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Colombian Adaptation of the HIV and Other Sexually Transmitted Infections Knowledge Scale (KSI) in an Adolescent Population

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Abstract

Colombia has one of the highest rates of sexually transmitted infections (STIs) and teenage pregnancies among Latin American countries. Knowledge about HIV/AIDS and other STIs has been identified as a factor in promoting healthy sexual behavior. The HIV and Other Sexually Transmitted Infections Knowledge Scale (KSI) is an instrument created in Spain to assess sexual health knowledge in adolescents. In view of the lack of scales that measure this construct in Colombia, this study aims to culturally adapt and validate the KSI for the Colombian adolescent population. The sample was comprised of 866 adolescent school children (458 females and 408 males) aged between 14 and 19 years ($M = 15.97$, $SD = 1.36$) from 12 schools in the cities of Bogotá (n = 467) and Barranquilla (n = 400). Results showed good item psychometric properties and adequate discrimination and difficulty indices. Factorial analysis confirmed a five-dimensional factor structure. The indicators of validity showed significant correlations with constructs related on theoretical grounds. In sum, the study presents a valid and reliable scale for evaluating knowledge about HIV and other STIs in Colombian adolescent population.

Keywords

HIV/AIDS, knowledge, validity, adolescents, Colombia

Nearly 36.7 million people around the world are currently living with HIV, with only 20.9 million having access to antiretroviral treatment (UNAIDS, 2017). Approximately 1.8 million people in Latin America live with HIV; of those, approximately 63,000 are adolescents between 15 and 19 years of age (UNAIDS, 2016). In Colombia, approximately 120,000 cases of HIV were reported between 1990 and 2016 (UNAIDS, 2017). Rates for other sexually transmitted infections (STIs) are also high among young people. For instance, bacterial vaginosis (42%), human papillomavirus infection (28%), and infections by chlamydia (11.4%), gonorrhea (0.10%), and urethritis (6.2%) (Paredes et al., 2015; Villegas-Castaño & Tamayo-Acevedo, 2016).

Research has shown that multiple cognitive variables influence sexual risk behaviors (Albarracin et al., 2001; Morales et al., 2018; Sheeran et al., 1999). One of the most important cognitive variables is an individual's level of knowledge about STIs (Ritchwood et al., 2017). This construct is related to variables including risk awareness, the person's belief in the effectiveness of condoms as a preventive agent, and their intention to use a condom (Catania et al., 1990).

A higher level of knowledge about STIs is associated with a later age of sexual initiation, more consistent use of condoms, and positive attitudes toward the prophylactic device (Bryan et al., 2006). Latin American young people have been found to possess a low level of knowledge concerning STIs (Dávila et al., 2008; Salas et al., 2011, Gomez-Bustamante & Cogollo-Milanés, 2011; Uribe et al., 2010). In Colombia, STI-related knowledge has been studied using only one scale: the HIV-AIDS Knowledge scale (CAP) (Cardona et al., 2015). Its 20 items were built and validated for adolescents, and it includes items on sexually transmitted infections, forms of prevention, routes and sources of transmission, symptoms, and treatment. However, considering the current use of ad hoc scales, a validated version specifically for use in Colombia is still needed.

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Although these and other studies provide an overview of the reality in the country, the lack of scales measuring knowledge about HIV simultaneously with other STIs and poor reliability are limitations to these approaches (for example, Cardona et al., 2015, Mazo-Vélez et al., 2014). None of these studies have used adapted and validated instruments designed explicitly for the Colombian adolescent population (for example, Galindo et al., 2011, Gómez-Bustamante & Cogollo-Milanés, 2011). In this context, an adequate and valid measure to assess a person's knowledge about HIV and other STIs should allow for the detection of populations at higher risk of engaging in risky sexual behavior and would make possible to evaluate how effective intervention programs are (Medley et al., 2009).

Espada et al. (2014) created a reliable scale with an adequate factor structure to evaluate knowledge about HIV and other STIs in the Spanish adolescent population. The instrument focuses on areas such as general awareness of the nature of HIV, as well as knowledge about condoms, HIV transmission, knowledge about other STIs, and HIV prevention. However, 33 different countries have Spanish as official language and have large cultural differences. While within English language adaptations are scarce, such adaptations are common in Spanish (Sanson-Fisher & Perkins, 1998). An example is the PISA test, for which the translation and adaptation processes were conducted following standardized guidelines (Programme for International Student Assessment, 2010). Indeed, guidelines for adapting test within the same language in different cultures were followed (Vallejo-Medina et al., 2017).

Therefore, the purpose of the present study was to adapt the HIV and Other Sexually Transmitted Infections Knowledge Scale (KSI) for adolescents, which was originally developed for the Colombian adolescent population by Espada et al. (2014). In addition, the results of the adapted scale are compared with other cognitive variables such as HIV attitudes (HIV Attitudes Scale, HIV-AS, Espada et al., 2013) and AIDS-phobia (Multicomponent AIDS Phobia Scale, MAPS, Espada et al., 2013, Harrell & Wright, 1998).

Participants

Convenience sampling was performed in 12 schools in the cities of Barranquilla and Bogotá (Colombia). These selected cities are characterized by their high prevalence of sexually transmitted infections and early pregnancies; their demographic, cultural, and climate characteristics are significantly different from each other. Bogotá is the capital of Colombia. Its population is close to eight million people, most of whom have migrated from various parts of the country. Due to its high altitude, Bogotá has a mountain climate. Temperatures range regularly between 5 and 19°. On the other hand, Barranquilla is a coastal city located on the western margin of the Magdalena River, 7.5 km from its mouth in the Caribbean Sea. Its population is approximately two million people, and its region is characterized by dry forests and high temperatures.

An initial sample of 1,300 adolescents was used for data collection; approximately 1,000 (76.9%) of these participants met the inclusion criteria. After the informed consent procedure, which considered both parents and participants, a final sample of 866 (66.6%) adolescents aged between 14 and 19 participated in this study. The inclusion criteria to participate in the study were: (1) having signed the informed consent forms (participants and their parents or legal guardians), (2) being between 14 and 19 years of age, and (3) attending a school located in Bogotá or Barranquilla. Exclusion criteria were: (1) presenting development disorders and (2) not being able to read or write. The data collection process was carried out over a 6-month period. As usual in Colombia, none of the schools had a sex education component in its curriculum.

Measures

Central measure. It represents the degree of knowledge about HIV and other STIs as obtained with the instrument described below:

HIV and Other STIs Knowledge Scale (KSI, Espada et al., 2014). This instrument comprises 24 items that evaluate aspects related to knowledge of HIV and other STIs, with *False*, *True,* or *I do not know,* as response options. For its statistic treatment, items were recoded into "Known or do not known". The items are grouped into five subscales: (a) *General HIV knowledge* (General Know), (b) *Condom knowledge* (Cond K), (c) *HIV transmission knowledge* (HIV Trans), *(d) Knowledge about other STIs* (Other STI K), and (e) *HIV prevention knowledge* (HIV Prev K). See Online Appendix B.

Measure of contrast criteria. This measure includes the results of two contrast tests that were compared with the instrument described below:

Multicomponent AIDS Phobia Scale (Multicomponent AIDS Phobia Scale, MAPS, Espada et al., 2013; Harrell & Wright, 1998). The present study uses the scale validated for Colombia by Vallejo-Medina et al. (2018). The scale consists of two theoretically independent subscales: (a) *Fear of Infection* (Fear infect), which assesses the fear of being infected with HIV, and (b) *Fear of Others/Avoidance* (Fear of AIDS) which evaluates avoidant behaviors in contexts related to the presence of AIDS. It is composed of 11 items scored on a 5-point Likert scale (from 1 = *Completely disagree* to 5 = *Completely agree*).

The following are two sample items: "*I think I have a high risk of getting HIV*," *or* "*I would feel comfortable if a doctor who is HIV positive completed my check-up."* In our study, Cronbach's alpha ranged from .68 to .80.

HIV/AIDS Attitudes Scale (HIV Attitudes Scale, HIV-AS, Espada et al., 2013). The present study used a scale validated for Colombia by Gómez-Lugo et al. (2020). This scale evaluates attitudes toward HIV/AIDS. Although the original version includes 12 items, the Colombian version includes 11. Items are scored on a 4-point Likert scale (from 1 = *Completely disagree* to 4 = *Completely agree*). Each item corresponds to one of four factors: (a) *attitudes toward safe sex when facing*

obstacles (Obstacles), (b) *attitudes toward taking an HIV test* (HIV test), (c) *attitudes toward condom use* (Cond use), and (d) *behaviors toward people who have AIDS* (Pw AIDS), including behaviors related to support and discomfort and behaviors toward those who have a close relationship with the affected person (i.e., *People living with HIV*).

The following are two sample items: "*I would try to convince my partner to use a condom if they do not want to use it*," or *"If a friend were infected with HIV, I would probably stay away from him/her."* A higher score indicates a more favorable attitude concerning the evaluated factor. In the present study, Cronbach's alpha values ranged from .60 to .72.

Procedure

The scale was adapted per guidelines by Vallejo-Medina et al. (2017); these authors explain how to translate and adapt scales to a different cultural context while maintaining the original intention of the items. Four psychologists with at least one postgraduate degree were responsible for conducting the cultural adaptation of the Spanish questionnaire from Castilian Spanish to Colombian Spanish. Once the adapted version was agreed upon, four Colombian psychologists with experience in the field of psychometrics or sexuality assessed the properties of the items.

The following four properties were evaluated: *Representativeness*, or the contribution of an item to the construct; *Comprehension*, or whether an adapted item is appropriately understood; *Interpretation*, or the ambiguity of an item; and *Clarity*, or the conciseness of an item. The experts assessed the presence of these properties using a 5-point Likert scale. Additionally, experts could propose an alternative phrasing of an item, if necessary.

Before administering the scale, the minors' parents or legal guardians were asked to sign an informed consent form, and the participants' agreement was confirmed. The questionnaire was self-administered, and participants responded in their classrooms using a pen or a pencil. The process was supervised by psychologists and trained psychology students. The process lasted 45 minutes and was voluntary and anonymous. Teachers were not in the classroom during the evaluation, and the maximum number of students evaluated per class was the number of students enrolled in the class, i.e. 35 participants per class.

Data analysis. All analyses were carried out using the R (R Core Team, 2020) and RStudio (RStudio Team, 2020) software. A table specifying the criteria of each item and Aiken's V score were used in these analyses. An Aiken's V below .50 indicated the need to review an item (Merino & Livia, 2009). All the experts' observations were included. A confirmatory factor analysis (CFA) was performed using the lavaan package (Rosseel, 2012) and plotted by semPlot (Epskamp, 2019). The tetrachoric matrix, a robust ML method (MLM), was also used, and three different fit indices were calculated: RMSEA (Steiger & Lind, 1980), the corresponding confidence interval [CFI] (Bentler- Bonett, 1980), and Tucker-Lewis Index [TLI] (Tucker & Lewis, 1973). RMSEA indicators below .06 (Steiger & Lind, 1980) and over .90 for CFI (Bentler-Bonett, 1980) and TLI (Tucker & Lewis, 1973) were considered proof of adequate fit. Invariance across cities was tested using the Cluster command in lavaan under the same specifications as presented above. A decrease of .01 for CFI and an increase of .015 for RMSEA indicates invariance issues. The psychometric properties of the items were determined using psych (Revelle, 2019) and Psychometrics (Fletcher, 2010). A tetrachoric matrix was used; therefore, reported alphas are ordinal; corrected item-total correlations were also calculated using this matrix.

Ethical considerations. This study was reviewed by the ethics committees of the participating institutions, which are governed by the Declaration of Helsinki of 1975, revised in 1983 by the Ethics Committee for Clinical Research. All legal guardians and participants gave their consent to participate. The study was endorsed by an independent ethics committee at the Konrad Lorenz University.

Results

Participants

A total of 866 adolescents aged between 14 and 19 years ($M = 15.94$; $SD = 1.30$) participated in this study. Of these, 408 (47%) were male and 458 (53%) were female from 12 schools in the cities of Bogotá ($n = 467$) and Barranquilla ($n = 400$). Half of the participants had married parents and 267 (30.9%) had divorced parents. A slight majority (n = 533; 61.6%) considered themselves as Catholic. The economical strata range from zero (lowest) to six (highest); stratum two (n = 324; 37.5%) and three (n = 399; 46.1%) were predominant.

Item analysis and content validity. A qualitative evaluation suggested that the items in the Colombian version were appropriately worded. Aiken's V scores higher than .70 were obtained for most items. Values between .40 and .60 were found for representativeness and clarity for items 10, 11, 12, 14, 17, 19, and 23. The low scores for items 1, 9, 10, 13, and 18 highlighted an area for improvement. Finally, judges' considerations and observations were used to modify the 11 items.

Confirmatory factor analysis (CFA) and invariance. CFA was performed for four different models that have shown theoretical coherence or adequate fit indices in other studies (Espada et al., 2014). Thus, model 1 is one-dimensional, model 2 is five-dimensional with independent factors, model 3 includes five related factors, and model 4 includes five factors with a second-order factor. Of the four models, models 3 and 4 showed adequate fit indices. According to data presented in Table 1, we decided to use model 3, although the grouping of the five factors into a single second-order factor could also have been used if the purpose of the study or a software application required it. Its standardized weights can be consulted in Online Appendix A.

Once dimensionality was settled down, we ran a progressive invariance across cities. As can be observed in Table 2, a level of partial strict invariance was reached. However, there are 3 items (1, 7 and 11) that should be excluded if the objective of the study is to compare between these Colombian cities.

Psychometric properties of items and internal consistency. Ordinal alphas ranged from .64 to .87, and, in general, the psychometric properties of the items confirmed the adequate operational pattern of the items. The difficulty to respond to the items ranged from very difficult (KSI 14) to very easy (KSI 2), but most items, along with the subscales, were considered of intermediate difficulty. The presence of items with a discrimination index below .30 was also observed. Thus, in general, this finding highlighted the behavior of certain items, which were observed in previous analyses of items 1, 2, and 10. Nevertheless, and despite their weakness, these items did not seem to affect the correct functioning of the scale to a significant extent. Additionally, the items contributed to the evaluation of the target construct, so they were preserved (see Table 3).

Validity with respect to other criteria. Table 4 shows the relationship between the dimensions of the knowledge scale and other theoretically related scales. Moderate correlations between HIV transmission knowledge and attitudes toward people who have AIDS and fear of people who have AIDS were observed. As expected, General HIV knowledge was associated with attitudes toward HIV and HIV phobia.

Table 1. Fit Indexes of the Four Models Tested.

Model	χ^2	*df*	*p* Value	RMSEA (CI 90%)	CFI	TLI
Model 1	1,139.93	232	<.01	.069(.065, .073)	.67	.64
Model 2	970.32	231	<.01	.062(.058, .066)	.74	.71
Model 3	469.05	221	<.01	.037(.032, .041)	.91	.90
Model 4	492.56	226	<.01	.038(.033, .042)	.90	.89

Note. *df* = degrees of freedom; RMSEA = root mean square error of approximation; CI = confidence interval; CFI = comparative fit index; TLI = Tucker-Lewis index. Model 1 = one-dimensional; Model 2 = five independent factors; Model 3 = five related factors; Model 4 = five independent dimensions with a second-order factor.

Discussion

Knowledge about HIV and other STIs is strongly related to perceived vulnerability to STIs, to the development of skills to negotiate the use of male or female condoms, and to the effective intention to use them (Giménez-García et al., 2018). However, a brief instrument designed to measure knowledge reliably and validly about HIV and other STIs in adolescents was needed in Colombia. Therefore, we sought to validate the Scale of knowledge about HIV and other sexually transmitted infections (KSI), initially developed by Espada et al. (2014), for Colombian adolescent populations. The scale consists of 24 items that showed, individually and as a whole, satisfactory psychometric properties.

Qualitative results showed that most of the items presented adequate properties: Aiken's V values were higher than .50 in most cases. Items presenting issues were reviewed with respect to some of their psychometric properties; this process provides theoretical evidence of the dimensionality of the instrument and the adjustment of its variables (Rubio et al., 2003).

The psychometric properties of the subscales were found to be adequate: alpha values remained unchanged when any item was eliminated. Corrected item-total correlations also showed optimal values. Regarding the indices of difficulty and discrimination, all items of the subscales of knowledge about other STIs, HIV prevention knowledge, HIV transmission knowledge, and condom knowledge, presented an Aiken index above .30 (Aiken, 1985) in most items. In the case of General HIV knowledge, the difficulty indices were under .30; therefore, the items of this subscale should be interpreted with caution in intervention contexts. The original (Espada et al., 2014) dimensionality was successfully replicated here, but some problems with three items were observed when comparing the structures from Barranquilla and Bogota. Thus, if the main objective is to compare scores for these two cities, such items should be excluded.

The most difficult subscale was condom knowledge. These results were expected since errors and problems when using condoms (González-Hernández et al., 2020) and ignorance regarding the female condom (Vallejo-Medina et al., 2019) have been found to be prevalent among Colombian adolescents. Knowledge about other STIs was probably the second most common issue in our adolescent sample, closely followed by HIV transmission knowledge, and then by HIV

Table 2. Invariance Across Cities (Barranquilla and Bogota).

	χ^2	χ2 Change *p*	*df*	RMSEA	CFI	AIC	Δ RMSEA	Δ CFI
Configural	790,61	—	484	.038	.898	21,298.61	—	—
Weak	821.22	.045*	503	.038	.894	21,291.23	0	−.004
Strong	911.49	.0001***	522	.041	.870	21,343.50	.003	−.024
Strong partial[a]	849.49	.011*	519	.038	.890	21,287.50	0	−.004
Strict	889.49	.017*	543	.038	.885	21,278.50	.001	−.005

Note. *df* = degrees of freedom; RMSEA = root mean square error of approximation; CI = confidence interval; CFI = comparative fit index; AIC: Akaike information criterion.
[a] Items 1, 7, and 11 were free.

Table 3. Item Psychometric Properties and Internal Consistency.

	Item	*M* (*SD*)	Dif I	Discr I	i-tcc	Alpha-item	Alpha	Idif *M*
	ECI 19	1.68 (0.47)	.68	.63	.55	.87		
	ECI 20	1.71 (0.45)	.71	.65	.69	.85		
Other STI K	ECI 21	1.61 (0.49)	.61	.80	.72	.84	.87	.68
	ECI 22	1.59 (0.49)	.58	.81	.67	.85		
	ECI 23	1.76 (0.43)	.76	.61	.75	.83		
	ECI 24	1.78 (0.42)	.77	.55	.65	.85		
	ECI 5	1.15 (.36)	.34	.14	.49	.83		
	ECI 6	1.66 (0.47)	.80	.66	.72	.77		
HIV Trans K	ECI 7	1.53 (0.50)	.70	.53	.58	.81	.83	.65
	ECI 15	1.71 (0.45)	.69	.71	.64	.79		
	ECI 16	1.32 (0.47)	.75	.32	.71	.77		
	ECI 1	1.28 (0.45)	.28	.44	.23	.63		
	ECI 2	1.11 (0.31)	.11	.19	.20	.64		
	ECI 3	1.52 (0.50)	.51	.57	.31	.61		
General K	ECI 4	1.26 (0.44)	.26	.41	.31	.61	.64	.32
	ECI 8	1.10 (0.30)	.10	.23	.51	.55		
	ECI 9	1.27 (0.44)	.26	.52	.51	.56		
	ECI 10	1.88 (0.33)	.87	.21	.20	.64		
	ECI 18	1.22 (0.41	.21	.42	.40	.59		
Cond K	ECI 13	1.18 (0.39)	.49	.18	.56	—	.72	.34
	ECI 14	1.50 (0.50)	.96	.50	.56	—		
	ECI 11	1.60 (0.49)	.60	.87	.62	.8		
HIV Prev K	ECI 12	1.30 (0.46)	.30	.78	.80	.62	.82	.43
	ECI 17	1.40 (0.49)	.40	.84	.61	.82		

Note. HIV Trans K = knowledge of HIV transmission; Other STI K = knowledge of other STIs; General K = general knowledge; Cond K = condom knowledge; HIV Prev K = HIV prevention knowledge; *M* = mean; *SD* = standard deviation; Dif I = difficulty index; Discr I = discrimination index; i-tcc = item-total corrected correlations (based on the tetra-matrix); alpha item = ordinal alpha if the item was deleted; alpha = ordinal alpha; *M* Dif I = mean of the difficulty index.

Table 4. Criteria Validity Indicators.

		HIV Attitudes				AIDS Phobia	
KSI factors	*M* (*SD*)	Cond use	Obstacles	Pw AIDS	HIV test	Fear Infect	Fear p AIDS
HIV Trans K	7.38 (1.48)	.11**	.11**	.30**	.05	−.12**	−.37**
Other STI K	10.13 (1.83)	.12**	.02	.11**	.02	−.04	−.09**
General Know	10.63 (1.46)	.17**	.11**	.12**	.13**	−.04	−.07*
Cond K	2.68 (0.72)	.10**	.07*	.07*	.04	.03	−.12**
HIV Prev K	4.31 (1.10)	.20**	.04	.15**	.07*	−.11**	−.10**

Note. Correlation here presented are based in raw items sum for its dimensions. *M* = mean; *SD* = standard deviation; HIV Trans K = HIV transmission knowledge; Other STI K = knowledge of other STIs; general K = general knowledge; Cond K = condom knowledge; HIV Prev K = HIV prevention knowledge; Cond use = attitude toward condom use; Obstacles = attitude toward obstacles; Pw AIDS = attitude toward people with AIDS; HIV test = attitude toward HIV testing; Fear infect = fear of infection; Fear p AIDS = fear of people with AIDS.
* The correlation is significant at the 0.05 level. **The correlation is significant at the 0.01 level.

prevention knowledge. These findings should guide sexual health promotion programs to address the most pronounced knowledge deficits. It is surprising, for example, that one in three adolescents ignores whether HIV is transmitted through the air.

The HIV knowledge scale showed adequate external validity, similar to the original version (Espada et al., 2014). In addition, a relationship was found between knowledge about HIV and other STIs and positive attitudes toward the use of condoms. These findings reflect results reported by Carratalá et al. (2013). Other findings suggest that knowledge is insufficient to affect behaviors by itself, but greater knowledge can improve attitudes, the perception of norms, and perceived abilities; in turn, these factors could have an effect on behaviors (Romero et al., 2011).

Negative correlations were found between General HIV knowledge and fear of infection and fear of others/avoidance, which confirms that greater knowledge about sexual health is less likely to promote serophobia. This finding supports a hypothesis by Sengupta et al. (2011); the authors propose that promoting sexual health reduces the stigma associated with HIV/AIDS. However, the magnitude of the relationships observed in the present study is relatively low, and only a few magnitudes are moderate.

The present study has certain limitations. Although the scale was validated in a large sample of Colombian adolescents, the sampling method omitted most regions of the country; therefore, populations of different cultures and ethnicities were excluded, and our results cannot be extrapolated to other populations. Future research should use sampling methods focusing on the entire national population. Also, caution is required when interpreting item 2 ("The main route of HIV transmission in Colombia is through sexual intercourse"): neither its psychometric properties nor its indices of difficulty and discrimination were optimal. However, the item was preserved because it was considered relevant to evaluate the target construct. Three items belonging to three different dimensions showed invariance issues when Colombian cities are compared. Future studies should deepen this issue.

In conclusion, the purpose of the present study was to provide a valid and efficient measure allowing for the simultaneous and integrated evaluation of knowledge about HIV and knowledge about other STIs to researchers focusing on sexual and reproductive health. The validated scale will allow the scientific community to detect populations presenting high sexual risk patterns with increased accuracy and to assess the effectiveness of intervention programs targeted at Colombian adolescents. But we could not prove than current adaptation is better than the Castilian original version, as there were no direct comparisons.

Declaration of Conflicting Interests

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Supplemental Material

Supplemental material for this article is available online.

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