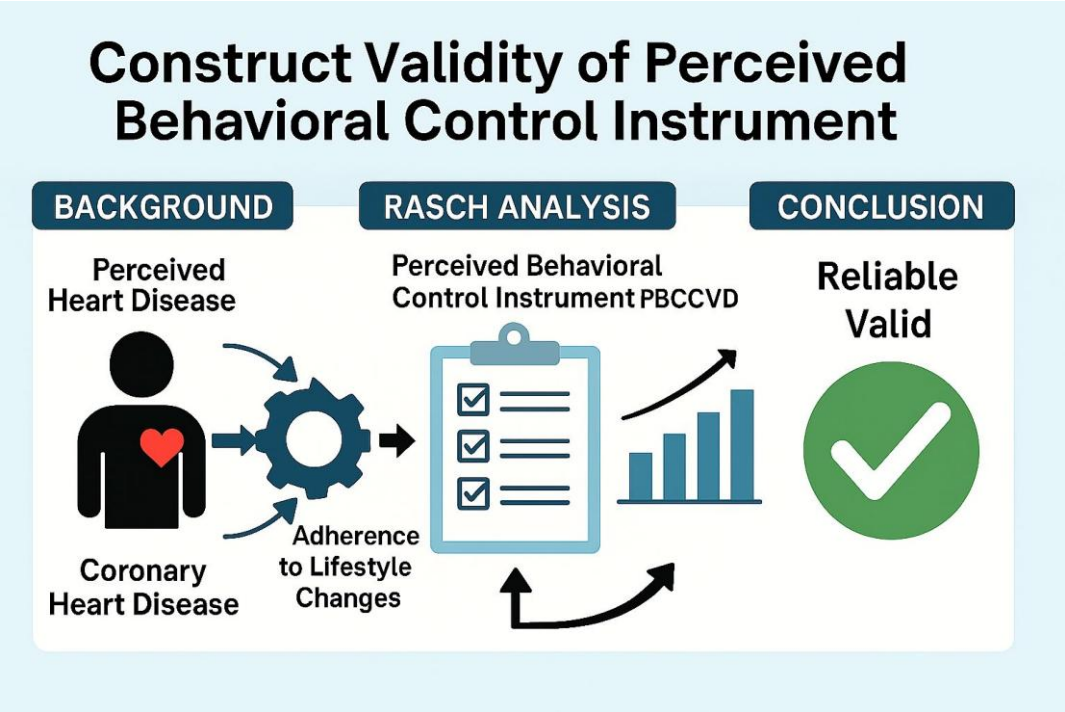
Key Messages:

- The PBCCVD instrument is a reliable measure of perceived behavioral control in CAD patients, aiding lifestyle change interventions.
- Rasch analysis confirmed the PBCCVD instrument's validity, measuring the intended construct unidimensionally with strong item and person separation, making it effective for clinical and research use.

Access this article online

Quick Response Code

GRAPHICAL ABSTRACT



INTRODUCTION

The Theory of Planned Behavior (TPB) developed by Ajzen can be used to understand the factors influencing dietary behavior(1). TPB explains that a person's intention to perform a behavior is determined by three main factors: attitude toward the behavior, subjective norms, and perceived behavioral control (PBC)(1). PBC is defined as the extent to which a person can control behavior, including secondary preventive behavior or behavioral control that can reduce recurrence or complications due to heart disease. Ajzen stated that individuals with high levels of PBC tend to have more self-confidence and greater control in maintaining healthy behaviors, even when faced with external and internal obstacles (2).

Several studies have also shown that PBC has a significant relationship with compliance with lifestyle changes, especially in secondary prevention efforts in patients with coronary artery disease (CAD). The lifestyle changes include regular physical activity, a heart-healthy diet, quitting smoking, and stress management (3–5). McEachan et al. state that individuals with high levels of PBC tend to perceive that they can control these behaviors even when facing external and internal obstacles (6). PBC is also a strong predictor of the intention and actualization of healthy lifestyle behaviors in cardiovascular populations (7).

Likewise, in post-hospitalization care, such as phase 2 and 3 cardiac rehabilitations, PBC is important in determining the patient's long-term adherence to healthy lifestyle recommendations. McEachan et al. in a Theory of Planned Behavior, meta-analysis showed that PBC is one of the most consistent predictors of changes in health behavior, including in heart patients(6). Nevertheless, to date, no instrument has been specifically developed and validated to measure Perceived Behavioral Control (PBC) in patients with cardiovascular diseases, either at the national or international level. Most existing instruments remain generic and fail to account for the unique physical, psychological, and socioeconomic conditions of this population. This limitation hampers healthcare providers, particularly nurses, in objectively assessing patients' readiness and perceived barriers in managing health-related behaviors.

Therefore, the development of a valid, reliable, and contextually appropriate instrument to measure PBC in cardiovascular patients is urgently needed. Such an instrument is expected to serve as an effective tool for behavioral assessment and intervention (8), ultimately supporting improved long-term health outcomes in post-treatment cardiovascular care.

The Rasch model is one of the modern approaches to psychometric measurement. This model has advantages in testing construct validity, unidimensionality, and the level of conformity between items and

https://doi.org/10.56303/jhnresearch.v4i3.503

respondents (9). Compared to the classical approach or classical test theory (CTT), Rasch analysis allows for testing whether each item in the instrument truly represents a consistent construct and can identify the quality of the items statistically and substantively (10). Based on the description, this study was conducted to evaluate the construct validity of the Perceived Behavioral Control Scale Related to Cardiovascular Disease (PBCCVD) using the Rasch analysis approach to evaluate whether this instrument can be used accurately and reliably.

METHODS

Study design

This quantitative study aims to develop and evaluate a measurement instrument designed to assess *Perceived Behavioral Control* (PBC) in patients with coronary artery disease (CAD) following hospitalization. The research follows an instrument development approach**,** which involves several key stages: constructing relevant items, validating the content through expert input, and testing the instrument's measurement quality using the Rasch model**.**

Sample and Data Collection

The population in this study consists of post-hospitalization CAD patients who have received knowledge about the management of CAD at one of the referral hospitals in West Java. The average number of visits per month is 103 people. A total of 92 respondents were selected using convenience sampling with specific criteria. The inclusion criteria in this study are: 1) Patients aged > 18 years, 2) Patients in full consciousness, and 3) Patients who have experienced a heart attack and hospitalization due to CAD. The data is secondary data from a study on the description of PBC in patients with CAD who have undergone treatment at the hospital.

The population in this study consists of post-hospitalization CAD patients who have received education about CAD management at one of the referral hospitals in West Java. The average number of visits to the cardiac outpatient clinic per month is approximately 103 individuals. A total of 92 respondents were selected using convenience sampling with specific inclusion criteria. The inclusion criteria for this study were: (1) patients aged over 18 years, (2) patients who were fully conscious, and (3) patients who had experienced a heart attack and had been hospitalized due to CAD.

Data collection was conducted in the cardiac outpatient clinic of the hospital. Prospective respondents were approached while waiting for their scheduled consultation. They were offered the opportunity to participate in the study by completing the PBC (Perceived Behavioral Control) instrument. Those who agreed were first given an informed consent form to read and sign. After providing consent, respondents were given the written instrument to complete independently.

The PBC instrument was self-administered, and respondents were instructed to read and respond to each statement based on their personal experiences and perceptions. The average time required to complete the instrument was approximately 5 minutes. During this time, research assistants were available nearby to provide clarification if needed, while ensuring that responses remained unbiased and self-directed. The data used in this study are secondary data derived from a previous study describing PBC in patients with CAD who had undergone treatment at the hospital.

Research Instrument

The Perceived Behavioral Control Scale Related to Cardiovascular Disease (PBCCVD) is a self-report instrument developed by the researcher based on the Theory of Planned Behavior proposed by Ajzen (8) and relevant literature on secondary prevention for patients with coronary artery disease (CAD). The instrument was designed to assess perceived behavioral control (PBC) in relation to post-hospitalization management of CAD.

To ensure content validity, the instrument underwent an expert panel review. A total of four experts participated in the process. Three were lecturers in medical-surgical and critical care nursing, with strong academic and clinical expertise in cardiovascular care and extensive research on health behaviors among CAD patients. The fourth expert was an academic in mental health nursing, who provided a behavioral science perspective aligned with the construct of perceived behavioral control. Each expert independently evaluated the instrument items for relevance, clarity, and conceptual alignment. All experts unanimously

https://doi.org/10.56303/jhnresearch.v4i3.503

agreed that the items were appropriate and adequately captured the construct of PBC in the context of CAD secondary prevention.

The final version of the PBCCVD instrument consists of 22 items, all of which are written as favorable statements—that is, agreement with the statements reflects a higher level of perceived behavioral control. A 4-point Likert scale is used for responses, ranging from 1 (Strongly Disagree) to 4 (Strongly Agree). No reverse-coded items were included, thereby ensuring that higher total scores consistently indicate stronger perceived control.

Although the full list of items is not presented in this manuscript due to ongoing intellectual property rights registration (Hak Kekayaan Intelektual/HKI), an overview of the instrument's twelve conceptual domains is provided. These domains cover critical aspects of secondary prevention for CAD and include:

1) Recognizing symptoms and prior experiences related to CAD
2) Participating in cardiac rehabilitation programs
3) Adhering to prescribed medications
4) Engaging in regular physical activity
5) Adopting a healthy diet (e.g., increasing fruit/vegetable intake, reducing fat consumption)
6) Maintaining an ideal body weight
7) Reducing salt intake through cooking modifications and limiting processed foods
8) Reducing sugar intake, particularly from sweetened foods and beverages
9) Quitting smoking and avoiding tobacco smoke exposure
10) Managing psychological stress through emotional expression and relaxation techniques
11) Utilizing personal strengths such as spirituality
12) Limiting alcohol consumption

To provide a clearer understanding of the instrument's scope and tone, selected sample items from the domains of healthy diet, salt reduction, and sugar intake are presented in the following section.

Table 1. Sample items from the domains of healthy diet, salt reduction, and sugar intake

Indicator	Sub-Indicator	Sample Item
PBC in healthy diet	Perceived ease in increasing fruit and vegetable intake	"I find it easy to increase my consumption of fruits and vegetables."
PBC in healthy diet	Perceived ease in avoiding fatty foods	"I find it easy to avoid high-fat foods such as red meat or organ meats."
PBC in reducing salt intake	Perceived ease in reducing dietary salt	"I find it easy to reduce salt in cooking and avoid consuming processed or canned foods."
PBC in reducing sugar intake	Perceived ease in limiting added sugar	"I find it easy to limit the intake of foods or drinks containing added sugars."

Data Analysis

Psychometric analysis of the PBCCVD instrument was conducted using Rasch modeling with Winsteps software. The analysis included evaluation of reliability, item and person fit, separation, and unidimensionality. Rasch-based person and item reliability values ≥0.80 and ≥0.90 respectively were considered acceptable (11). Infit and outfit mean square (MNSQ) values between 0.5–1.5 and standardized Z-scores (ZSTD) between –2.0 to +2.0 were used to assess fit (12). Separation indices ≥2.0 for persons and ≥3.0 for items indicate sufficient differentiation (Wright & Masters, 1982). Unidimensionality was evaluated using principal component analysis (PCA) of residuals, with acceptable criteria being ≥20% variance explained and first contrast eigenvalue <2.0 (13).

CODE OF HEALTH ETHICS

This study has received ethical approval with the approval letter number 499/UN6.KEP/EC/2019.

https://doi.org/10.56303/jhnresearch.v4i3.503

RESULTS

Characteristics of Respondents

This study presents the characteristics of respondents (Table 2) based on several demographic variables, employment status, and diagnosis history. The data reveals that most respondents are male (77.2%) and aged between 46 and 65 years (50%). Other age groups, such as 36-45 years and 18-35 years, represent smaller proportions, while 16.3% of respondents are over 65. Regarding marital status, most respondents are married (94.6%), with only 5.4% being unmarried. The respondents' educational backgrounds vary, with the largest group having completed intermediate education (46.7%), followed by higher education (35.9%) and basic education (17.4%).

Regarding employment, the majority of respondents (56.5%) are not working, while 43.5% are employed. Regarding diagnosis history, most respondents (82.6%) have been diagnosed with their condition for more than 6 months, indicating that they have been dealing with it for an extended period.

Table 2. Frequency Distribution of Respondent Characteristics (n = 92)

Characteristics		n (%)
Gender	Female	21 (22,8)
	Male	71 77,2)
Age	18 – 35 years old	2 (2,2)
	36 – 45 years old	8 (8,7)
	46 – 55 years old	21 (22,8)
	56 – 65 years old	46 (50)
	> 65 years old	15 (16,3)
Marital Status	Married	87 (94,6)
	Not Married	5 (5,4)
Educational Background	Basic	16 (17,4)
	Intermediate	43 (46,7)
	Higher education	33(35,9)
Employment	Working	40 (43,5)
	Not Working	52 (56,5)
Long time diagnosed	<6 months	16 (17,4)
	>6 months	76 (82,6)

Reliability Results

From Table 2, in the summary of items aspect, the item mean value is at 0.00 logit (SD = 0.20). The item reliability is 0.94, while the item separation reliability reaches 0.95, which falls into the very good to excellent category. The item separation index value of 4.18 indicates that the instrument can separate the items into more than four strata based on their difficulty levels. Similarly, the separate item strata value of 5.90 indicates that the items can be classified into six different difficulty levels.

Furthermore, from Table 3, the analysis results on the summary of the person aspect show that the person means is at 1.44 logit (SD = 0.43), indicating that the average ability of the respondents is above the average difficulty level of the items. The person reliability is 0.86, while the person separation reliability is 0.88, placing these values in the very good category. The person separation index value of 2.74 shows that the respondents' abilities can be separated into nearly three strata, with a separate person strata value of 3.98, close to the "very good" category. Additionally, the Cronbach's Alpha value for the instrument's internal consistency is recorded at 0.86, which exceeds the minimum threshold of 0.67.

Table 3. Measurement of PBCCVD Instrument Reliability with the Rasch Model

Parameters (with quality criteria)	PBCCVD Instrument Scale (22 items)
RELIABILITY	
Model fit: summary of items	
• Item mean in logits (criteria: 0.0 logits)	0.00 (SD=0.20)
• Item reliability	0.94
• Item separation reliability (criteria: good, 0.81-0.90); very good, 0.91-0.94; excellent, >0.94)	0.95

https://doi.org/10.56303/jhnresearch.v4i3.503

Parameters (with quality criteria)	PBCCVD Instrument Scale (22 items)
• Item separation index (criteria: > 3)	4.18
• Separate item strata = [(4 x separation index) + I]/3 (criteria: fair, 2-3; good, 3-4; very good, 4-5; excellent, >5)	5.90
Model fit: summary of persons	
• Person mean logits	1.44 (SD=0.43)
• Person reliability	0.86
• Person separation reliability (criteria: air, 2-3; good, 0.81-0.90; very good, 0.91-0.94; excellent, >0.94)	0.88
• Person separation index (criteria: >2)	2.74
• Separate person strata = [(4 x separation index) + I]/3 (criteria: fair, 2-3; good, 3-4; very good, 4-5; excellent, >5)	3.98
Alpha Cronbach (criteria ≥0.67)	0.86

Validity Results

Based on the results of the Rasch analysis of the PBCCVD scale in Table 4, the raw variance explained by measures is 34.9%, which falls into the "adequate" category. Additionally, the unexplained variance in the first to fifth contrasts ranges from 4.5% to 7.7%, indicating that the values are in the "good" to "very good" category. Meanwhile, the eigenvalue for the first contrast is 2.6054, exceeding the ideal threshold of ≤ 2.0, suggesting the potential presence of a second dimension in the instrument. The estimated Andrich thresholds from the category analysis demonstrated a correct ordering (b1 < b2 < b3), indicating that the response categories functioned in a logically progressive manner. However, the distance between threshold b2 and b3 was notably large (3.93 logits), suggesting that the highest response category may have been perceived as substantially more difficult to endorse or was selected less frequently by respondents.

Table 4. Measurement of the Validity of the PBCCVD Instrument with the Rasch Model

Parameters (with quality criteria)	PBCCVD Instrument Scale (22 items)
VALIDITY	
Model fit: summary of items	
• Infit-Outfit MNSQ (criteria: 0.5 – 1.50)	1.01 – 1.00
• Infit-Outfit ZSTD (Criteria+2 – (-) 2)	(-) 0.03 – (-) 0.08
• Item model fit MNSQ range extremes (criteria: good, 0.5-1.5; very good, 0.71-1.4; excellent, 0.77-1.3)	1.01 – 1.00
• Item difficulty parameters	–2.43 to +1.44 logits, with a mean of 0.00 logits (SD = 0.88)
Model fit: summary of persons	
• Infit-Outfit MNSQ (criteria: 0.5 – 1.50)	1.00 – 1.00
• Infit-Outfit ZSTD (Criteria+2 – (-) 2)	(-) 0.15 – (-) 0.12
• Person ability parameters	–0.71 to +6.61 logits, with a mean of 1.44 logits (SD = 1.29)
Unidimensionality	
• Raw variance in data explained by measures (criteria: enough if 20-40%, good if 40-60%, and excellent if above 60%)	34.9%
• PCA eigenvalue for first contrast (criteria: > 2.0 indicates the presence of another dimension; ≤2 supports unidimensional scale)	2.6054
• Unexplained variance in contrasts 1st-5th of PCA of residuals (criteria: fair, 10 – 15%; good, 5–10%; very good, 3–5%; excellent, < 3%)	4.5 – 7.7%
• Adjacent threshold distance (criteria: Andrich Threshold index 1.4-5 logits)	b1 = –2.64 (transition between category 1 and 2),

https://doi.org/10.56303/jhnresearch.v4i3.503

Parameters (with quality criteria)	PBCCVD Instrument Scale (22 items)
	b2 = −0.65 (transition between category 2 and 3), b3 = +3.28 (transition between categories 3 and 4).

DISCUSSION

The results of the Rasch analysis of the PBCCVD instrument show that it is very reliable, both in terms of items and persons or respondents. This is clearly seen in the summary of item and person data and is also supported by Cronbach's Alpha values and separation, which indicate strong consistency of results (14). From the analysis results in the summary of items section, the average item difficulty level is at 0.00 logit with a standard deviation of 0.20. This shows that the distribution of question items in the PBCCVD instrument is correct in the middle of the logit scale (9). This means that the level of item difficulty is quite balanced with the respondents' average ability, so this instrument is appropriate and relevant for this group of respondents. In addition, the item reliability value reached 0.94, and the item separation reliability value was even slightly higher namely 0.95. Both are included in the very good to excellent category. This means that this instrument can provide consistent results when measuring what should be measured.

Furthermore, this instrument can also differentiate the difficulty level between items well. This can be seen from the item separation index of 4.18, which shows that this instrument can group items into more than four difficulty levels (9). The separate item strata value of 5.90 indicates that the items in this instrument can be classified into almost six different difficulty levels. This shows that the PBCCVD instrument can measure the variation of respondents based on their ability level (14).

From the analysis results on the summary of the person aspect, it is known that the person mean value is at 1.44 logit with a standard deviation of 0.43. This figure shows that the average ability of respondents is above the average difficulty level of the items, which in the Rasch context means that most respondents can answer the items in the instrument quite well (9). This is a positive indication because it shows that the items in the PBCCVD instrument are not too difficult for the respondent group studied.

The person reliability value was recorded at 0.86, while the person separation reliability was slightly higher, namely 0.88. Both are in the outstanding category, indicating that the instrument can differentiate respondents based on their ability level (15). This means the results would remain consistent if this study were repeated with a similar sample. In addition, the person separation index value of 2.74 shows that the instrument can separate respondents into almost three different ability groups. This is reinforced by the separate person strata value of 3.98, practically at the threshold of the "very good" category (16). Furthermore, the PBCCVD instrument also showed a very good level of internal consistency, as indicated by Cronbach's Alpha value of 0.86. This value is well above the recommended minimum limit of 0.67 (17). This strong internal consistency indicates that each item contributes positively to the overall measurement, thereby increasing the validity of the measurement results.

Unidimensionality is one of the fundamental assumptions in Rasch modeling, which states that all items in an instrument measure one central construct, in this case, measuring PBC in patients with CAD. To test this assumption, Principal Component Analysis (PCA) was conducted on the residuals, considering three leading indicators: raw variance explained by measures, eigenvalue of the first contrast, and unexplained variance in the first five contrasts (18). The raw variance explained by the measured value is 34.9%. According to the criteria proposed by Sumintono and Widhiarso (2014), it is in the "sufficient" category because it has exceeded the minimum threshold of 20%. However, if we consider a stricter standard suggested by Linacre, namely a minimum of 40% to strongly support unidimensionality, then this value is still slightly below the "good" threshold (19).

Furthermore, the analysis results show that the unexplained variance values in the first to fifth contrasts range from 4.5% to 7.7%. These figures indicate that the residuals not explained by the main dimensions are still within acceptable limits. These residuals are usually analyzed to detect the potential presence of additional dimensions not yet covered by the main model (20). In general, unexplained

https://doi.org/10.56303/jhnresearch.v4i3.503

variance values for each contrast below 10% are considered not strong enough to indicate the presence of other significant dimensions (15). Therefore, this finding indicates that the PBCCVD instrument has a low residual structure from the possible presence of other dimensions.

The next value is the eigenvalue at first contrast of 2.6054. This value exceeds the ideal threshold of ≤ 2.0. This value indicates the possible existence of other dimensions in the instrument. This indicates the need for further analysis, such as reviewing the contents of items with high loadings on the residuals to identify (21). However, a second dimension does not necessarily mean the instrument is invalid or useless. It could be that the additional dimensions are still closely related to the primary construct or represent theoretically relevant subdimensions (9,16).

The findings of this study demonstrated that the Andrich thresholds across all items in the PBCCVD instrument were ordered correctly (b1 < b2 < b3), which indicates that the 4-point Likert response categories functioned in a logically progressive manner. This is consistent with Rasch model expectations for polytomous items, in which an ordered sequence of thresholds reflects respondents' increasing levels of the latent trait being measured (11,12). Proper threshold ordering is a crucial component of category functioning, as it provides evidence that each response option is meaningful and distinct to the respondents (16). Disordered thresholds, on the other hand, suggest that respondents may not differentiate well between adjacent categories, potentially compromising the interpretability and validity of the instrument (19).

However, the present results also revealed that the distance between threshold b2 and b3 was considerably large (3.93 logits), which may indicate a potential problem in the usage of the highest response category. A wide threshold gap such as this often suggests that the top category was either infrequently selected or perceived as disproportionately difficult to endorse by the sample (13). This could be due to the semantic distinction of the wording, respondents' reluctance to choose extreme responses, or cultural tendencies in response styles. Such a pattern warrants careful consideration. While the thresholds were properly ordered, the extreme spacing between b2 and b3 may reflect a ceiling effect or reduced category efficiency at the upper end of the scale. As suggested by Linacre (22), when threshold distances exceed approximately 2.5 logits, it may be necessary to review the category labels or consider collapsing adjacent categories to improve measurement precision. Therefore, further refinement or testing of the uppermost response category is recommended in future iterations of the instrument.

CONCLUSION

Based on the findings of this study, the PBCCVD instrument is a reliable and valid tool for assessing patients' perceived behavioral control in managing lifestyle factors related to coronary artery disease (CAD). The instrument demonstrated adequate measurement properties, including good item and person fit, acceptable unidimensionality, and properly ordered response category thresholds, indicating that respondents were able to meaningfully distinguish between the response options. In particular, the ordering of thresholds (b1 < b2 < b3) confirmed that the 4-point Likert scale functioned in a logically progressive manner. However, the considerable distance between the second and third thresholds suggests that the highest response category was rarely selected, which may reflect difficulty in interpreting the category or respondent hesitancy in choosing extreme options. Although there was a slight indication of multidimensionality and reduced efficiency at the upper end of the scale, the overall fit to the Rasch model remained acceptable. Thus, the PBCCVD instrument is suitable for identifying patients' levels of perceived behavioral control and effectively distinguishing between those with higher and lower levels of self-regulation. This instrument holds practical value for nurses and other healthcare professionals, as it enables them to assess patients' self-efficacy in managing CAD-related behaviors and to design more targeted, patient-centered interventions. Nonetheless, it is recommended that future refinement be directed toward improving the Likert scale, particularly in clarifying and enhancing the effectiveness of the highest response category to optimize the instrument's measurement sensitivity and accuracy.

FUNDING

This research received no external funding.

https://doi.org/10.56303/jhnresearch.v4i3.503

ACKNOWLEDGMENTS

The authors would like to thank the respondents who were willing to participate in this study and express their gratitude to Padjadjaran University for facilitating the database search for references in this research.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

REFERENCES

1. Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process. 1991;50(2):179–211.
2. Azjen I. Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior. J Appl Soc Psychol [Internet]. 2002;32(4):665–83. Available from: https://www.researchgate.net/profile/Icek_Ajzen/publication/264004005_Perceived_Behavioral_Control_Self-Efficacy_Locus_of_Control_and_the_Theory_of_Planned_Behavior/links/0deec53c861b699ad6000000/Perceived-Behavioral-Control-Self-Efficacy-Locus-of-Control
3. Rakhman A, Hamid MA, Nurulfuadi N, Nadila D, Aiman U. Relationship between Fast Food Consumption, Sedentary Lifestyle, and Physical Activity with Body Mass Index (BMI) among Students of Madrasah Aliyah Alkahiraat Pusat Palu Post-Covid-19 Pandemic. J Heal Nutr Res. 2025;4(1):8–14.
4. Damayanti DS, Humairah AT, Darmayanti F, Isnaenil M IP, Maarif R. Relationship Between Eating Patterns, Physical Activity, and Obesity Incidence Among Madrasah Tsanawiyah (MTs) Students. J Heal Nutr Res. 2024;3(2):133–7.
5. Armitage CJ. Can the theory of planned behavior predict the maintenance of physical activity? Vol. 24, Health Psychology. 2005. p. 235–45.
6. McEachan RRC, Conner M, Taylor NJ, Lawton RJ. Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. Vol. 5, Health Psychology Review. 2011. p. 97–144.
7. French DP, Sutton S, Hennings SJ, Mitchell J, Wareham NJ, Griffin S, et al. The importance of affective beliefs and attitudes in the theory of planned behavior: predicting intention to increase physical activity 1. J Appl Soc Psychol. 2005;35(9):1824–48.
8. Hermala Dewi N. Development and Validation of Psychosocial Problem Assessment Instruments in Critical Patients in the Intensive Care Unit (ICU). J Heal Nutr Res. 2025;4(1):15–28.
9. Bond TG, Fox CM. Applying the Rasch model: Fundamental measurement in the human sciences. Psychology Press; 2013.
10. Boone W, Staver J, Yale M. Rasch Analysis in the Human Sciences. Dordrech: Springer; 2014.
11. Bond TG, Fox CM. Applying the Rasch Model: Fundamental Measurement in the Human Sciences. 3rd ed. Routledge. New York: Routledge; 2015.
12. Linacre JM. Winsteps® User's Guide [Internet]. Winsteps.com; 2024. Available from: https://www.winsteps.com
13. Tennant A, Conaghan PG. The Rasch measurement model in rheumatology: What is it and why use it? Arthritis Rheum. 2007;57(8):1358–62.
14. Sumintono B, Widhiarso W. Application of the Rasch Model to Research in the Social Sciences. Revised Ed. Trim B, editor. Cimahi: Trim Komunikata Publishing House; 2014.
15. Linacre M. winstep.com. 2011. A user's guide to WINSTEPS: Rasch-model computer programs.
16. Wright BD, Masters GN. Rating scale analysis. MESA press; 1982.
17. Taber KS. The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. Res Sci Educ. 2018;48(6):1273–96.
18. Brentani E, Silvia G. Unidimensionality in the Rasch model how to detect and interpret. Stat anno

https://doi.org/10.56303/jhnresearch.v4i3.503

LXVII, n 3. 2007;67(3):253–61.
19. Linacre J. Rating Scale Instrument Quality Criteria. Rasch Meas Trans [Internet]. 2007;21(1):1095. Available from: http://www.education.uwa.edu.au/httpwww.education.uwa.edu.aunews/rasch_conference
20. Wright BD. Unidimensionality coefficient. Rasch Meas Trans. 1994;8(3):385.
21. Aryadoust V, Ng LY, Sayama H. A comprehensive review of Rasch measurement in language assessment: Recommendations and guidelines for research. Lang Test. 2021;38(1):6–40.
22. Linacre JM. What do Infit and Outfit, Mean-square and Standardized mean? Rasch Meas Trans. 2002;16(2):878.

https://doi.org/10.56303/jhnresearch.v4i3.503