Esc Anna Nery 2026;30:e20250186

RESEARCH

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Cross-cultural adaptation and validity of the Questionnaire on Handwashing Knowledge and Behavior (QHKB)[a]

Adaptação transcultural e validação do Questionnaire on Handwashing Knowledge and Behavior (QHKB)

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Submitted on 11/08/2025.
Accepted on 04/23/2026.

DOI:https://doi.org/10.1590/2177-9465-EAN-2025-0186en

Abstract

Objective: to perform the cross-cultural adaptation and validity of the Questionnaire on Handwashing Knowledge and Behavior (QHKB) into Brazilian Portuguese. **Method:** a methodological study conducted in two phases: cross-cultural adaptation according to the COnsensus-based Standards for the selection of health Measurement INstruments guidelines; and psychometric assessment. A total of 49 adolescents participated in the pretest stage and 618 in the validity phase. Content validity, factorial structure, and internal reliability were assessed. **Results:** the Brazilian version of the instrument (QHKB-Br) achieved an overall Content Validity Index higher than 0.95. In the pretest, the agreement rate among adolescents was 98.7%. Factor analysis indicated a better fit for the unidimensional model compared with the original bidimensional model, with explained variance of 61.5%. Reliability of the total instrument showed α=0.67 and Ω=0.76, which were considered adequate for instruments with few items. **Conclusion and implications for the practice:** QHKB-Br is a brief, self-administered, and easy-to-use instrument that demonstrated better fit to a unidimensional model in the studied sample. Its use by healthcare professionals may support educational actions and strategies to promote health literacy, contributing to the health promotion of Brazilian adolescents in different school and community settings.

Keywords: Adolescent; COVID-19; Hand Hygiene; Health Literacy; Validation Study.

Resumo

Objetivo: realizar a adaptação transcultural e a validação do *Questionnaire on Handwashing Knowledge and Behavior* (QHKB) para o português do Brasil. **Método:** estudo metodológico, realizado em duas fases: adaptação transcultural segundo diretrizes *COnsensus-based Standards for the selection of health Measurement INstruments*; e avaliação psicométrica. Participaram 49 adolescentes na etapa de pré-teste e 618 na fase de validação. Foram avaliadas a validade de conteúdo, a estrutura fatorial e a confiabilidade interna. **Resultados:** a versão brasileira do instrumento (QHKB-Br) obteve Índice de Validade de Conteúdo global superior a 0,95. No pré-teste, a taxa de concordância entre adolescentes foi de 98,7%. A análise fatorial indicou melhor ajuste do modelo unidimensional, em comparação ao modelo bidimensional original, com variância explicada de 61,5%. A confiabilidade do instrumento total apresentou α=0,67 e Ω=0,76 — considerados adequados para instrumentos de poucos itens. **Conclusão e implicações para a prática:** o QHKB-Br é um instrumento breve, de fácil aplicação, autoadministrado e que apresentou melhor ajuste ao modelo unidimensional na amostra estudada. Sua utilização por profissionais de saúde pode subsidiar ações educativas e estratégias de promoção do letramento em saúde, contribuindo para a promoção da saúde de adolescentes brasileiros em diferentes contextos escolares e comunitários.

Palavras-chave: Adolescente; COVID-19; Estudo de Validação; Higiene das Mãos; Letramento em Saúde.

Resumen

Objetivo: realizar la adaptación transcultural y validación del *Questionnaire on Handwashing Knowledge and Behavior* (QHKB) al portugués de Brasil. **Método:** estudio metodológico desarrollado en dos fases: adaptación transcultural conforme a las directrices del *COnsensus-based Standards for the selection of health Measurement Instruments*; y evaluación psicométrica. Participaron 49 adolescentes en la etapa de prueba piloto y 618 en la fase de validación. Se evaluaron la validez de contenido, la estructura factorial y la confiabilidad interna. **Resultados:** la versión brasileña del instrumento (QHKB-Br) obtuvo un índice de validez de contenido global superior a 0,95. En la prueba piloto, el índice de concordancia entre adolescentes fue del 98,7%. El análisis factorial indicó un mejor ajuste para el modelo unidimensional en comparación con el modelo bidimensional original, con una varianza explicada del 61,5%. La fiabilidad del instrumento total presentó α=0,67 y Ω=0,76, valores considerados adecuados para instrumentos con pocos ítems. **Conclusión e implicaciones para la práctica:** el QHKB-Br es un instrumento breve, de fácil aplicación, autoadministrado y que presentó un mejor ajuste al modelo unidimensional en la muestra estudiada. Su utilización por profesionales de la salud puede apoyar acciones educativas y estrategias de promoción de la alfabetización en salud, contribuyendo a la promoción de la salud de adolescentes brasileños en diferentes contextos escolares y comunitarios.

Palabras clave: Adolescente; Alfabetización en Salud; COVID-19; Estudio de Validación; Higiene de las Manos.

INTRODUCTION

Hand hygiene is one of the main protective measures against the spread of diseases, including Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), the causative agent of COVID-19. During the COVID-19 pandemic scenario, hand hygiene was one of the most effective and widely disseminated preventive measures against infections, since human hands represent a critical transmission vector.[1]

Hand hygiene consists of a set of practices aimed at removing or eliminating microorganisms from the hands to prevent infections and pathogen transmission. It involves washing hands with soap and water or rubbing them with alcohol-based preparations and is widely recommended.[2] Therefore, in the absence of effective treatment against COVID-19, measures such as hand hygiene were extremely important. The goal was for individuals to adopt behaviors capable of minimizing the risk of infection and, consequently, reducing the spread of SARS-CoV-2 and other microorganisms.[3]

Although the literature showed lower severity of COVID-19 among children and adolescents infected with SARS-CoV-2, adolescents were more likely to engage in risky health practices related to COVID-19 and were identified as a target group in disease transmission.[4,5] Furthermore, the transition period from childhood to adulthood, during which more critical thinking develops, coincides with the moment when adolescents' knowledge, attitudes, and values regarding the disease may be reflected in their actions and perceptions about the severity of the situation, which may or may not result in health-protective behaviors.[5,6]

Studies conducted in Poland, Saudi Arabia, and Norway[7-9] indicated that hand hygiene could influence the course of the COVID-19 pandemic. An investigation conducted with 2,323 Polish adolescents attending high school demonstrated that individuals from regions with low COVID-19 morbidity presented better hand hygiene habits when compared with those from regions with high COVID-19 morbidity.[7] A study conducted in Saudi Arabia corroborates the relevance of the topic by revealing that knowledge regarding hand hygiene is significantly lower among individuals aged 18 to 37 years than among those aged 38 to 47 years.[8]

Although recommendations and the importance of hand hygiene are widely disseminated, resistance and/or lack of knowledge among children and adolescents can still be observed. The population's level of knowledge regarding hand hygiene, including among adolescents, may vary across different countries, which directly reflects behavior regarding this practice, as described in several studies.[6,9,10]

During the first year of the COVID-19 pandemic, Riiser et al.[10] developed the Questionnaire on Handwashing Knowledge and Behavior (QHKB). This questionnaire was developed in English and consists of six items aimed at assessing adolescents' domains of knowledge and behavior regarding hand hygiene. Since it is a brief self-administered questionnaire, it may be considered easy for adolescents to understand and use, making it useful for supporting interventions directed toward this specific population. Along with QHKB, the authors assessed the HL of the studied population to relate adolescents' behavior and knowledge regarding hand hygiene to their HL.[10]

Although hand hygiene was widely discussed during the COVID-19 pandemic, it has been the subject of studies in multiple contexts both before and after the pandemic period. Recent literature has reinforced that school-based educational interventions are determinants for adherence to hand hygiene. A meta-analysis identified that intervention programs in schools significantly increased the frequency of this practice among children and adolescents, with a direct impact on the prevention of transmissible diseases.[11] Similarly, an implementation study conducted in schools in Pakistan demonstrated that structured educational strategies consistently improved hygiene habits among schoolchildren, highlighting the school environment as a privileged setting for health promotion.[12]

No validated instruments in Portuguese were identified in Brazil to assess knowledge, behavior, or other aspects related to hand hygiene among adolescents. Brazilian adolescents are inserted in different sociocultural and educational contexts, with different levels of inequality in access to health information and hygiene habits.[13] Therefore, any investigation regarding hand hygiene behaviors in Brazil should consider the specificities of this population. Adolescents may present health-related behaviors and practices influenced by factors such as school education, the media, and family guidance.[14]

It should be emphasized that making a culturally adapted and psychometrically valid questionnaire available for the Brazilian context may guide actions that contribute to adolescent health promotion, since it includes the assessment of knowledge and health behavior. Knowledge may be understood as the ability to recall specific facts, apply these facts in problem-solving, or formulate concepts based on acquired understanding about a given event.[15] This cognitive process may be the starting point for behavioral changes. Health behavior, although sequential in nature, may be influenced by several external factors.[16] However, this process may begin with knowledge acquisition and subsequently evolve into attitudes and practices that favor behavioral changes, including healthier choices.[15,17]

Therefore, the present study aimed to perform the cross-cultural adaptation and validity of QHKB into Brazilian Portuguese.

METHOD

This was a methodological study conducted in two phases. In the first phase, the cross-cultural adaptation of QHKB into Brazilian Portuguese was performed using the Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures.[18,19] The entire process was conducted according to COnsensus-based Standards for the selection of health Measurement INstruments guidelines.[20]

QHKB is a self-administered questionnaire composed of six items divided into two domains: knowledge (items 01 to 03) and behavior (items 04 to 06).[10] Each item is assessed using a five-point Likert-type scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The score for each domain is obtained by summing the points assigned to the three corresponding items, resulting in scores ranging from 3 to 15. Scores were treated as continuous variables, according to the recommendations of the original instrument authors, with no cutoff points or predefined categorical stratifications. The instrument demonstrated good reliability, with Cronbach's alpha values of 0.75 for the "knowledge" domain and 0.76 for the "behavior" domain.[10]

In the second phase, the final version was assessed through psychometric analyses for validity purposes. The study was conducted between April and June 2021 in a public teaching hospital located in the countryside of the state of São Paulo, Brazil. Data collection was conducted remotely through the Google Forms® platform. Before the beginning of the study, authorization was requested from and granted by the authors of QHKB. The stages of the first phase are described in Figure 1.

In the first phase, the following stages were performed:

1) Initial translation of the questionnaire: this stage was conducted by two bilingual Brazilian translators, one aware of the study objectives and the other unaware. Each translation generated the T1 and T2 versions.
2) Synthesis of translations: in this stage, the T1 and T2 versions were reviewed by the translators together with the principal researcher to identify discrepancies, resulting in the ST1-2 version.
3) Back-translation: this stage was conducted by two other bilingual translators whose native language was English and who had no knowledge of the original questionnaire. The ST1-2 version was back-translated into English to verify whether meanings had been maintained and to assess translation quality. This process generated the BT1 and BT2 versions.
4) Review by expert committee: at this stage, an expert committee composed of 18 healthcare professionals was formed. Participants were selected through curriculum analysis on the Plataforma Lattes. The following inclusion criteria were established: holding a doctoral degree in the health field; fluency in English; experience with healthcare-associated infections, child/adolescent health, or HL; and knowledge of the cross-cultural adaptation process. The committee assessed all items from all questionnaire versions (T1, T2, ST1-2, BT1, and BT2), together with the original version, to verify semantic, idiomatic, conceptual, and cultural equivalences. Agreement among experts was calculated using the Content Validity Index (CVI), considered adequate when higher than 0.80.[21] After assessment by the expert committee and the research team, the first pre-final Brazilian Portuguese version of the questionnaire (PFV) was generated.
5) Pretest: this stage was conducted to assess possible difficulties regarding comprehension, objectivity, and clarity of the PFV among the target population, in addition to providing space for suggestions. A total of 49 young adolescents aged between 15 and 19 years participated, corresponding to the age range used in the original questionnaire application.[10] According to the World Health Organization, adolescents are individuals aged between 10 years and 19 years, 11 months, and 29 days.[22] However, this classification allows subdivisions, including younger adolescents (15 to 19 years old) and young adults (20 to 24 years old).[23] For this stage, adolescents were recruited through social media and personal contacts of the research team. Agreement among adolescents was calculated using the agreement rate based on the responses "agree" and "disagree". An agreement rate above 90% was considered acceptable.[24]

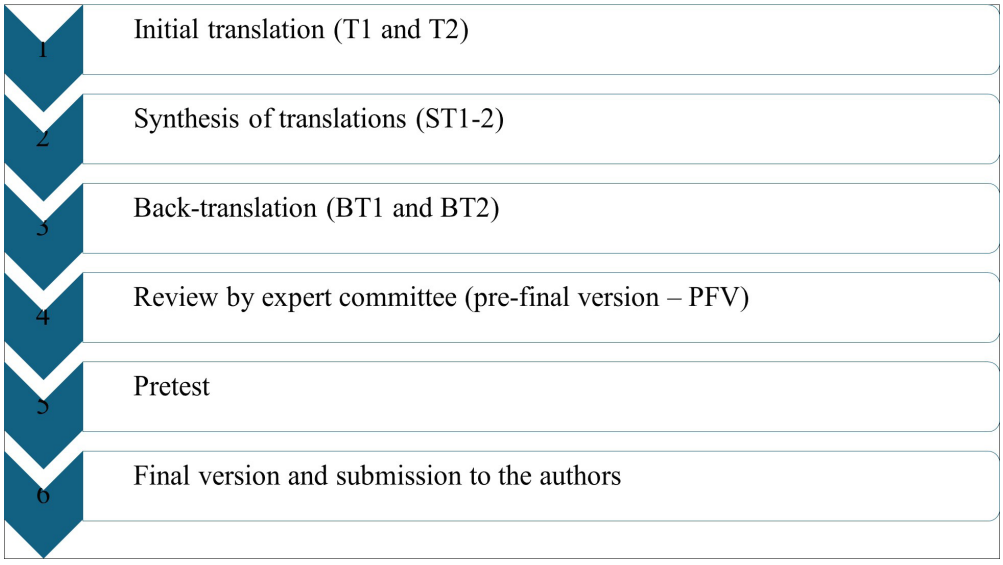

Figure 1. Flowchart of the cross-cultural adaptation stages of the Questionnaire on Handwashing Knowledge and Behavior.

Since this was research conducted in a virtual environment involving adolescents younger than 18 years, initial contact was established with parents and/or legal guardians, who digitally signed the Informed Consent Form (ICF). After this consent, adolescents also completed their Informed Assent Form with the support of their guardians, according to the provided instructions. Participant selection occurred through the snowball sampling technique using social media (Facebook® and Instagram®), personal contacts (WhatsApp® and email), as well as dissemination in schools, communities, and churches, aiming to reach adolescents from all regions of Brazil. For participants aged 18 years or older, guardian authorization was not required, and the ICF was signed directly by the participants. Individuals who did not complete the questionnaire or who did not meet the established criteria were excluded.

6) Finalization of the final version and submission to the authors: at this stage, all considerations identified during the pretest stage were assessed, resulting in the final Brazilian Portuguese version of the instrument (QHKB-Br). All versions generated during the cross-cultural adaptation process were sent to the authors of the original version.

In the second phase, for psychometric assessment of QHKB-Br, the instrument was applied to 618 adolescents. To characterize the studied population, descriptive analyses were performed for the following variables: sex (female, male, or other); age (options ranging from 15 to 19 years); state of residence (including all Brazilian federative units); type of school attended (public or private); school grade (ranging from 6th to 9th grade of elementary school, 1st to 3rd year of high school, and preparatory courses); employment status (yes or no); and participation in technical or undergraduate courses in the health field (yes or no).

Sample adequacy was verified using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's sphericity test. These measures also indicated the feasibility of performing exploratory factor analysis (EFA).[25] This questionnaire analysis makes it possible to verify item interrelationships and how item grouping occurs, with the formation of factors or dimensions.[26] Confirmatory factor analysis (CFA) was performed to verify the validity of the previous theoretical structure, with factor extraction using Robust Unweighted Least Squares. Instrument fit indices were verified using the Non-Normed Fit Index, Comparative Fit Index, Goodness of Fit Index, Adjusted Goodness-of-Fit Index, Root Mean Square Error of Approximation, and Root Mean Square Residual.[27]

Factor reliability was verified using Cronbach's alpha coefficient (α) and McDonald's omega (Ω), with expected values higher than 0.70 for both indices.[28] Dimensionality was investigated using parallel analysis (PA), with 5,000 bootstrap simulations. Data were analyzed using Statistical Package for the Social Sciences 23 and Factor 12.04.05.

The study was approved by the institution's Research Ethics Committee (Opinion 4,661,979), in accordance with Resolution 466/12 of the Brazilian National Health Council. All participants electronically signed the ICF.

RESULTS

Cross-cultural adaptation

In the first phase, corresponding to the cross-cultural adaptation, the original QHKB version was translated by two independent bilingual translators (Portuguese and English), resulting in the T1 and T2 versions. After analysis and selection of the most appropriate terms, the ST1-2 version was obtained. At this stage, differences were related to terms with similar meanings used in Brazil, such as "properly" (*adequadamente ou corretamente*), "advice easy to understand" (*orientações são fáceis de entender ou instruções fáceis de entender*), and "socializing" (*contato com pessoas ou socializar*). In the third stage, the ST1-2 version was back-translated into English by two other independent bilingual translators, both without information regarding the questionnaire objectives, resulting in the BT1 and BT2 versions. This stage revealed few differences between the produced versions and the original questionnaire, making it possible to verify the quality of the Portuguese version produced.

In the fourth stage, 60 participants were invited electronically, and 18 composed the expert committee. The committee assessed all items from all questionnaire versions. Regarding the characteristics of the expert committee, 17 participants were women (94.4%), and the mean time since graduation was 25.5 years. In terms of professional background, 13 were nurses, four were physicians, and one was a nutritionist. In addition, 14 held doctoral degrees and four held postdoctoral degrees. Concerning area of expertise, some specialists had experience in more than one field: four in HL, five in healthcare-associated infections, seven in child and adolescent health, eight in health education, and nine in validity of measurement instruments.

The ST1-2 version was assessed regarding semantic, idiomatic, conceptual, and cultural equivalences. CVI values for each item and the overall questionnaire, in addition to the knowledge and behavior domains, are described in Table 1.

The expert committee made important considerations regarding questions 4 and 5. The main difference between the original version and the Brazilian Portuguese translation was related to the term "*socializar*" (socialize). Replacement with the term "*reunir-me*" (gather) was suggested because it is better understood and more commonly used in the context of Brazilian adolescents. Suggestions were also made regarding questionnaire presentation format. The recommendation concerned landscape page orientation while maintaining the internal text formatting to improve data visualization.

In the subsequent stage (pretest), the PFV was applied to 49 adolescents to assess comprehension, objectivity, and clarity of QHKB, and suggestions were also requested. The mean response time for returning the completed questionnaire was 13 days. Agreement among adolescents was 98.7%, and no changes to the instrument were suggested. Thus, QHKB-Br was generated and sent to the authors of the original questionnaire.

Table 1. Agreement among the expert committee regarding equivalences of the ST1-2 version of the Questionnaire on Handwashing Knowledge and Behavior for Brazil. Botucatu, SP, Brazil, 2021.

Questionnaire items	Semantic equivalence	Idiomatic equivalence	Conceptual equivalence	Cultural equivalence
1. Eu sei quando devo lavar minhas mãos	1.00	1.00	0.94	0.94
2. Eu sei como lavar minhas mãos corretamente	1.00	1.00	1.00	1.00
3. Eu acho que as orientações para lavar as mãos são fáceis de entender	1.00	0.94	1.00	0.94
4. Eu lavo minhas mãos antes de reunir-me com pessoas	1.00	0.98	0.88	0.94
5. Eu lavo minhas mãos depois de reunir-me com pessoas	0.88	0.94	0.88	0.94
6. Eu lembro outras pessoas de lavar as mãos corretamente	1.00	0.94	0.88	0.94
Knowledge dimension	1.00	0.98	0.92	0.96
Behavior dimension	0.96	0.94	0.88	0.94
Overall CVI	0.98	0.96	0.97	0.95

Note: QHKB - Questionnaire on Handwashing Knowledge and Behavior; CVI - Content Validity Index.

Table 2. Factor loadings and communalities of the Brazilian version of the Questionnaire on Handwashing Knowledge and Behavior. Botucatu, SP, Brazil, 2021.

QHKB-Br items	λ	H^2	λ D1	λ D2	H^2
1. *Eu sei quando devo lavar minhas mãos*	0.700	0.491	**0.638**	0.166	0.558
2. *Eu sei como lavar minhas mãos corretamente*	0.642	0.413	**0.845**	-0.060	0.658
3. *Eu acho que as orientações para lavar as mãos são fáceis de entender*	0.498	0.248	**0.512**	0.056	0.299
4. *Eu lavo minhas mãos antes de reunir-me com pessoas*	0.720	0.518	0.209	**0.514**	0.433
5. *Eu lavo minhas mãos depois de reunir-me com pessoas*	0.746	0.556	0.217	**0.535**	0.470
6. *Eu lembro outras pessoas de lavar as mãos corretamente*	0.593	0.352	-0.071	**0.822**	0.613

Note: QHKB-Br - Brazilian version of the Questionnaire on Handwashing Knowledge and Behavior; λ - factor loading; H^2 - communality; D1 - unidimensional model; D2 - bidimensional model.

Psychometric assessment

In the second phase, for psychometric assessment and validity of QHKB-Br, the questionnaire was applied to 618 adolescents. Regarding sociodemographic characteristics, 148 participants were female (73.3%), with a mean age of 17 years, and 135 belonged to the Southeast region of Brazil (66.8%). In addition, 97 adolescents reported having attended public school (48%); 99 were attending college (49%), of whom 89 were enrolled in health-related programs (44.1%); and 163 reported not working (80.7%).

After administration of QHKB-Br, mean scores of 12.9 (±1.6) and 11.0 (±2.3) were observed for adolescents' knowledge and behavior regarding hand hygiene, respectively.

The degree of sample adequacy was verified using a KMO value of 0.81 (95%CI: 0.765–0.836). Bartlett's sphericity test was significant (χ^2 = 1330.3; df =15; p = 0.000000). The tests indicated good factorability of the data. The matrix determinant of 0.14 indicated the possibility of collinearity/multicollinearity among some items.

PA indicated a one-factor model, with explained variance of 61.50%. Since dimensionality presented a model different from the original one (two factors), EFA was applied to both the uni- and bidimensional models, as shown in Table 2. Therefore, although the original instrument was structured into two domains (knowledge and behavior), the studied sample indicated better fit to the unidimensional model compared with the originally proposed bidimensional model.

The internal structure of the scale was assessed through CFA, and fit indices were calculated for both the unidimensional and bidimensional models (Table 3).

Reliability analysis of the total instrument indicated Cronbach's alpha values of 0.67 and McDonald's omega values of 0.76. When reliability was assessed according to instrument domains, the following values were obtained: knowledge (α = 0.66 and Ω = 0.70) and behavior (α = 0.62 and Ω = 0.65).

Table 3. Fit indices of the confirmatory factor analysis of the Brazilian version of the Questionnaire on Handwashing Knowledge and Behavior. Botucatu, SP, Brazil, 2021.

Fit indices	One factor	Two factors
Non-Normed Fit Index (Tucker & Lewis)	0.94	0.99
Comparative Fit Index	0.96	0.99
Goodness of Fit Index	0.98	0.99
Adjusted Goodness of Fit Index	0.97	0.98
Root Mean Square of Residuals	0.07	0.07
Root Mean Square Error of Approximation	0.10	0.01

DISCUSSION

The cross-cultural adaptation of QHKB into Brazilian Portuguese was conducted rigorously, following the recommended methodological stages to ensure instrument consistency and quality. Once an instrument is developed in a given country, it may be used in different countries, provided that methodological procedures are followed.[18-20] Cross-cultural adaptation of instruments ensures the accuracy and reliability of measurements obtained by healthcare professionals and researchers, in addition to promoting knowledge exchange and representing a financially accessible method.[29]

In the present study, assessment by the expert committee was essential to ensure the linguistic, semantic, and cultural adequacy of QHKB-Br for the target population. Suggestions such as replacing the term "*socializar*" (socialize) with "*reunir-me*" (gather) made the instrument more understandable for Brazilian adolescents. The pretest, in turn, confirmed the clarity and objectivity of the version, with no need for additional modifications. Since 1993, the literature has indicated that the participation of expert committees and the application of pretests are important stages for strengthening instrument validity.[26] Evidence demonstrates that expert committee assessment stages produce better model fit indices, with content that is more appropriate for the proposed context.[30,31]

In the subsequent phase, focused on psychometric assessment, QHKB-Br presented adequate evidence of validity and reliability for measuring the constructs of knowledge and behavior regarding hand hygiene among adolescents. Factor analysis demonstrated differences in relation to the original model, which presented a bidimensional structure. In the Brazilian context, the unidimensional version demonstrated better fit, which may be explained by linguistic and cultural particularities.[32]

Unidimensionality in psychological testing is not an absolute concept and may vary according to the population and context.[33] In the case of QHKB-Br, a single factor explaining the variance suggests that knowledge and behavior are strongly correlated and may manifest as a general construct related to hand hygiene. This may indicate that, for the studied population, the distinction between knowledge and behavior is not psychometrically clear, possibly due to the way the topic is learned in Brazil, across different contexts, and how it is internalized by adolescents. Both perception and practice of hand hygiene among adolescents may be influenced by cultural, socioeconomic, and educational factors, which tend to integrate knowledge and behavior into a common experience. The fact that the unidimensional model differs from the original one indicates the need for careful adaptation of the instrument to the Brazilian context and for further investigation regarding the integration between knowledge and behavior.

Reliability assessment of QHKB-Br as a unidimensional questionnaire demonstrated the precision of the Brazilian version, which was confirmed by the adequate values of Cronbach's alpha and McDonald's omega.[31,34-36] These assessments aimed to increase interpretive precision, since Cronbach's alpha coefficient values are strongly influenced by the number of instrument items, meaning that a small number of items per domain may reduce alpha values and compromise internal consistency.[34] Although alpha is not considered a good indicator for model comparison,[36] it is the only common indicator in the study. The cross-cultural adaptation process of QHKB provided good evidence of validity and reliability for measuring knowledge and behavior regarding hand hygiene among Brazilian adolescents when applied remotely.

The instrument had previously been used in a study involving 473 adolescents during the COVID-19 pandemic. Results showed an association between digital HL, assessed using the eHealth Literacy Scale, and QHKB-Br scores. Knowledge and behavior regarding hand hygiene were higher among adolescents who had completed high school compared with those attending higher education, those enrolled in health-related courses, those seeking information about the pandemic, and those searching for information through scientific articles.[37] When comparing the knowledge and behavior scores of Norwegian and Brazilian adolescents, the scores may be considered similar. In Norway, the mean scores for adolescents' knowledge and behavior regarding handwashing were 14.1 (±1.6) and 11.9 (±2.6),[10] respectively, whereas in Brazil they were 12.9 (±1.6) and 11.0 (±2.3).[37]

These findings reinforce the cross-cultural applicability of QHKB, which, even after adaptation, maintained equivalent measurement capacity. Furthermore, international studies indicate that the use of instruments to assess hand hygiene practices is necessary to support educational interventions in school and community environments, where children and adolescents constitute a priority group for infection prevention.[9,38]

A recent systematic review with meta-analysis demonstrated that school-based hand hygiene programs have a significant impact on improving health behaviors and reducing infections, strengthening the potential of instruments such as QHKB-Br to monitor and guide such interventions.[11] Likewise, an implementation study conducted in schools in Pakistan showed that educational strategies directed toward children resulted in positive and sustainable changes in hygiene habits, demonstrating that the practical application of assessment instruments may support the formulation of public policies and effective school interventions.[12]

It is important to emphasize that behaviors related to hand hygiene among children and adolescents cannot be understood solely as individual choices. They are influenced by intrapersonal factors, such as knowledge, attitudes, and skills; interpersonal factors, such as family support, peer influence, and school curriculum; and community and macrostructural factors, such as public policies and access to health resources and information.[16] In this sense, instruments such as QHKB-Br make it possible not only to assess the individual level, but also to identify gaps that may be addressed through educational and community-based strategies, thereby expanding their applicability potential in public health.

QHKB-Br represents an advance for nursing practice because it provides a brief, valid, and reliable instrument to assess knowledge and behavior regarding hand hygiene among adolescents. Its application may support educational interventions conducted by nurses in schools and communities, strengthening HL and promoting adolescents' autonomy regarding self-care. In addition, the instrument, developed in a context of global crisis, reinforces the role of nursing as a protagonist in health promotion strategies, health education, and disease prevention.

CONCLUSION AND IMPLICATIONS FOR THE PRACTICE

The Brazilian version of the instrument, developed in a context of global health crisis, presents potential to support strategies aimed at strengthening the HL of Brazilian adolescents. By enabling the assessment of knowledge and behavior related to hand hygiene, QHKB-Br is configured as a tool to support educational actions developed by nurses and may contribute to reducing health problems resulting from inadequate hygiene practices, promoting adolescents' empowerment in self-care, and enabling infection prevention. It should be emphasized that, because it is a brief instrument, easy to apply, and feasible for use in both face-to-face and remote formats, its applicability may be expanded to different school and community settings, reinforcing its relevance as a health promotion tool and for strengthening the role of nursing in this process.

The study presents limitations related to the cross-sectional design and remote questionnaire administration, which may restrict the generalization of results and a deeper understanding of the investigated phenomenon. Furthermore, although the remote format made it possible to reach participants from different regions of the country, self-reported responses may be subject to social desirability bias, especially in items related to health behavior, in which participants tend to report practices considered socially appropriate. Nevertheless, QHKB-Br stands out as a relevant instrument because it brings together aspects capable of guiding healthcare professionals in the health education of Brazilian adolescents and contributing to strengthening HL. Future studies are recommended to adopt face-to-face administration accompanied by new psychometric analyses in order to expand evidence of validity and reliability.

FINANCIAL SUPPORT

Bicudo TB received funding from the Institutional Program for Scientific Initiation Scholarships - PIBIC Scholarship Affirmative Action RT - PROPe Notice 4/2021- Process Number: 2988.

Translation of the article carried out with funding from *Programa de Apoio à Pós-graduação* - PROAP - Graduate Program in Nursing, *Faculdade de Medicina* - UNESP (Process Number: 3703/2025).

DATA AVAILABILITY RESEARCH

The contents are available at: https://hdl.handle.net/11449/252676

CONFLICTS OF INTEREST

None.

REFERENCES

1. Talic S, Shah S, Wild H, Gasevic D, Maharaj A, Ademi Z et al. Effectiveness of public health measures in reducing the incidence of covid-19, SARS-CoV-2 transmission, and covid-19 mortality: systematic review and meta-analysis. BMJ. 2021;375:e068302. https://doi.org/10.1136/bmj-2021-068302. PMid:34789505.
2. Toney-Butler TJ, Gasner A, Carver N. Hand hygiene [Internet]. Treasure Island: StatPearls Publishing; 2026 [cited 2026 Apr 17]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK470254/
3. Mieth L, Mayer MM, Hoffmann A, Buchner A, Bell R. Do they really wash their hands? Prevalence estimates for personal hygiene behaviour during the COVID-19 pandemic based on indirect questions. BMC Public Health. 2021;21(1):12. https://doi.org/10.1186/s12889-020-10109-5. PMid:33397344.
4. Brodin P. SARS-CoV-2 infections in children: understanding diverse outcomes. Immunity. 2022;55(2):201-9. https://doi.org/10.1016/j.immuni.2022.01.014. PMid:35093190.
5. Dardas L, Khalaf I, Nabolsi M, Nassar O, Halasa S. Developing an understanding of adolescents' knowledge, attitudes, and practices toward COVID-19. J Sch Nurs. 2020;36(6):430-41. https://doi.org/10.1177/1059840520957069. PMid:32990150.
6. Choi S, Bang KS, Shin DA. eHealth literacy, awareness of pandemic infectious diseases, and healthy lifestyle in middle school students. Children. 2021;8(8):699. https://doi.org/10.3390/children8080699. PMid:34438590.
7. Skolmowska D, Głąbska D, Guzek D. Hand hygiene behaviors in a representative sample of Polish adolescents in regions stratified by COVID-19 morbidity and by confounding variables (PLACE-19 Study): is there any association? Pathogens. 2020;9(12):1011. https://doi.org/10.3390/pathogens9121011. PMid:33271861.

8. Bazaid AS, Aldarhami A, Binsaleh NK, Sherwani S, Althomali OW. Knowledge and practice of personal protective measures during the COVID-19 pandemic: a cross-sectional study in Saudi Arabia. PLoS One. 2020;15(12):e0243695. https://doi.org/10.1371/journal.pone.0243695. PMid:33306718.
9. Chen X, Chen H. Differences in preventive behaviors of COVID-19 between urban and rural residents: lessons learned from a cross-sectional study in China. Int J Environ Res Public Health. 2020;17(12):4437. https://doi.org/10.3390/ijerph17124437. PMid:32575700.
10. Riiser K, Helseth S, Haraldstad K, Torbjørnsen A, Richardsen KR. Adolescents' health literacy, health protective measures, and health-related quality of life during the COVID-19 pandemic. PLoS One. 2020;15(8):e0238161. https://doi.org/10.1371/journal.pone.0238161. PMid:32857806.
11. Ismail SR, Radzi R, Megat Kamaruddin PSN, Lokman EF, Lim HY, Abdul Rahim N et al. The effects of school-based hygiene intervention programme: systematic review and meta-analysis. PLoS One. 2024;19(10):e0308390. https://doi.org/10.1371/journal.pone.0308390. PMid:39378207.
12. Pradhan NA, Hashmi M, Mazhar L, Uzair M, Hussain L, Naseem M et al. Intervention to improve children's hygiene in urban squatter settlement schools in Pakistan: an implementation research. Environ Health Insights. 2025;19:11786302241306288. https://doi.org/10.1177/11786302241306288. PMid:39759482.
13. Abrinq F. Um retrato da infância e adolescência no Brasil 2024 [Internet]. São Paulo: Fundação Abrinq; 2024 [cited 2025 May 9]. Available from: https://fadc.org.br/sites/default/files/2024-11/Um-Retrato-da-Infancia-e-Adolescencia-no-Brasil-2024.pdf
14. Ministério da Saúde (BR), Secretaria de Vigilância em Saúde, Departamento de Análise de Situação em Saúde. Pesquisa Nacional de Saúde do Escolar: 2019 [Internet]. Brasília: Ministério da Saúde; 2019 [cited 2025 Oct 22]. Available from: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/publicacoes-svs/pnse/pense-2019.pdf
15. Praxedes RCS, Gubert FDA, Sousa GB, Castro Jr AR, Martins MC, Alves RS et al. Saúde bucal na infância: construção e validação de instrumento sobre conhecimento, atitude e prática de cuidadores. Cien Saude Colet. 2023;28(8):2203-14. https://doi.org/10.1590/1413-81232023288.07042023en. PMid:37531529.
16. Prihanto JB, Nurhayati F, Wahjuni ES, Matsuyama R, Tsunematsu M, Kakehashi M. Health literacy and health behavior: associated factors in Surabaya high school students, Indonesia. Int J Environ Res Public Health. 2021;18(15):8111. https://doi.org/10.3390/ijerph18158111. PMid:34360404.
17. Andrade C, Menon V, Ameen S, Praharaj SK. Designing and conducting knowledge, attitude, and practice surveys in psychiatry: practical guidance. Indian J Psychol Med. 2020;42(5):478-81. https://doi.org/10.1177/0253717620946111. PMid:33414597.
18. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine. 2000;25(24):3186-91. https://doi.org/10.1097/00007632-200012150-00014. PMid:11124735.
19. Epstein J, Santo RM, Guillemin F. A review of guidelines for crosscultural adaptation of questionnaires could not bring out a consensus. J Clin Epidemiol. 2015;68(4):435-41. https://doi.org/10.1016/j.jclinepi.2014.11.021. PMid:25698408.
20. Mokkink LB, Prinsen CA, Bouter LM, Vet HC, Terwee CB. The COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) and how to select an outcome measurement instrument. Braz J Phys Ther. 2016;20(2):105-13. https://doi.org/10.1590/bjpt-rbf.2014.0143. PMid:26786084.
21. Souza AC, Alexandre NMC, Guirardello EB. Psychometric properties in instruments evaluation of reliability and validity. Epidemiol Serv Saude. 2017;26(3):649-59. https://doi.org/10.5123/S1679-49742017000300022. PMid:28977189.
22. World Health Organization. Adolescent health [Internet]. Geneva: WHO; 2026 [cited 2026 Apr 17]. Available from: https://www.who.int/health-topics/adolescent-health
23. Ministério da Saúde (BR), Secretaria de Vigilância em Saúde. Marco legal da saúde de adolescentes [Internet]. Brasília: Ministério da Saúde; 2007 [cited 2025 Oct 22]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/07_0400_M.pdf
24. Polit DF, Beck CT. The content validity index: are you sure you know what's being reported? Critique and recommendations. Res Nurs Health. 2006;29(5):489-97. https://doi.org/10.1002/nur.20147. PMid:16977646.
25. Schreiber JB. Issues and recommendations for exploratory factor analysis and principal component analysis. Res Social Adm Pharm. 2021;17(5):1004-11. https://doi.org/10.1016/j.sapharm.2020.07.027. PMid:33162380.
26. Echevarría-Guanilo ME, Gonçalves N, Romanoski PJ. Psychometric properties of measurement instruments: conceptual basis and evaluation methods – Part II. Texto Contexto Enferm. 2019;28:e20170311. https://doi.org/10.1590/1980-265x-tce-2017-0311.
27. Sellbom M, Tellegen A. Factor analysis in psychological assessment research: common pitfalls and recommendations. Psychol Assess. 2019;31(12):1428-41. https://doi.org/10.1037/pas0000623. PMid:31120298.
28. Ferrando PJ, Lorenzo-Seva U. On the added value of multiple factor score estimates in essentially unidimensional models. Educ Psychol Meas. 2019;79(2):249-71. https://doi.org/10.1177/0013164418773851. PMid:30911192.
29. Vocci MC, Fontes CMB, Abbade LPF. Cultural adaptation of the Glamorgan Scale to Brazilian Portuguese: pressure injury in pediatrics. Rev Lat Am Enfermagem. 2021;29:e3424. https://doi.org/10.1590/1518-8345.4083.3424. PMid:33852689.
30. Hair JF, Black WC, Babin BJ, Anderson RE, Tatham RL. Multivariate data analysis. 8th ed. Upper Saddle River: Thomson Business; 2018.
31. Lorenzo-Seva U, Ferrando PJ. MSA: the forgotten index for identifying inappropriate items before computing exploratory item factor analysis. Methodology (Gött). 2021;17(4):296-306. https://doi.org/10.5964/meth.7185.
32. Oliveira F, Kuznier TP, Souza CC, Chianca TCM. Theoretical and methodological aspects for the cultural adaptation and validation of instruments in nursing. Texto Contexto Enferm. 2018;27(2):e4900016. https://doi.org/10.1590/0104-070720180004900016.
33. Shapiro J, Donaldson S. The Leader Vitality Scale: development, psychometric assessment, and validation. Front Psychol. 2022;13:884672. https://doi.org/10.3389/fpsyg.2022.884672. PMid:35756249.
34. Sijtsma K. On the use, the misuse, and the very limited usefulness of Cronbach's alpha. Psychometrika. 2009;74(1):107-20. https://doi.org/10.1007/s11336-008-9101-0. PMid:20037639.
35. Grama MM, Fonseca DL, Lovisi GM, Lima LA. CONNECT – uma medida de continuidade do cuidado em serviços de saúde mental: adaptação transcultural e confiabilidade da escala. J Bras Psiquiatr. 2016;65(2):140-8. https://doi.org/10.1590/0047-2085000000115.
36. Campo-Arias A, Oviedo H. Psychometric properties of a scale: internal consistency. Rev Salud Publica. 2008;10(5):831-9. PMid:19360231.
37. Prata RA, Silva JB, Pimentel SM, Nunes HRC, Avila MAG. Digital health literacy, behavior and knowledge of adolescents for hand hygiene during the COVID-19 pandemic. Rev Lat Am Enfermagem. 2024;32:e4308. https://doi.org/10.1590/1518-8345.7228.4308. PMid:39230134.
38. Schulenkorf T, Sørensen K, Okan O. International understandings of health literacy in childhood and adolescence a qualitative-explorative analysis of global expert interviews. Int J Environ Res Public Health. 2022;19(3):1591. https://doi.org/10.3390/ijerph19031591. PMid:35162618.

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[a] Extracted from the dissertation "Letramento Digital em Saúde e Conhecimento e Comportamento para higienização das mãos de adolescentes brasileiros na pandemia COVID-19", presented to the Graduate Program in Nursing at Universidade Estadual Paulista, Faculdade de Medicina de Botucatu, in 2023.