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Translation and psychometric validation of the Vietnamese versions of the Drinker Inventory of Consequences and Protective Behavioral Strategies Scale

Original article

Trieu Van Nhat[a,b], Sudaporn Stithyudhakarn[a], Penpaktr Uthis[a,*]

[a]*Faculty of Nursing, Chulalongkorn University, Bangkok 10330, Thailand*
[b]*Faculty of Nursing, Thai Nguyen University of Medicine and Pharmacy, Thai Nguyen 250000, Vietnam*

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Abstract: **Objective:** Despite hazardous alcohol use (HAU) being prevalent in Vietnam, culturally adapted and psychometrically validated tools to assess alcohol-related consequences and protective behavioral strategies are unavailable. This study aimed to translate into Vietnamese and evaluate the psychometric properties of two instruments: the Drinker Inventory of Consequences (DrInC) and the Protective Behavioral Strategies Scale-20 (PBSS-20).

Methods: Both instruments were translated into Vietnamese using Brislin's forward–backward translation method, followed by expert panel review to establish content validity. Pre-testing was conducted with Vietnamese adult men to ensure cultural appropriateness and item clarity. Psychometric evaluation included assessments of internal consistency and inter-rater reliability. Data were collected from a pilot sample (n = 30) and a main sample (n = 104) comprising men aged 35–44 years identified as having HAU.

Results: The Vietnamese versions showed strong semantic and conceptual equivalence to the original instruments. Mean expert ratings for language comparability and interpretability were below 2, indicating good equivalence. Content validity was high (scale-level CVI [S-CVI] > 0.90). Internal consistency was acceptable for both the DrInC (Cronbach's $\alpha = 0.75$) and the PBSS-20 ($\alpha = 0.79$). Inter-rater reliability was excellent, with intraclass correlation coefficients (ICC) above 0.85. Corrected item-total correlations ranged from −0.08 to 0.58 for the DrInC and −0.12 to 0.60 for the PBSS-20, with most items showing acceptable contributions. Split-half reliability coefficients were 0.67 for both scales, providing additional evidence of moderate internal consistency. Cultural adaptations, including clarification of idiomatic expressions, enhanced item clarity and relevance.

Conclusions: The Vietnamese DrInC and PBSS-20 are valid and reliable tools for evaluating alcohol-related consequences and protective strategies among Vietnamese men. These instruments can support both research and clinical efforts to address HAU in Vietnam.

Keywords: *alcohol drinking • cultural adaptation • Drinker Inventory of Consequences • protective behavioral strategies • psychometrics*

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1. Introduction

Alcohol consumption is a major global public health issue, contributing to approximately 3 million deaths annually and accounting for 5.1% of the global disease burden.[1] In Vietnam, alcohol use is deeply embedded in social and cultural norms, particularly among men.[2,3] Hazardous alcohol use (HAU), a drinking pattern that increases the risk of physical, psychological, and social harm,[4] is especially prevalent. Among 482 male

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**Corresponding author.*
E-mail: Penpaktr.u@chula.ac.th (P. Uthis).

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community drinkers in Vietnam, 60.2% were classified as engaging in hazardous drinking, compared to only 3.6% identified as harmful users or alcohol-dependent.[5] Similar patterns are reported globally, with HAU prevalence reaching 70.2% among men in China[6] and 39.2% in the United Kingdom.[7]

HAU is associated with a wide range of adverse health outcomes, including hypertension, stroke, cancer, liver cirrhosis, and mental health disorders such as anxiety and depression.[4,8,9] In Vietnam, alcohol use is a leading contributor to years of life lost and is implicated in over 75% of road traffic fatalities involving men.[10,11] These alarming statistics underscore the urgent need for effective interventions grounded in accurate and culturally appropriate assessment tools.

While screening tools such as the Alcohol Use Disorders Identification Test (AUDIT) are commonly used to identify HAU,[12] and weekly consumption thresholds also serve as diagnostic benchmarks,[13] they do not fully capture the broader consequences of alcohol use or the strategies individuals employ to minimize harm. There is a growing need to assess not only the risks but also the protective behaviors that can reduce alcohol-related harm.

Two widely used instruments in alcohol research are the Drinker Inventory of Consequences (DrInC) and the Protective Behavioral Strategies Scale-20 (PBSS-20). The DrInC measures negative outcomes across 5 domains: physical, interpersonal, intrapersonal, impulse control, and social responsibility.[14] The PBSS-20 evaluates behavioral strategies aimed at reducing alcohol intake and its adverse effects.[15] Together, these instruments provide a comprehensive assessment of alcohol-related harm and harm-reduction behaviors.

Both tools have demonstrated strong psychometric properties across various cultural and linguistic contexts.[16,17] For example, the DrInC has been translated into Swahili and validated in Tanzania,[18] while the PBSS-20 has been adapted into French and German and validated among young men in Switzerland.[19] These cross-cultural studies highlight the importance and feasibility of adapting such tools for use in diverse populations.

However, no validated Vietnamese versions of the DrInC or PBSS-20 currently exist. This gap limits research and intervention efforts in Vietnam, particularly in underserved or rural communities where HAU is common and access to mental health services is limited.[20] Culturally adapted assessment tools are critical in these settings to enable accurate diagnosis, guide clinical decisions, and evaluate intervention outcomes.

Cross-cultural adaptation of psychological instruments is essential to ensure semantic, conceptual, and content equivalence.[21,22] Without rigorous translation and validation, measurement bias may compromise the validity of data and the effectiveness of interventions.[22] This issue is particularly pressing in low- and middle-income countries, where the burden of alcohol-related harm is increasing but context-specific assessment tools remain scarce.

To address this gap, the present study aimed to translate, culturally adapt, and validate the Vietnamese versions of the DrInC and PBSS-20 using Brislin's forward–backward translation method.[23] The adaptation process included expert panel review, pilot testing, and psychometric evaluation of content validity and reliability. The availability of these rigorously adapted tools is expected to enhance research, screening, and intervention efforts in Vietnam and contribute to broader global health and nursing responses to HAU.

2. Methods

2.1. Study design and setting

This study was part of a larger doctoral research project conducted in Thai Nguyen, a northeastern province of Vietnam. The broader project included a randomized controlled trial (RCT) evaluating the effectiveness of a promoting protective behavioral strategies program to reduce alcohol use, alcohol-related consequences, and intention to drink among adult men with HAU.

The current study focused on the translation, cultural adaptation, and psychometric validation of two instruments used in the RCT: the DrInC[14] and PBSS-20.[15] Psychometric properties were assessed using data from a pilot study to examine inter-rater reliability and baseline data from the RCT to evaluate internal consistency.

The study was conducted in a rural area of Thai Nguyen Province using stratified random sampling. One rural district was randomly selected from 6 in the province, followed by the random selection of one commune within that district. Eligible individuals were screened and randomly recruited using a computerized selection process.

Ethical approval was granted by the Ethical Review Board for Biomedical Research at Hanoi University of Public Health, Vietnam (No. 454/2024/YTCC-HD3). All participants provided written informed consent. Data were anonymized to ensure confidentiality. This study adheres to the Strengthening the reporting of observational studies in epidemiology (STROBE) guidelines for cross-sectional studies, as detailed in the completed STROBE checklist (Appendix 1).[24]

2.2. Participants

The target population consisted of men aged 35–44 years residing in Thai Nguyen Province who met criteria for HAU.

2.2.1. Inclusion criteria

Participants were eligible if they: Had an AUDIT score between 8 and 15, indicating HAU according to World Health Organization [WHO] classification;[12] had completed at least primary education; were fluent in Vietnamese; owned a mobile phone; and provided informed consent to participate.

2.2.2. Exclusion criteria

Participants were excluded if they: Reported co-use of alcohol and illicit drugs; had a physical or psychiatric disorder that could interfere with participation.

2.2.3. Sample size

The sample size for the main study was calculated using G*Power 3.1.9.4 (Heinrich Heine University Düsseldorf, Düsseldorf, Germany) based on effect sizes from a meta-analysis of alcohol brief interventions.[25] A minimum of 87 participants was required. To account for an anticipated 20% attrition rate, the final target sample was set at 104 participants. An additional 30 participants with similar characteristics were included in the pilot study for inter-rater reliability testing.

2.3. Measurements

2.3.1. Demographic characteristics

Participants completed a structured questionnaire assessing demographic and alcohol use characteristics. Age and age of first alcohol use were treated as both continuous and categorical variables (early ≤17 years; typical 18–20; late ≥21). Other variables included marital status (single/married), education (primary, secondary, high school or higher), occupation (officer/businessman, worker, laborer, farmer), family history of alcohol use (yes/no), and monthly income (categorized as low, middle, or high based on quartiles and interquartile range).

2.3.2. Drinker Inventory of Consequences

The DrInC is a 50-item self-report instrument measuring alcohol-related consequences over the past 3 months across 5 domains: physical (8 items), interpersonal (10 items), intrapersonal (8 items), impulse control (12 items), and social responsibility (7 items).[14] Five additional control items assess response bias but are not included in the total score. Items are rated on a 4-point Likert scale (0 = never to 3 = daily or almost daily), yielding a total score range of 0–135. Severity levels are categorized as very low (0–23), low (24–38), medium (39–52), high (53–67), and very high (≥68).

2.3.3. Protective Behavioral Strategies Scale

The PBSS-20 includes 20 items assessing use of behavioral strategies to reduce alcohol consumption and related harm.[15] It comprises 3 subscales: (manner of drinking [MOD]; 5 items), (stopping/limiting drinking [SLD]; 7 items), and (serious harm reduction [SHR]; 8 items). Items are rated on a 6-point Likert scale, with higher scores indicating more frequent use of protective strategies.

2.4. Psychometric evaluation

2.4.1. Translation and cultural adaptation

The translation process followed Brislin's forward–backward translation model to ensure linguistic and conceptual equivalence.[23] This process consisted of 5 key steps:

1. Forward Translation: Two bilingual experts (an English language specialist and a nursing lecturer with a PhD and expertise in alcohol research) independently translated the instruments into Vietnamese.
2. Review and Reconciliation: A bilingual reviewer compared and reconciled discrepancies to create a provisional Vietnamese version.
3. Back-Translation: Two additional bilingual experts (one certified translator, one nursing lecturer with English qualification and expertise in alcohol research) independently back-translated the version, blinded to the original.
4. Comparison and Consensus: A bilingual reviewer compared the back-translated versions with the originals, and discrepancies were resolved through consensus.
5. Expert Review: 5 bilingual experts (3 nursing educators and 2 alcohol researchers) evaluated language equivalence and interpretability using a 7-point Likert scale.[26] Items scoring >3 were revised; scores ≤2 were deemed acceptable.

The process was run until the semantic equivalence between back-translated and original scales were assured. Moreover, to ensure linguistic and cultural equivalence, several items underwent iterative refinement beyond direct translation. Specific adjustments to problematic or culturally sensitive items were made based on expert feedback and semantic review. These item-level adaptations, including final Vietnamese wording and rationale for modification, are documented in Appendix 2.

2.4.2. Content validity assessment

Five additional experts in alcohol research and clinical practice (2 nursing educators and 3 researchers)

evaluated item relevance. Item-level (I-CVI) and scale-level content validity indices (S-CVI) were computed, with I-CVI ≥ 0.78 considered acceptable.[27]

2.4.3. Reliability testing

Inter-rater reliability: Two trained interviewers independently recorded responses during live interviews. Intraclass correlation coefficients (ICC) were calculated using a two-way random-effects model with absolute agreement. ICC values were interpreted as follows: <0.50 = poor; 0.50–0.75 = moderate; 0.75–0.90 = good; >0.90 = excellent.[28]

Internal consistency: Cronbach's alpha coefficients were calculated from RCT baseline data ($n = 104$). Values ≥0.70 indicated acceptable internal consistency.[29] Split-half reliability was also assessed, with coefficients ≥0.70 considered acceptable.[30]

Item-level diagnostics: Corrected item-total correlations were examined to evaluate the contribution of individual items to the overall scale. Correlations <0.20 are generally considered poor, while those <0.30 suggest insufficient contribution.[31,32]

2.5. Data analysis

All data were analyzed using IBM SPSS Statistics version 28 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participant characteristics. CVI, Cronbach's alpha coefficients, and ICC values were computed to evaluate the instruments' psychometric properties.

3. Results

3.1. Characteristics of participants

Table 1 summarizes the demographic characteristics of participants in both the pilot and main studies. The mean age was comparable across samples (39.23 ± 2.57 years in the pilot and 39.53 ± 2.85 years in the main study). Most participants were married, had completed secondary education, and were primarily

Variable	Pilot study ($n = 30$)	Main study ($n = 104$)
Age (years), Mean (SD)	39.23 ± 2.57	39.53 ± 2.85
Marital status, n (%)		
Single	1 (3.30)	15 (14.40)
Married	29 (96.70)	89 (85.60)
Education level, n (%)		
Primary school	12 (40.00)	21 (20.20)
Secondary school	15 (50.00)	54 (51.90)
High school or higher	3 (10.00)	29 (27.90)
Occupation, n (%)		
Officer and own businessman	2 (6.70)	4 (3.90)
Worker	5 (16.70)	19 (18.30)
Laborer	2 (6.70)	17 (16.30)
Farmer	21 (70.00)	64 (61.50)
Monthly Income (USD), Median (IQR)	116.69 (133.37)	155.58 (116.69)
Low (≤116.68), *n (%)*	11 (36.70)	21 (20.20)
Middle (116.69–155.58), *n (%)*	9 (30.00)	37 (35.57)
High (≥155.59), *n (%)*	10 (33.30)	46 (44.23)
Age of first drink (years), Mean (SD)	19.20 ± 2.11	19.45 ± 2.63
Early (≤17), *n (%)*	3 (10.00)	17 (16.30)
Typical (18–20), *n (%)*	23 (76.70)	65 (62.50)
Late (≥21), *n (%)*	4 (13.30)	22 (21.20)
Family history of alcohol use, n (%)		
Yes	20 (66.70)	48 (46.20)
No	10 (33.30)	56 (53.80)

Note: Income groups based on sample-specific tertiles of monthly income (USD); IQR, Interquartile Range.

Table 1. Demographic characteristics of study participants.

employed as farmers. Income levels varied, with nearly half of the main study participants falling into the high-income group. Notably, a substantial proportion reported early alcohol initiation (before age 18 years), and nearly half reported a family history of alcohol use.

3.2. Alcohol-related problems and protective behavioral strategies

Table 2 presents scores on the DrInC and PBSS-20 among participants in the main study. The mean total DrInC score was 25.17 (SD = 7.83), indicating a low to moderate level of alcohol-related consequences. The highest mean scores were observed in the physical, interpersonal, and intrapersonal domains, while lower scores were reported in impulse control and social responsibility.

The mean PBSS-20 score was 78.43 (SD = 14.15), indicating moderate use of protective behavioral strategies. Among subscales, SHR strategies were used most frequently (M = 36.10), followed by MOD (M = 21.71) and stopping/limiting drinking (M = 20.63).

3.3. Translation and language equivalence

Expert review confirmed strong linguistic and conceptual equivalence between the original English and Vietnamese versions of both instruments. Mean ratings for language comparability and interpretability were below 2 on a 7-point scale, indicating excellent equivalence, (Table 3).

3.4. Psychometric properties of the Vietnamese versions of DrInC and PBSS-20

Table 4 presents the psychometric outcomes for both instruments. The I-CVI ranged from 0.80 to 1.00 for both tools, exceeding the recommended threshold of 0.78. The S-CVI was 0.97 for the DrInC and 0.95 for the PBSS-20, indicating strong content validity.

Inter-rater reliability was excellent for the DrInC, with ICCs of 0.95 (single measures) and 0.97 (average measures). The PBSS-20 demonstrated good inter-rater reliability, with ICCs of 0.75 and 0.86, respectively. All ICCs were statistically significant ($P < 0.001$).

Internal consistency, assessed via Cronbach's alpha, was acceptable for both instruments: 0.75 for the DrInC and 0.79 for the PBSS-20.

For item-total correlations, the values of DrInC ranged from −0.08 to 0.58. Several items (such as items 10, 18, 23, 42, 43) showed strong alignment with the overall scale (>0.50), most items were acceptable, and a few items were weaker (such as items 8, 12, 17, 20, 22, 25, 28) or negative (items 24, 37, 50). Cronbach's alpha if item deleted

Variable	Mean ± SD
Alcohol-related problems (DrInC, Mean [SD])	25.17 ± 7.83
Physical	5.69 ± 2.03
Interpersonal	5.45 ± 2.33
Intrapersonal	5.41 ± 2.42
Impulse control	4.85 ± 2.72
Social responsibility	3.77 ± 1.20
Protective behavioral strategies (PBSS, Mean [SD])	78.43 ± 14.15
MOD	21.71 ± 6.06
SLD	20.63 ± 5.52
SHR	36.10 ± 6.77

Note: DrInC, Drinker Inventory of Consequences; MOD, manner of drinking; PBSS, Protective Behavioral Strategies Scale; SHR, serious harm reduction; SLD, stopping/limiting drinking.

Table 2. Alcohol-related problems and protective behavioral strategies (main study) (n = 104).

Instrument	Total items	Language comparability (mean, range)	Interpretability Similarity (Mean, Range)
DrInC	50	1.50 (1.00–2.00)	1.34 (1.00–2.00)
PBSS-20	20	1.43 (1.00–2.00)	1.27 (1.00–2.00)

Note: Scores based on a 7-point Likert scale (1 = highly comparable, 7 = not comparable). Scores ≤2 indicate acceptable equivalence; DrInC, Drinker Inventory of Consequences; PBSS, Protective Behavioral Strategies Scale.

Table 3. Expert evaluation of language equivalence (n = 5).

Instrument	I-CVI range	S-CVI	ICC type	ICC (95% CI)	ICC interpretation	Cronbach's alpha	Internal consistency	Corrected item–total correlation (range)	Cronbach's alpha if item deleted	Split-half reliability (Spearman–Brown)
DrInC	0.80–1.00	0.97	Single measures	0.95* (0.89, 0.98)	Excellent	0.75	Acceptable	−0.08 to 0.58	0.74 to 0.76	0.67
			Average measures	0.97* (0.94, 0.99)	Excellent					
PBSS-20	0.80–1.00	0.95	Single measures	0.75* (0.53, 0.88)	Good	0.79	Acceptable	−0.12 to 0.60	0.76 to 0.81	0.67
			Average measures	0.86* (0.70, 0.93)	Good					

Note: DrInC, Drinker Inventory of Consequences; ICC, intraclass correlation coefficients; I-CVI, Item-level content validity index; and PBSS, Protective Behavioral Strategies Scale; S-CVI, scale-level content validity index; *$P < 0.001$.

Table 4. Psychometric properties of the Vietnamese DrInC and PBSS-20.

ranged only from 0.74 to 0.76, indicating that removing these items would not meaningfully improve reliability.

For the PBSS-20, corrected item-total correlations ranged from −0.12 to 0.60. Several items (such as items 2, 5, 8, 14, 15, 18) demonstrated strong correlations with the total scale (>0.50), most items were acceptable, and a few items were weaker (3, 7, 10, 11, 20) or negative (item 4). Cronbach's alpha if item deleted ranged from 0.76 to 0.81, indicating that all items contributed meaningfully to overall reliability.

Split-half reliability provided additional evidence of internal consistency. The Spearman–Brown coefficients were about 0.67 for both DrInC and PBSS-20, consistent with the overall Cronbach's alpha.

4. Discussion

This study aimed to translate, culturally adapt, and validate the Vietnamese versions of the DrInC and the PBSS-20, addressing a critical gap in alcohol assessment tools for Vietnamese populations. The findings support the linguistic, cultural, and psychometric suitability of these instruments for use in alcohol research and community-based interventions in Vietnam.

4.1. Psychometric performance and reliability

The expert evaluation process demonstrated that the translated instruments retained both linguistic accuracy and conceptual equivalence with the original versions. The language comparability and interpretability similarity scores indicated that the translations preserved the meaning of the original items while ensuring clarity for Vietnamese population. This result aligns with previous research suggesting that systematic translation procedures, such as Brislin's (1970) method, contribute to maintaining conceptual consistency across different languages.[26]

Content validity was confirmed through high I-CVI: 0.8–1.0; S-CVI >0.9, exceeding standard benchmarks.[27] These values indicate a high degree of expert agreement on the relevance and clarity of each item. An I-CVI of 0.78 or higher is typically considered acceptable when using 5 or more raters, and the S-CVI values in this study meet the threshold for excellent content validity.[27] The expert panel's diverse backgrounds including 2 nursing educators and 3 researchers with experience in addiction health and behavioral science, further enhance the credibility of these evaluations.[33,34] These results also affirm the success of the rigorous translation and adaptation process, which prioritized semantic accuracy, cultural alignment, and linguistic clarity.

Reliability analysis supported the overall suitability of both scales for use in the Vietnamese context. The DrInC demonstrated excellent inter-rater reliability and acceptable internal consistency (Cronbach's $\alpha = 0.75$), while the PBSS-20 showed good internal consistency ($\alpha = 0.79$). These values fall within the established thresholds for research instruments,[28] although they are slightly lower than those reported in validation studies conducted in Western or high-income country settings, as discussed below.

For the PBSS-20, internal consistency in this study ($\alpha = 0.79$) is comparable to that reported in the Spanish version (subscale $\alpha = 0.71$–0.77) among university students,[35] supporting its cross-cultural reliability. However,

higher internal consistency was reported in the original validation, with subscale alphas ranging from 0.81 to 0.88.[15] These differences may be due to demographic and contextual variation, such as the use of a rural, older adult male population in this study compared to younger, university-based samples in earlier validations. Cultural norms around alcohol use and behavioral self-regulation may also influence how consistently individuals respond to protective strategy items, particularly when harm-reduction concepts are less familiar or socially reinforced.[36] This is consistent with behavioral health theories such as the Theory of Planned Behavior (TPB), which emphasizes the role of subjective norms and perceived behavioral control in shaping protective health behaviors.[37]

For the DrInC, the internal consistency in this study was 0.75, which is lower than that reported for the English version ($\alpha = 0.937$)[38] and the Swahili version ($\alpha = 0.96$).[18] These discrepancies may stem from differences in health literacy, cultural framing of alcohol-related harm, and the salience of certain consequences across contexts. For instance, items assessing moral or spiritual harm may be interpreted differently in collectivist versus individualist cultures. Nevertheless, the Vietnamese DrInC maintained acceptable reliability and item performance, suggesting that the core structure of the instrument remains robust even across culturally distinct populations. Furthermore, the high inter-rater reliability of the DrInC suggests strong agreement in item ratings across expert reviewers, which further supports its usability in clinical and research settings requiring consistent scoring.

Additionally, split-half reliability analyzes for both instruments yielded coefficients slightly below the conventional 0.70 threshold,[30] but closely aligned with overall Cronbach's alpha values. This indicates moderate internal consistency and supports the reliability of using total or subscale scores for research and clinical purposes, while cautioning against overreliance on single items.

The item-level analyzes of the Vietnamese DrInC offer insights into how these instruments function in the Vietnamese cultural context. While several items demonstrated strong alignment with the overall scale, others showed weaker or even negative correlations. These weaker items often reflect consequences that are either very common but non-discriminating like hangover,[39] rare in this population such as accidents, absenteeism from work,[40] or socially sensitive and prone to underreporting as drunk driving.[41] The limited variability or under-endorsement of these items likely reduced their correlations with the overall scale. Importantly, Cronbach's alpha remained stable even when these items were excluded, suggesting that the instrument as a whole maintains acceptable reliability.

At the subscale level, the findings further highlight the role of cultural and contextual influences in shaping item responses. For example, behaviors in the impulse control domain such as drunk driving, physical fights, and other reckless actions may be interpreted less as personal failures of restraint and more as normalized outcomes of heavy group drinking.[2,3] Similarly, legal-related items, such as arrests for drinking and driving, may be underreported due to shame, and social desirability, because of Vietnam's strict zero-tolerance laws.[42] Items within the social responsibility domain, including missed work or financial problems, implicate family reputation and collective honor. In Vietnam's collectivist culture, acknowledging such failures can bring shame not only to the individual but also to their family,[43] contributing to underreporting despite their prevalence. These cultural nuances underscore the importance of interpreting DrInC subscales through the lenses of collectivism and social obligation within the Vietnamese sociocultural environment.

For the PBSS-20, items with stronger correlations included a mix of self-regulation strategies (such as not exceeding a set number of drinks, avoiding pregaming, avoiding keeping up with others) and safety-oriented harm reduction strategies (e.g. refusing to ride with a drunk driver, avoiding drinking games, monitoring one's drink).[15] These findings suggest that both domains of protective strategies resonate meaningfully with Vietnamese participants. In contrast, several items showed weaker or negative correlations, particularly strategies that may be less common or less culturally relevant in this setting. For example, alternating alcoholic and non-alcoholic drinks, drinking water, or adding extra ice[15] are not typical practices in Vietnamese drinking culture, when one has had enough may conflict with prevailing peer norms that encourage drinking.[2] Such patterns suggest that while many protective strategies are broadly applicable, others may require cultural adaptation or additional explanation to ensure relevance and adoption in Vietnam.

Although exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) are critical methods for examining construct validity, their reliability depends heavily on adequate sample size.[44] The current study's sample of 104 participants which falls below commonly recommended thresholds for factor analysis. For example, guidelines suggest at least 5–10 participants per item or a minimum of 200–300 participants to ensure stable factor solutions, particularly for scales with complex, multidimensional structures such as the 50-item DrInC.[44,45] Similarly, CFA typically requires samples of at least 200 participants to achieve stable estimates and reliable model fit indices.[44,45] Conducting factor

analysis with the current sample risked unstable or uninterpretable results, which could undermine the validation process.[44] Therefore, this study prioritized rigorous translation, cultural adaptation, content validation, inter-rater reliability, and internal consistency as foundational steps in the validation process. Future studies with larger, more diverse samples should use EFA, CFA, and invariance testing to confirm construct validity, factorial stability, and generalizability across Vietnamese populations.

Finally, robustness checks such as placebo tests and variable substitutions were not conducted in this study. These analyzes widely used in fields that rely on causal inference or regression modeling, where the goal is to verify that findings are not biased covariate selection.[46] The present study, however, focused exclusively on the psychometric validation of translated measurement instruments. For this reason, robustness analyzes were not applicable. The absence of such analyzes may limit the extent to which we can comment on the robustness of these measures under different analytic specifications.[46] Future studies that apply the Vietnamese DrInC or PBSS-20 in intervention trials, longitudinal cohorts, or predictive modeling could incorporate robustness analyzes.

4.2. Interpretation of alcohol use patterns

Participant characteristics aligned with prior epidemiological profiles of hazardous drinkers in Vietnam,[3,47] including early initiation of alcohol use and family history of drinking, both of which are known risk factors of HAU.[20,48] Notably, the rate of early initiation in this study was higher than in some Western countries,[49] suggesting cultural influences on alcohol exposure during adolescence.

The relatively moderate mean DrInC scores (M = 25.17) are consistent with the AUDIT classification used in this study, which focuses on hazardous, rather than harmful or dependent drinking. Importantly, the highest DrInC subscale scores were observed in the physical, interpersonal, and intrapersonal domains, indicating that even non-dependent drinking levels were associated with early disruptions in health, relationships, and emotional well-being.[12]

Similarly, PBSS-20 scores revealed moderate use of protective strategies, with a strong preference for SHR behaviors (e.g. using a designated driver, eating before drinking). In contrast, strategies aimed at reducing the quantity or pace of drinking were less common, pointing to a reliance on externally observable harm mitigation rather than internal behavior control.[15] This pattern may reflect the sociocultural context in Vietnam, where alcohol use is deeply linked to rituals of masculinity, celebration, and hospitality.[2] In such contexts, reducing quantity or abstaining may be socially discouraged, whereas minimizing visible harm may be more acceptable.

These findings point to the need for culturally grounded interventions that not only promote protective strategies but also challenge drinking norms embedded in social identity, family roles, and occupational environments, particularly in rural settings.

4.3. Linguistic and cultural adaptation: A methodological strength

A notable strength of this study lies in the detailed and culturally sensitive approach to translation and adaptation. While Brislin's forward–backward translation model ensured semantic accuracy,[23] the study went further by conducting systematic item-level refinements guided by iterative expert review, cultural relevance, and field context.[21]

Several items from the PBSS-20 required careful localization. For instance, culturally specific concepts such as *"pregaming"* or *"designated driver"* lack direct Vietnamese equivalents and were therefore reworded to convey meaning through locally relevant behaviors and contexts. Likewise, DrInC items involving morality or spirituality, such as Item 36 with the term *"my spiritual or moral life"* were adapted using broader, more inclusive language to ensure clarity across varying belief systems and educational backgrounds.

These thoughtful adaptations were driven by iterative expert reviews and guided by both linguistic precision and cultural humility. In doing so, the study ensured that the translated instruments were not only psychometrically sound but also emotionally and socially appropriate for Vietnamese men in rural settings, who may be less familiar with formal or Westernized phrasing.[21]

This approach enhances the tools' validity, usability, and acceptability, contributing to greater participant engagement and more accurate data collection in future research and clinical applications. A detailed summary of key item adaptations, including original phrases, final Vietnamese versions, and adaptation rationales, is presented in Appendix 2. By documenting this process, the study provides a valuable reference for researchers engaged in cross-cultural validation of psychological and behavioral measures, particularly in low- and middle-income countries where local adaptations are crucial for meaningful implementation.

4.4. Limitations and future directions

A key limitation of this study is the relatively small sample size, which restricted psychometric evaluation to internal consistency and inter-rater reliability, without

the ability to assess construct validity through factor analysis. As such, the factorial structure and measurement invariance of the Vietnamese DrInC and PBSS-20 remain to be empirically tested. Future validation efforts should employ factor analytic techniques with larger and more diverse populations to confirm structural validity and enhance the robustness and generalizability of these culturally adapted tools.

Second, the study sample comprised rural men aged 35–44 years with HAU, which limits the generalizability to women, adolescents, urban populations, and individuals with alcohol dependence. Future validation studies should include these groups to extend applicability and ensure cultural relevance across the broader Vietnamese population.

Third, test-retest reliability was not assessed. Establishing temporal stability is critical for confirming measurement consistency over time, particularly in the context of intervention studies. Future validation studies should include longitudinal testing and cognitive interviews to further evaluate score stability and enhance the clarity and cultural relevance of scale items.

4.5. Implications for nursing and community health practice

The validated Vietnamese DrInC and PBSS-20 instruments provide frontline healthcare workers, particularly nurses and primary care providers, with standardized, culturally appropriate tools for assessing alcohol-related problems and evaluating harm-reduction strategies. Their ease of use makes them ideal for integration into community health outreach, rural clinics, and public health screening programs, where formal diagnostic tools may be scarce.

In the nursing context, these tools can support early identification of risky drinking behaviors, facilitate patient-centered care planning, and provide metrics to monitor intervention outcomes over time. Their availability also opens new possibilities for multisite studies, cross-cultural comparisons, and international collaborations focused on alcohol harm reduction in Southeast Asia.

5. Conclusions

This study provides the first validated Vietnamese versions of the DrInC and PBSS-20, two widely used instruments in alcohol research. Through rigorous translation, cultural adaptation, and psychometric testing, these tools have demonstrated strong reliability and content validity. Their availability fills a critical gap in Vietnam's alcohol research infrastructure and offers practical applications for clinical screening, program evaluation, and policy development. Future work should expand their use across diverse populations and examine additional psychometric properties to further support their widespread implementation.

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Ethical approval

Ethical issues are not involved in this paper.

Conflicts of interest

All contributing authors declare no conflicts of interest.

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