

KNOWLEDGE, ATTITUDES, AND PRACTICES SURVEY ON ADOLESCENT SEXUAL AND REPRODUCTIVE HEALTH: EVIDENCE OF INTERNAL STRUCTURE VALIDITY

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Highlights: (1) Two factors structured the instrument: Practices, and Knowledge and attitudes. (2) The model showed good internal consistency. (3) The model proved adequate regarding precision and replicability.

PRE-PROOF

(as accepted)

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ABSTRACT

Objective: To evaluate evidence of validity based on the internal structure of the Knowledge, Attitudes, and Practices survey on sexual and reproductive health among adolescents.

Methods: A methodological study involving 380 participants that examined evidence of validity based on the internal structure of the Knowledge, Attitudes, and Practices survey on sexual and reproductive health among adolescents, conducted in public schools in the city of Floriano, Piauí, Brazil. A questionnaire addressing sociodemographic, sexual, reproductive, and lifestyle profiles was administered, along with the survey developed by Barros (2024). Data were analyzed using the Statistical Package for the Social Sciences (version 20.0) and Factor (version 11.05.01) software. Factor extraction was performed using the Robust Unweighted Least Squares (ULS) method with polychoric correlation. McDonald's Omega coefficient (ω) was used to verify factor reliability. The research was approved by the Research Ethics Committee (approval number 6,596,376). **Results:** Two factors representing the items were identified, with their respective explained variances: factor 1 = 38.5%; factor 2 = 25.3%. The model showed good internal consistency ($\omega = 0.767$). The ORION and FDI indices indicated adequate reliability of the survey. **Conclusion:** The Knowledge, Attitudes, and Practices survey on sexual and reproductive health among adolescents, comprising 10 items and two dimensions (Practices; and Knowledge and attitudes), demonstrated satisfactory psychometric properties, proving to be a model with sound evidence of validity related to internal structure and reliability.

Keywords: Validation study; Adolescent Health; Health Knowledge, Attitudes, Practice; Sexual behavior.

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INTRODUCTION

Sexual health is understood as a state of physical, mental, and social well-being in relation to sexuality, as defined by the World Health Organization (WHO), going beyond the mere absence of disease, dysfunction, or infirmity¹. Reproductive health, in turn, is linked to physical, mental, and social well-being related to the reproductive system, aiming to ensure a safe and satisfying sexual life, with access to information and services that allow for conscious choices².

These two concepts are particularly important during adolescence, a phase of intense changes and discoveries, in which sexuality begins to manifest more strongly. This period is a decisive stage in individuals' lives, as it is frequently when first sexual experiences occur³.

Issues related to adolescent sexual health constitute a major public health problem due to the risks associated with insufficient adequate information and the adoption of risky sexual behaviors³. Lack of information, as well as belief in unreliable information—such as the misconception that condoms do not prevent sexually transmitted infections (STIs)—are factors that can contribute to non-use⁴.

Furthermore, aspects of sexuality are influenced by factors such as the cultural dimension. In this sense, comprehensive sex education strategies and the dissemination of qualified information constitute important tools to expand knowledge and promote the adoption of safer sexual practices².

Thus, health education plays a fundamental role in guiding and promoting awareness-raising actions among adolescents regarding the importance of condom use, the prevention of STIs and unplanned pregnancies, and the practice of safe sex⁵.

In the development of these actions, health professionals must consider adolescents' knowledge, attitudes, and practices regarding sexual and reproductive health. To this end, the use of instruments that allow these aspects to be identified in a valid and reliable manner is necessary, enabling a more precise understanding of this population's needs.

From this perspective, Barros (2024) developed the Knowledge, Attitudes, and Practices (KAP) survey on sexual and reproductive health among adolescents, presenting evidence of validity based on content and response processes. However, the absence of

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evidence of validity based on the internal structure of the instrument still limits its broader use, as it remains uncertain whether the items adequately reflect the proposed constructs.

The discussion regarding the reliability of research instruments concerning what they propose to measure is highly relevant and contextualized within psychometrics, especially when focusing on sensitive phenomena such as adolescent sexual and reproductive health. Thus, this study aims to answer the following research question: What is the evidence of validity based on the internal structure of the Knowledge, Attitudes, and Practices survey on sexual and reproductive health among adolescents?

This study is justified by the need for instruments with robust evidence of validity that can be used in different contexts, such as epidemiological surveys for situational diagnosis, evaluation of educational interventions, and monitoring of public policies, thereby contributing to the planning and qualification of health actions.

Additionally, the research presents scientific and social relevance by providing subsidies for future studies and for the development of strategies aimed at raising adolescents' awareness regarding the prevention of sexually transmitted infections and unplanned pregnancies, as well as the promotion of sexual and reproductive health. Furthermore, it takes into account the social and economic impacts of these health problems, such as costs to the health system, school dropout rates, and increased demand for social assistance.

In view of the above, this study aimed to evaluate the evidence of validity based on the internal structure of the Knowledge, Attitudes, and Practices survey on sexual and reproductive health among adolescents.

METHODS

This is a methodological study focusing on the phase of verifying evidence of internal structure validity, conducted in public schools (state and federal) in the city of Floriano, Piauí, Brazil. The municipality of Floriano has one Regional Education Office and a total of 11 high schools, with 3,523 active students enrolled in 2022.

The study population comprised adolescent students enrolled in high school in Floriano, Piauí. The inclusion criteria were adolescents of both sexes regularly enrolled in high

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school in public schools in Floriano, Piauí. The exclusion criteria were adolescents presenting with verbal communication difficulties or cognitive impairments that could compromise their comprehension and participation.

The sample size was calculated based on simple random sampling without replacement for a finite population. Based on this calculation, the initial sample size was 345 adolescents; however, anticipating potential losses, a 10% margin was added, totaling 380 adolescents.

Data collection took place on school premises in a private room between May and August 2024. For the initial contact with students, a presentation meeting was organized to introduce the researcher and the intended study. During this meeting, participants were instructed on the study objectives, the relevance of their participation, and the need to inform their parents, especially in the case of adolescents under 18 years of age. For minors, an invitation letter was sent to parents explaining the importance of the research involving students; upon acceptance, parents signed the Informed Consent Form (ICF) authorizing participation, and the underage adolescents signed two copies of the Informed Assent Form (IAF). Consequently, at least two visits to each school were required. Adolescents aged 18 years or older did not require parental or legal guardian authorization, and thus were asked to sign the ICF in two copies.

Data were collected using two instruments: the first contained 24 questions addressing the sociodemographic, sexual, reproductive, and lifestyle profiles of the adolescents; the second instrument was the KAP survey developed by Barros (2024). The applied KAP survey comprised 45 questions structured as follows: the first 23 questions regarding knowledge, the subsequent 10 questions (24 to 34) regarding attitudes, and the final 11 questions (35 to 45) regarding practices concerning adolescent sexual and reproductive health.

Data collection was conducted through face-to-face interviews in a private room, subject to school availability, with an average duration of 15 minutes. Data collection involved a team of volunteers composed of undergraduate nursing students who underwent prior training to ensure the correct administration of the data collection instruments.

Initially, data were organized in Microsoft Office Excel electronic spreadsheets and subsequently coded to create a data dictionary. After error correction, data were exported and analyzed using the Statistical Package for the Social Sciences (SPSS, version 20.0) and Factor

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(version 11.05.01) software. Variables regarding the sociodemographic, sexual, reproductive, and lifestyle characteristics of the adolescents were analyzed descriptively in SPSS using absolute and relative frequencies and measures of central tendency (mean).

To obtain evidence of internal structure validity, Exploratory Factor Analysis (EFA) was performed using the Factor software. The Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were applied to verify data adequacy for factor analysis. KMO values closer to 1.0 are considered ideal, whereas values below 0.5 are unacceptable. For the interpretation of KMO indices, values below 0.5 are considered mediocre; values between 0.7 and 0.8 are considered good, while values greater than 0.8 and 0.9 are considered great and excellent, respectively. Bartlett's test of sphericity values with significance levels ($p < 0.05$) indicate that the matrix is factorable, rejecting the null hypothesis that the data matrix is similar to an identity matrix⁶.

The dimensionality of the instrument was tested via Parallel Analysis (PA) using the optimal implementation of Parallel Analysis⁷. Test robustness was determined using bootstrap association, extending the sample to 2,000 cases. According to Cestari (2022)⁸, this is a data resampling procedure used to calculate confidence intervals for the analyzed parameters.

Factor extraction was performed using the Robust Unweighted Least Squares (ULS) method based on a polychoric correlation matrix, which is considered more suitable for the analysis of polytomous and ordinal data because it provides a more accurate estimation of the association between categorical variables. The choice of the ULS method is due to its robustness against violations of multivariate normality, a characteristic frequently observed in data of this type. For factor rotation, the Robust Promin method was used, allowing for an oblique solution that accommodates correlation between factors while favoring a simpler and more interpretable factor structure. Model adequacy was evaluated by analyzing the residuals of the correlation matrix, with a satisfactory reduction observed, indicating a good fit of the model to the data⁸.

As complementary analyses to test the number of factors, the unidimensionality/multidimensionality techniques UNICO (Unidimensional Congruence > 0.95), ECV (Explained Common Variance > 0.80), and MIREAL (Mean of Item Residual Absolute Loadings < 0.30) were applied⁷.

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The criteria for retaining or excluding items from the model considered the convergence of the polychoric matrix and the percentage of discarded covariance for each item (PCDi), excluding items that compromised matrix structure. Item correlations were also analyzed, retaining those with a correlation greater than 0.20 with at least two other items, alongside kurtosis and skewness values. Regarding factor properties, communalities greater than 0.40 ($h^2 > 0.40$) and factor loadings above 0.30 were adopted as retention criteria⁸.

The quality and efficiency of factor score estimates (Overall Reliability of fully-Informative prior Oblique N-EAP scores – ORION > 0.70), latent trait representativity and factor estimation effectiveness (Factor Determinacy Index – FDI > 0.80), sensitivity (Sensitivity Ratio – SR > 2.0), expected percentage of true differences (Expected Percentage of true Differences – EPTD > 90%), and replicability (Generalized G-H Index > 0.80) were evaluated^{7,9}.

To verify the fit of the data to the two-factor structure, Confirmatory Factor Analysis (CFA) was performed, considering goodness-of-fit indices and their respective 95% confidence intervals: Tucker-Lewis Index (TLI > 0.90), Comparative Fit Index (CFI > 0.94), Goodness of Fit Index (GFI > 0.95), Adjusted Goodness of Fit Index (AGFI > 0.93), Root Mean Square Error of Approximation (RMSEA < 0.07), and Root Mean Square of Residuals (RMSR < 0.08)^{7,8}.

McDonald's Omega coefficient (ω) was used to verify factor reliability. The adoption of the Omega coefficient sought to increase interpretation reliability, as numerous inconsistencies regarding reliability via Cronbach's alpha have been reported^{8,10}.

This research is an excerpt from the project "Knowledge, Attitudes, and Practices of adolescents regarding sexual and reproductive health", which was submitted to the Research Ethics Committee of the Federal University of Piauí via Plataforma Brasil and approved under opinion no. 6,596,376. Consequently, ethical aspects involving human research were observed in accordance with Resolution no. 466/12 of the Ministry of Health and Resolution no. 510 of April 7, 2016, of the Ministry of Health.

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RESULTS

Initially, a population of 3,523 adolescents enrolled in high schools in public schools in the municipality of Floriano, Piauí, was considered. Following the selection process, including the application of eligibility criteria and sample calculation, a final sample of 380 adolescents from state and federal public schools was obtained, as shown in Figure 1.

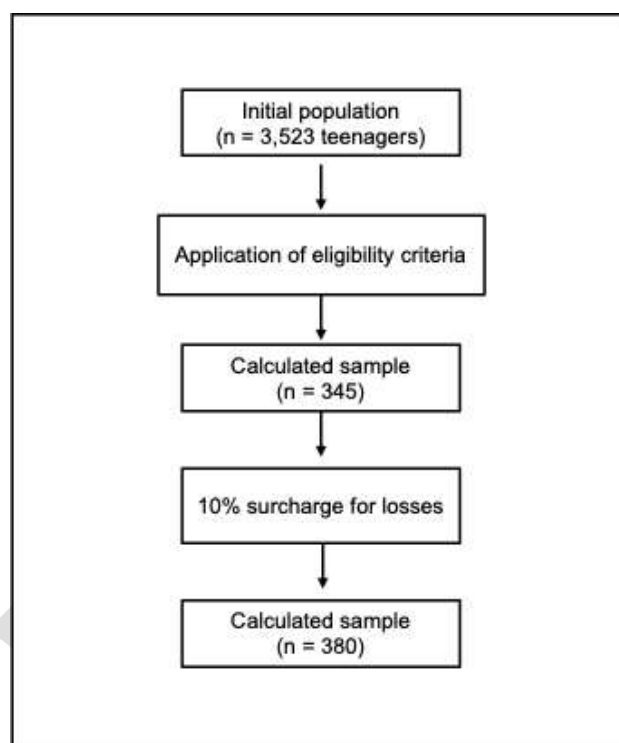


Figure 1 – Study sample selection flowchart

Participant ages ranged from 15 to 19 years, with a mean of 17.0 years. The majority self-identified as mixed-race (parda) (56.6%), single (93.7%), Catholic (55.8%), and enrolled in the state public education system (75.5%). Furthermore, 56.1% completed elementary school in the municipal public system, and 73.9% stated they had never failed a grade in elementary school. Regarding paid employment, 84.5% of the participants did not work, and 28.2% reported a monthly family income of more than 1.5 minimum wages. Most adolescents resided

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in urban areas (81.3%), in their own homes (80.0%), with their families in a house or apartment (87.4%), and with four to six people per household (57.4%).

Regarding the parents' employment status and educational attainment, 62.4% of adolescents reported that their fathers worked, while 57.5% reported that their mothers also worked. Regarding education level, 26.8% reported that the father had completed elementary school, and 30.0% reported that the mother had completed high school. Concerning sexual orientation, gender identity, and sexual experiences, most adolescents declared themselves heterosexual (82.9%) and cisgender (81.6%), and 50.0% stated they had already engaged in sexual intercourse, with the age at first sexual intercourse being 16 years (21.2%). Only 3.7% of the adolescents reported having children, with the majority having a single child.

Table 1 presents the fit indices of the tested models and reveals the quality of the final model compared to the initial one, expressed by the values found in Exploratory Factor Analysis and Confirmatory Factor Analysis (CFA).

Table 1 - Fit indices of the factorial models

Estimate	Mod 1	Mod 2	Mod 3	Mod 4	Mod 5	95% CI*
Polychoric matrix	Negative	Positive	Positive	Positive	Positive	-
Kaiser-Meyer-Olkin	0.79	0.42	0.67	0.67	0.72	0.14- .73
Tucker Lewis Index	-	0.96	0.95	0.95	0.84	0.74- 0.93
Comparative Fit Index	-	0.97	0.97	0.97	0.91	0.85- 0.96
Goodness of Fit Index	-	0.92	1.0	1.0	1.0	1.0- 1.0
Adjusted Goodness of Fit Index	-	0.91	1.0	1.0	1.0	1.0- 1.0
Root Mean Square Error of Approximation	-	0.04	0.04	0.52	0.10	0.06- 0.12
Root Mean Square of Residuals	-	0.07	0.05	0.05	0.10	0.07- 0.12

* 95% CI: 95% confidence interval for Model 5

Source: Prepared by the author.

Based on the initial analysis (Model 1) with the 45 items of the survey, as shown in Table 1, the results evidenced a negative factor matrix with a covariance destruction percentage of 40.4% and a reasonable KMO (0.79), which precluded further analyses. Items that were destroying the covariance matrix (V1, V2, V4, V5, V6, V18, V27, V29, V31, V32, V39, V45) were removed. Following the exclusion of these items, a positive matrix and an unacceptable KMO (0.42) were obtained (Model 2).

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In Model 2, the results indicated the removal of 20 additional items (V8, V11, V12, V14, V16, V17, V19, V20, V21, V22, V23, V24, V28, V33, V34, V37, V40, V41, V42, V43) that showed inadequate kurtosis and communalities. With the exclusion of these items, a new analysis was performed (Model 3) with 13 variables. This latter model presented a positive factor matrix and a mediocre KMO (0.67). However, it still required adjustments as it presented two items with inadequate communalities (V10 and V44). Following the exclusion of these items, the process proceeded to Model 4, which presented one item with an inadequate communality (item V13), which was then removed.

Model 5 demonstrated good sample adequacy, with a KMO index of 0.72 and a positive polychoric matrix (Table 1). This adequacy was confirmed by Bartlett's test of sphericity results ($\chi^2 = 1619.6$; $df=45$; $p<0.001$) and a reasonable KMO value (0.72; 95%CI=0.14–0.73), indicating that correlations among items are statistically significant and appropriate for factor analysis, as presented in Table 2. The KMO value classified as reasonable reinforces that the sample presents sufficient quality for factor extraction, with an adequate proportion of common variance among items.

Taken together, these results demonstrate that the correlation matrix is factorable and that the data possess an adequate structure for identifying latent dimensions.

The multidimensionality of the instrument was evidenced by the UniCo (0.73; 95%CI=0.70–0.80), ECV (0.60; 95%CI=0.55–0.66), and MIREAL (0.33; 95%CI=0.28–0.37) indices. Specifically, UniCo and ECV values below the cut-off points for unidimensionality, combined with MIREAL above the recommended limit, indicate that the items do not organize into a single dominant factor, but rather into multiple dimensions. This finding empirically supports the adoption of a multifactorial model, which is consistent with the complexity of the evaluated construct.

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Table 2 - Metrics for evaluating the adequacy and simplicity of the factor model – Floriano, PI, Brazil, 2025.

Metric	Value (95% CI)	P-value
Bartlett's Test of Sphericity	1619.6	< 0.001*
KMO (<i>Kaiser-Meyer-Olkin</i>)	0.72 (0.14 – 0.73)	
Bentler's simplicity index (S)	0.99 (0.99-1.0)	
Loading simplicity index (LS)	0.76 (0.70- 0.93)	
UniCo indices (Unidimensional Congruence)	0.73 (0.70- 0.80)	
ECV index (Explained Common Variance)	0.60 (0.55- 0.66)	
MIREAL	0.33 (0.28- 0.37)	

* p < 0.05: statistically significant difference.

Source: Prepared by the authors.

The model showed good internal consistency, expressed by McDonald's ordinal Omega value of $\omega=0.767$. The ORION and FDI indices indicated adequate reliability of the KAP survey, comprising 10 items, with acceptable fit indices in the Exploratory Factor Analysis (EFA) (Non-Normed Fit Index [NNFI] = 0.849; Comparative Fit Index [CFI] = 0.913; Goodness of Fit Index [GFI] = 1.000; and Adjusted Goodness of Fit Index [AGFI] = 1.000). The fit indices of the analyzed models confirm the quality of Model 5.

Parallel analysis, presented in Table 3, indicated the retention of two factors representing the items, with explained variances of 38.5% (Factor 1) and 25.3% (Factor 2), totaling 63.8% of the variance. Factor 1 comprised three items (V35, V36, V38) with adequate factor loadings and corresponded to the Practices domain. Factor 2, comprising seven items (V3, V7, V9, V15, V25, V26, V30), grouped items related to the Knowledge and Attitudes domains, presenting satisfactory factor loadings above the established cut-off point (>0.30). Items showed higher associations with their respective factors, with no evidence of relevant cross-loadings, reinforcing the consistency of the factor solution. Although the instrument was originally constructed with three domains, the Knowledge and Attitudes items grouped into a single factor, suggesting conceptual proximity between these constructs in the studied sample. Table 3 presents the complete results of the exploratory factor analysis of the KAP survey on adolescent sexual and reproductive health.

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Table 3 - Factor loadings, communalities, and kurtosis of the final two-factor model –
Floriano, PI, Brazil, 2025.

Item	Factor loadings		H ²	K
	F1	F2		
V35	0.83		0.69	2.97
V36	0.75		0.61	-1.77
V38	0.81		0.65	-1.73
V3		0.62	0.37	4.29
V7		0.65	0.41	-0.27
V9		0.53	0.31	-1.59
V15		0.66	0.43	0.57
V25		0.74	0.55	2.91
V26		0.64	0.42	3.69
V30		0.76	0.59	1.61
%Variance	38.5	25.3	Total variance: 63.8%	

F1: Practices; F2: Knowledge and attitudes; h²: Communality; K: Kurtosis.

Source: Prepared by the author

Chart 1 details the items of the KAP survey on adolescent sexual and reproductive health that comprise each factor of Model 5.

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Dimensions	Item	Item description	Item response
Practices	V35	Have you ever used alcoholic beverages and/or illicit drugs (e.g., marijuana, inhalants – loló, lança-perfume/solvents, cocaine, crack, among others) before any sexual intercourse?	☐ Yes, always ☐ Yes, almost always ☐ Yes, sometimes ☐ No ☐ No, I've never had sexual relations. ☐ Don't know
	V36	Do you use a condom during sexual intercourse to prevent a sexually transmitted infection or an unplanned pregnancy?	☐ Yes, always ☐ Yes, almost always ☐ Yes, sometimes ☐ No, I never use it ☐ No, I've never had sexual relations. ☐ Don't know
	V38	Did you use a condom during your first sexual intercourse?	☐ Yes ☐ No ☐ Don't know ☐ I have never had sexual relations
Knowledge and attitudes	V3	Do you know what contraceptive methods are?	☐ Yes ☐ No ☐ I don't know/No opinion
	V7	The use of a condom during vaginal sex is	☐ Necessary ☐ Unnecessary ☐ I don't know/No opinion
	V9	The use of a condom during anal sex is:	☐ Necessary ☐ Unnecessary ☐ I don't know/No opinion

	V15	Can a person be infected with HIV (Human Immunodeficiency Virus) or Hepatitis B by sharing contaminated needles and syringes?	☐ Yes ☐ No ☐ I don't know/No opinion
	V25	Would you use a condom during sexual intercourse to prevent a sexually transmitted infection?	☐ Yes, always ☐ Yes, almost always ☐ Yes, sometimes ☐ No ☐ I don't know/No opinion
	V26	Would you use a condom during sexual intercourse to prevent a pregnancy?	☐ Yes, always ☐ Yes, almost always ☐ Yes, sometimes ☐ No ☐ I don't know/No opinion
	V30	Would you take a rapid test (with results available within a few minutes) for HIV (Human Immunodeficiency Virus) or other sexually transmitted infections, such as syphilis and Hepatitis B?	☐ Yes ☐ No ☐ I don't know/No opinion

Chart 1 - KAP survey on adolescent sexual and reproductive health – Florianópolis, PI, Brazil, 2025.

Source: Prepared by the author.

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Finally, Table 4 shows that the KAP survey, specifically Model 5, proved adequate regarding precision ($0.852 \leq \text{ORION} \leq 0.858$), representativity ($0.923 \leq \text{FDI} \leq 0.926$), and replicability ($0.852 \leq \text{Latent H} \leq 0.858$, $0.666 \leq \text{Observed H} \leq 0.705$). These data specify the quality and efficacy of the survey's factor score estimates.

Table 4 - Quality and efficacy of factor score estimates – Floriano, PI, Brazil, 2025.

Factors	ORION*	FDI**	G-H Index	
			Latent H	Observed H
1- Practices	0.852	0.923	0.852 (0.68-0.88)	0.705 (0.64-0.76)
2- Knowledge and attitudes	0.858	0.846	0.858 (0.79-0.89)	0.666 (0.58-0.87)

ORION*: Overall Reliability of fully-Informative prior Oblique N-EAP scores (>0.70); FDI: Factor Determinacy Index (>0.80).

Source: Prepared by the author.

DISCUSSION

This study demonstrated that the Knowledge, Attitudes, and Practices survey on sexual and reproductive health among adolescents exhibits a two-dimensional structure, comprising the Practices and Knowledge and Attitudes domains, explaining 63.8% of the total variance. The final model, consisting of 10 items, showed adequate internal consistency ($\omega=0.767$), as well as good fit indices, precision, and replicability, indicating satisfactory evidence of validity based on internal structure.

As previously mentioned, this research achieved its objective by analyzing the internal structure of the Knowledge, Attitudes, and Practices Survey on Sexual and Reproductive Health among Adolescents. This type of evidence refers to the degree to which the relationships between the items of a test reflect the underlying theoretical structure of the construct being measured. In other words, it evaluates whether the items are organized and correlate consistently with theory⁸. In the healthcare field, numerous instruments have been developed, and evidence of validity based on internal structure has been verified to make them more consistent and valid^{3,11-13}.

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The covariance matrix is a square matrix that organizes the covariances between all pairs of variables in a multivariate dataset, reflecting the degree of joint variation between variables and the individual dispersion of each¹⁴. In view of this and the analysis performed, certain alterations were necessary in the survey evaluated in this research. Consequently, initially, 12 items were removed because they exhibited behavior that distorted the relationship among the remaining items and compromised the structure of the covariance matrix.

Kurtosis and communality measures were used as criteria for retaining items in the instrument. Kurtosis characterizes the shape of the probability distribution, indicating the degree of peakedness or flatness of the curve¹⁵. Communality, in turn, represents the total amount of variance that an original variable shares with the other variables present in the analysis. Based on these criteria, 23 items were excluded for presenting inadequate kurtosis and communalities. Following the exclusion of these items, the model solution proved appropriate, with no deleterious effects arising from the sample or the established model.

The final model demonstrated good sample adequacy, with a positive polychoric matrix confirmed by Bartlett's test of sphericity and KMO, indicating that the variables share a relationship and can be grouped to represent latent constructs or traits¹⁶. EFA and CFA showed that the Knowledge, Attitudes, and Practices Survey on Sexual and Reproductive Health among Adolescents organizes into two factors representing the items: the first encompassed the Practices domain, and the second presented items related to the Knowledge and Attitudes domains. The factor loadings of each item were satisfactory, remaining within acceptable limits and loading onto a single factor, with kurtosis and communalities considered statistically acceptable. According to Hair et al. (2013)¹⁵, factor loadings represent one of the outcomes of factor analysis and indicate how much an item contributes to the factor. The higher an item's factor loading, the greater its importance to the construct in question.

Previous psychometric studies also evidence variations in the factor structure of instruments aimed at evaluating health constructs, reinforcing that such differences may stem from sample characteristics and the application context. In a recent investigation, it was observed that the organization of factors does not always reproduce the initially proposed theoretical structure, requiring empirical adaptation of the model based on the obtained data^{12,16}.

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Accordingly, the findings of the present study, which indicated the merger of the Knowledge and Attitudes domains into a single factor, are consistent with the literature, which recognizes that constructs related to health behavior may present overlap, especially in adolescent populations, where knowledge tends to directly influence attitudes¹⁷.

The items in the first domain (Practices) address elements related to sexual health and risk behaviors among adolescents, specifically regarding non-use of condoms and the consumption of psychoactive substances. It is known that condoms, besides requiring no medical prescription and being usable by anyone, are the sole method guaranteeing protection against unplanned pregnancies and STIs¹⁸. Thus, it is timely to reinforce that sexual health education stimulates the practice of self-care, clarifying doubts on the subject, particularly through interventions that consider the social and cultural context of the adolescent, promoting dialogue and participation in exchanges¹⁹.

Furthermore, the importance of educational actions regarding proper condom use during sexual intercourse is highlighted, for both sexually active adolescents and those who have not yet initiated sexual activity, since despite the abundance of information available on adolescent sexuality, a gap still persists between knowledge and practice regarding condom use²⁰. It is worth recalling that adolescents have the right to access information and education on sexual and reproductive health, as well as to access means and methods that assist them in avoiding unplanned pregnancies and preventing STIs, respecting their freedom of choice, as provided by the family/reproductive planning law.

Additionally, it is emphasized that alcohol and other drugs, frequently consumed, cause direct harm to health, amplifying risk behaviors and adolescent vulnerability²¹. In highlighting the relationship between alcohol influence in adolescents and risky sexual behaviors, groups with higher rates of alcohol consumption are associated with a higher incidence of unplanned sexual relations and increased use of emergency contraceptives, suggesting potential low condom use¹⁹.

In this context, the importance of investigative instruments capable of identifying factors influencing adolescent risk behaviors is evidenced, as well as understanding the relationship between the use of these substances and adolescents' sexual choices, in order to

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develop more effective prevention strategies that not only warn about risks but also guide toward healthier practices.

The second domain explores issues related to adolescents' Knowledge and Attitudes regarding the use of contraceptive methods and STI prevention. For Cabral and Brandão (2020)²², knowledge, combined with practice, is directly related to the prevention of STIs and unplanned pregnancies; however, prevention also depends on access to information and the possibility of exercising various forms of safe sex.

In view of this, it is important that instruments directed at sexual and reproductive health evaluate individuals' knowledge and attitudes to enable healthcare professionals to establish a situational diagnosis, which will permit the development of educational actions focused on what these individuals know and think about a given topic.

Moreover, the second domain includes a question exploring a type of transmission for HIV, syphilis, and Hepatitis B. Doubts regarding STI transmission routes still persist among adolescents. A KAP study conducted with 187 adolescents from 14 public schools regarding Hepatitis B revealed that a considerable number of participants were unaware of the disease's transmission routes, which may increase vulnerability to infection by hindering the adoption of preventive measures²³. Complementarily, a qualitative study investigated access to health services and linkage to care for HIV and other STIs in the context of community interventions offering testing and pre-exposure prophylaxis (PrEP) to youth and adolescents in São Paulo and Salvador. The results showed that participants lacked knowledge regarding HIV transmission, highlighting the precariousness of information concerning transmission, prevention, diagnosis, and treatment²⁴.

This informative deficit compromises prevention, as it is essential for adolescents to understand the transmission routes of these infections to adopt safe practices. Hepatitis B, for instance, is transmitted primarily through sexual contact with an infected person; via injections or wounds caused by contaminated material; through treatment with contaminated blood derivatives; or from an infected carrier mother to her baby at birth²³. HIV is transmitted via sexual routes (vaginal, anal, or oral) (heterosexual or homosexual), by sharing syringes, in accidents involving infected needles and sharp objects, through contaminated blood transfusion, via vertical transmission from an infected mother to the fetus during gestation or

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labor, and during breastfeeding²⁴. Syphilis, a bacterial infection, can be transmitted through sexual contact with an infected person, blood transfusion, or direct contact with contaminated blood, in addition to mother-to-child transmission¹⁷.

Knowledge regarding the transmission routes, prevention, and care related to these diseases is directly related to adolescents' attitudes. A study on syphilis showed that a higher degree of knowledge is associated with a safer attitude toward sexual health¹⁷. Understanding these issues often shapes preventive attitudes, demonstrating that an integrated approach is essential to promote meaningful behavioral changes. The proximity between these two concepts justifies their combination into a single domain, allowing for a more effective analysis.

The multidimensionality of the instrument reflects the complexity of the interactions among the social, cultural, economic, educational, and psychological aspects of adolescents. Thus, the relationship among these factors encompasses everything from the level of knowledge about sexual and reproductive health to attitudes, practices, and access to information and contraceptive methods²⁵. Comprehending this multidimensionality is essential for designing prevention strategies that take into account the specific realities of adolescents, thereby promoting sex education, open dialogue, and access to resources that encourage safe sex practices.

It is also noteworthy that the factors demonstrated good internal consistency, as indicated by the omega value. This metric was adopted to enhance the reliability of the interpretation, given the inconsistencies observed in the use of Cronbach's alpha, according to Santos and Rebutini (2023)¹⁰. Furthermore, according to Silva Júnior (2010)²⁶, omega provides a more accurate estimate of the true reliability of the measurement than alpha.

In addition, the model showed significant adequacy in terms of precision, representativity, and replicability, as evidenced by the ORION, FDI, latent H, and observed H indices, which demonstrate its robustness. When analyzed together, the model fit indices (NNFI, CFI, GFI, and AGFI) reinforce its overall adequacy, while the GFI and AGFI values highlight the model's high representativity and its capacity to accurately describe the relationships among variables in the dataset, according to the CFA

In view of the above, it is highlighted that evidence of validity based on the internal structure of the Knowledge, Attitudes, and Practices Survey on Sexual and Reproductive Health

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among Adolescents was identified, and that the instrument, even consisting of only 10 items, can be objective in evaluating aspects related to sexual and reproductive health.

The limitations of this study include the nature of the participants. Adolescents from private educational institutions did not participate in the research, which limits the generalization of the findings to adolescents from different socioeconomic contexts. This aspect introduces a restricted perspective regarding the observed variations, considering that access to educational resources and cultural differences can influence the measurable outcomes. Nonetheless, the sample proved satisfactory for the analyzed dataset. According to Matos and Rodrigues (2019)¹⁴, the recommended number of observations is at least five times the number of variables, and this study achieved a proportion of 8.4 times more observations than the number of variables, ensuring robust and reliable statistical analysis.

Furthermore, a limitation of the study is the potential influence of the item exclusion process on the content validity of the instrument throughout the factor analyses. Although such exclusions were necessary to ensure statistical adequacy and internal structure consistency, they may have reduced, to some extent, the initial comprehensiveness of the construct, particularly regarding the representation of the originally proposed domains. However, the final model, comprising 10 items, demonstrated the capacity to synthesize the main theoretical aspects of the instrument, as evidenced by the factor organization and the internal consistency indices obtained.

CONCLUSION

The Knowledge, Attitudes, and Practices survey on sexual and reproductive health among adolescents demonstrated satisfactory psychometric properties for the 10-item instrument with two dimensions (Practices; Knowledge and attitudes), proving to be a model with good evidence of validity related to internal structure and reliability, and demonstrating its capacity to measure what it proposes to measure, thereby offering reliability for its use in research contexts.

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The findings highlight that the instrument is capable of measuring, in a valid and reliable manner, aspects related to adolescent sexual and reproductive health, and can be used in different research and health practice contexts.

In practice, the instrument can support health and educational actions by enabling the identification of gaps in knowledge, attitudes, and practices, thereby contributing to the planning of more targeted interventions. Further studies in different population contexts are recommended to broaden the instrument's evidence of validity.

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SUPPLEMENTARY MATERIALS

**SUPPLEMENTARY MATERIAL A - KNOWLEDGE, ATTITUDES, AND
PRACTICES SURVEY ON ADOLESCENT SEXUAL AND REPRODUCTIVE
HEALTH**

**KNOWLEDGE, ATTITUDES, AND PRACTICES SURVEY ON ADOLESCENT
SEXUAL AND REPRODUCTIVE HEALTH**

The following survey is anonymous and confidential. You do not need to write your name. For each question, you must select one response option. All data will be kept in absolute confidentiality.

QUESTION	KNOWLEDGE / ATTITUDES	RESPONSES
01	Do you know what contraceptive methods are?	☐ Yes ☐ No ☐ Don't know / No opinion
02	The use of a condom during vaginal sex is:	☐ Necessary ☐ Unnecessary ☐ Don't know / No Opinion
03	The use of a condom during anal sex is:	☐ Necessary ☐ Unnecessary ☐ Don't know / No Opinion
04	Can a person be infected with HIV (Human Immunodeficiency Virus) or Hepatitis B by sharing contaminated needles and syringes?	☐ Yes ☐ No ☐ Don't know / No opinion
05	Would you use a condom during sexual intercourse to prevent a sexually transmitted infection?	☐ Yes, always ☐ Yes, almost always ☐ Yes, sometimes ☐ No ☐ Don't know / No opinion

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06	Would you use a condom during sexual intercourse to prevent a pregnancy?	☐ Yes, always ☐ Yes, almost always ☐ Yes, sometimes ☐ No ☐ Don't know / No opinion
07	Would you take a rapid test (with results available within a few minutes) for HIV (Human Immunodeficiency Virus) or other sexually transmitted infections, such as syphilis and Hepatitis B?	☐ Yes ☐ No ☐ I don't know/No opinion

QUESTION	PRACTICES	RESPONSES
08	Have you ever used alcoholic beverages and/or illicit drugs (e.g., marijuana, inhalants – loló, lança-perfume/solvents, cocaine, crack, among others) before any sexual intercourse?	☐ Yes, always ☐ Yes, almost always ☐ Yes, sometimes ☐ No ☐ No, I've never had sexual relations. ☐ Don't know
09	Do you use a condom during sexual intercourse to prevent a sexually transmitted infection or an unplanned pregnancy?	☐ Yes, always ☐ Yes, almost always ☐ Yes, sometimes ☐ No, I never use it ☐ No, I've never had sexual relations ☐ Don't know
10	Did you use a condom during your first sexual intercourse?	☐ Yes ☐ No ☐ Don't know ☐ Never had sexual relations