
PSYCHOMETRIC PROPERTIES OF THE HIV/ AIDS KNOWLEDGE SCALE FOR SPANISH ADOLESCENTS (HIV-KS).

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RESUMEN

El objetivo de este trabajo consistió en desarrollar y analizar las propiedades psicométricas de una escala multidimensional para evaluar los conocimientos relacionados con el VIH/SIDA en adolescentes (Escala de conocimientos sobre VIH/SIDA, HIV-KS). Tras un estudio piloto se administró un cuestionario de 48 ítems a una muestra de 14 centros escolares de 5 provincias españolas. Se puso a prueba la estructura teórica del cuestionario mediante un análisis de componentes principales al que se le aplicó un análisis confirmatorio. Se analizó la validez convergente y discriminante y la fiabilidad de la escala y, finalmente, se procedió a comprobar su invarianza factorial en función del género y la edad con una muestra de 1216 participantes. La versión final de HIV-KS estuvo compuesta por 10 ítems distribuidos en 3 factores principales. Los factores incluidos fueron (1) Transmisión oral del VIH, (2) Efectos del VIH, y (3) Otras vías de transmisión del VIH. La escala HIV-KS muestra invarianza en función del género y la edad y buena consistencia interna.

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HIV-KS es una escala capaz de evaluar de forma rápida y eficaz el grado de conocimientos sobre VIH/SIDA en población adolescente.

Palabras clave: conocimientos sobre VIH/SIDA, escalas, propiedades psicométricas, adolescentes

ABSTRACT

This paper aims to describe the development process, the factor structure, the reliability and validity of a multidimensional scale to measure HIV/AIDS-related knowledge for adolescents (HIV/AIDS Knowledge Scale, HIV-KS). After a pilot study of the items, a questionnaire of 28 items was administered to a sample from 14 different schools in 5 counties in Spain. Firstly, Principal-component analysis was used: first, to test a theory-driven structure and second, to develop an empirically derived factor structure for HIV-KS, which was tested with a confirmatory factor analysis. Secondly, reliability and convergent and discriminant validity were examined and finally, the factorial invariance was analyzed according to gender and age with a sample of 1,216 Spanish adolescents. The final version of the HIV-KS consists of 10 items distributed across three major factors. The factors included are: (1) HIV oral transmission, (2) HIV effects, and (3) other HIV transmission methods. The HIV-KS is invariant across gender and age and shows good validity and internal reliability. HIV-KS is a capable and parsimonious self-report scale for assessing main aspects of HIV/AIDS-related knowledge for adolescents.

Keywords: HIV/AIDS-related knowledge, rating scale, psychometric properties, adolescence, Spanish.

INTRODUCTION

AIDS represents a major social and health problem worldwide, with 33 million people infected and 2 million deaths in 2007. In Spain, the rate of affected people in that year was 140,000 and 2,300 deaths (UNAIDS, 2008). While there is now a greater awareness among the population about the disease and transmission routes, rates of newly affected people remains high. New infections especially affect young people and adolescents with 45% of new infections occurring in the age range of between 15 and 29.

Theoretical models of risk behavior and AIDS include knowledge about the disease as a variable that influences the implementation of healthy behaviors. According to the socio-cognitive theory by Bandura (1994) the subject's knowledge influences his health behaviors as well as the ability to perform these behaviors and the social support. The IMB model (Information-Motivation-Behavioral Skills) by Fisher and Fisher (2000) highlights the role of information as a moderator which affects the abilities to implement health behaviors, mediated by an individual's motivations. While the Centers for Disease Control and Prevention in the United States (CDC, 1999) highlights the importance of acquiring knowledge about HIV/AIDS because of its direct connection to risk behavior.

In the applied field, programs that work often involve a first stage of educational intervention in order to provide information on mechanisms of HIV transmission, measures to prevent transmission (Johnson, Carey, Marsh, et al., 2003; Kirby, 2001; Song, Pruitt, Colwell, & McNamara, 2000) and to amend any mistaken beliefs (Espada, Quiles, & Méndez, 2002). Similarly, most interventions which do not form part of school and community protocols use the strategy of supplying information as a way of reducing the incidence of the disease, although it is acknowledged that something more is needed. All of them assume that if the subject has better information, health behaviors can start to improve.

In the context of the evaluation of prevention programs, it is necessary to have valid, reliable and parsimonious instruments to assess the degree of knowledge in the target population. As in the case of the studies that aim to integrate variables explaining risk behaviors in relation to AIDS, program evaluations require appropriate evaluation scales for adolescents.

The review of literature reveals that there are very few studies, based on the Spanish population, about risk factors and assessment programs that measure the level of knowledge about HIV/AIDS through valid and reliable instruments. Non-standardized questionnaires are usually used to provide useful information about the level of knowledge, but they have unknown psychometric guarantees.

A common strategy is to adapt scales developed in other countries, although this is an alternative which presents limitations due to cultural differences (Zometa et al., 2007). An example of adaptation in the Spanish context is the VIH/SIDA-164 scale (Bermúdez, Buela-Casal, & Sánchez, 2003) adapted from the scale originally developed by Pania-

gua et al. (1994). The questionnaire assesses the adolescents' knowledge about the routes of HIV transmission and prevention. It also evaluates psychological risk variables and self-efficacy.

Other studies have developed ad hoc scales and present a description of their characteristics. With college students, Ergen, Coke, Tumer and Ünal (2005) used an information about AIDS scale with 14 items that assess the subjects' knowledge about the risk of sexually transmitted diseases, knowledge about prevention, about casual relations, HIV testing, moderate risk of sexual transmission and basic aspects about transmission. However, they do not give the psychometric properties of the items and their possible dimensions. Givaudan and Pick (2005) developed an instrument to assess knowledge about HIV/AIDS in adolescents. The scale items are divided into knowledge about HIV/AIDS (19 items), knowledge about HIV transmission (e.g.: a person can become infected with HIV in their first sexual intercourse) comprising 16 items, knowledge of the consequences of infection (e.g.: persons with HIV/AIDS may not generate antibodies) (8 items) and biomedical knowledge (e.g.: WESTERNBLOT test is used to confirm whether a person is a carrier of HIV/AIDS) (5 items). All subscales had Cronbach's alpha coefficients between .59 and .79. The Knowledge Scale by London and Robles (2000) combines the information content in two dimensions: correct/documented knowledge and incorrect/undocumented knowledge. The test shows adequate internal consistency (Cronbach's alpha for the two subscales of .79 and .65), although it has been validated with a sample consisting of women only between 15 and 49.

The review of instruments that assess the degree of knowledge about HIV indicates several limitations in the area. Firstly, few questionnaires are specifically designed for adolescents. This means that the information content on HIV/AIDS is not necessarily the most appropriate for this population and the psychometric properties of the scale are not guaranteed for use with adolescents. Others were designed to evaluate a particular social group or culture (Di Noia & Schink, 2007). Secondly, there are few instruments that specifically assess knowledge. Most include information, attitudes and risk behaviors on the same scale of measurement (Givaudan, Leenen, Van De Vijver, Poortinga, & Pick, 2008; Stulhofer, Graham, Bozicevic, Kufirin, & Ajdukovi, 2007). The construction of a questionnaire optimizes the task of evaluation and is a more precise tool. Another feature of the instruments available up to now is that they

include a large number of items, which lengthens the time of application. The development of these scales does not always follow a process of systematic, replicable, and statistical data, so, although they are useful, there is no information about their psychometric properties.

The aim of this paper is to present the process for developing a reliable and valid instrument to assess knowledge about HIV/AIDS among Spanish adolescents. The aim was to construct a brief specific scale (Scale of Knowledge on HIV/AIDS, HIV-KS) with adequate psychometric guarantees directed at adolescents, and to explore its factorial structure in a large sample, analyzing the differences according to gender and age.

METHOD

PARTICIPANTS

The incidental sample consisted of 1,216 high school students from 10th and 11th grade in 14 public schools in five provinces in Spain: Alicante, Castellon, Madrid, Oviedo, and Murcia. Six-hundred and three (49.6%) study 10th grade and 613 (50.4%) 11th grade. Five hundred and twenty four were boys (43.1%) with a mean age of 15.87 (SD = 0.80) and 692 were girls (56.9%) with a mean age of 15.81 (SD = 0.76), divided into 445 adolescents of 15 or younger, 549 of 16 and 222 of 17 or older.

PROCEDURE

Phase 1: Identification of domains and items on HIV/AIDS knowledge for adolescents. In the first phase of the study a group of HIV/AIDS experts identified the major domains of information on HIV/AIDS among adolescents and proceeded to develop the items to be included in the questionnaire. The original bank was made up of 41 items grouped into seven areas: general knowledge, transmission routes, HIV effects on the body, risk behaviors, virus detection, treatment and other sexually transmitted diseases.

Phase 2: Identification of the validity and content validity of the questionnaire. To assess the validity and content validity of the instrument, the initial version of the questionnaire was sent to experts (10 professionals and researchers in HIV/AIDS). The experts' assessment focused on understanding (clarity of the statement) and the suitability of the

question (relevant to adolescents), relevance (suitability of the item for assessing the level of information) and the correct allocation of the item on the subscale it had been assigned to. The experts could also make suggestions for reformulating or adding new items.

The following criteria were established for the reformulation, modification or removal of items: a) understanding (items were reviewed when the agreement of the experts was less than 80%), b) relevant to HIV/AIDS (items were removed if the agreement among the judges was lower than 80%), c) reformulation (modifying the wording of the items if more than 20% of judges indicated so) d) assignment of title (the assigned subscale was retained when the agreement was above 80%). After the removal of the elements that did not meet these criteria, the final questionnaire was made up of 28 items.

Phase 3: Pilot study of the initial version of the questionnaire. The questionnaire was administered to a small sample of subjects ($n = 21$) belonging to the same population to be assessed, in order to evaluate the understanding of the items. Each student answered the questionnaire and assessed the degree of understanding on a three-point scale (1 = I do not understand the question, 2 = I do not understand the question very well, 3 = I understand the question well). The item was considered properly understood when 80% of the subjects rated it as well understood. Three items were reformulated because they were rated as not understood.

INSTRUMENTS

Two self-report measures were used to find the convergent validity of HIV-KS:

The Multicomponent AIDS Phobia Scale (MAPS, Harrell and Wright, 1998). It comprises 20 items rated on a 6-point scale (from 0 "strongly disagree" to 5 "strongly agree"). It has a factorial structure of two components, fear of infection, which includes hypochondriac responses and excessive worry about the disease (Cronbach's $\alpha = .73$) and fear of others / avoidance, including avoidance behavior and escape from AIDS-related stimuli (Cronbach's $\alpha = .70$). The test-retest reliability after one week was .64 (Harrel & Wright, 1998).

The Questionnaire of Attitudes towards AIDS and Risk Behaviors, QAARB, is made up of 12 items with a 4-point response. The test has

an internal consistency of .77 and items are grouped into 4 subscales: Obstacles (3 items, alpha .77), Testing (2 items, alpha .74), Condom use (4 items, alpha .70) and Affected People (3 items, alpha .69). The test-retest reliability for the full scale was $r = .60$ ($p < .01$) (QAARB, Espada et al., 2009).

The total score on the Self-Description Questionnaire II (SDQ-II; Marsh, Relich & Smith, 1983; Marsh, 1989) was used to calculate discriminant validity. It is a self-report made up of 76 items with a 5point scale response format. The scale includes eleven factors, plus a general rate, which consist of different domains of self: self-education, appearance, physical activity, mathematical, relationship with parents, relationships, peer group, honesty, verbal, emotional stability and general self. The authors report adequate internal consistency of the instrument, Cronbach's $\alpha = .80$ (Marsh, Ellis, Parada, Richards, & Heubeck, 2005).

DATA ANALYSIS

A principal component analysis was performed (oblique rotation with $\delta = -0.2$) (Jennrich & Sampson, 1966), correlation analysis using the statistical program SPSS for Windows (version 13.0). Correlational inter-group analysis controlling Type I error rate was carried out with the Bonferroni procedure assuming two-tailed α . Confirmatory factor analysis using AMOS (version 7.0) was used for assessing the equivalence of the factor solution of the three HIV-KS factors and factorial invariance analysis to verify the factorial structure by age and sex (Abalo, Lévy, Rial, et al., 2006). Cronbach reliability coefficient to determine the internal consistency of the scale was obtained. The validity (convergent and divergent) and test-retest reliability were assessed by Pearson correlation coefficient.

RESULTS

EXPLORATORY FACTOR ANALYSIS

Initially, a series of exploratory analyses of principal components using oblique rotation with the total sample were made. The criteria for obtaining the factor solution were: a) retaining factors with eigenvalue equal to or greater than 1, b) assigning items with loads of 0.39 or greater to each factor, and c) including at least 3 items in each factor. We found three factors with eigenvalue greater than 1 (Kaiser criterion for retention of

factors), which explained 56.65% of the variance. Eighteen items were removed because they had less than .39 saturation or because of saturation on two factors.

A robust factor solution of three factors consisting of 10 items was established (the KMO index = .86 and Bartlett test was significant). Factor 1, Oral transmission, includes the subject's behavior in relation to the possibility of HIV transmission through saliva. This factor is made up of 3 items that explain 28.26% of the variance. Factor 2, Effects of HIV, includes knowledge about the process of infection and the spreading of the virus in the body. It consists of 3 items that explain 15.77% of the variance. Factor 3, Other routes of transmission, evaluates the knowledge about different ways of transmitting the virus not related to saliva. The latter is a 4-item component explaining 12.61% of the variance (Table 1).

CONFIRMATORY FACTOR ANALYSIS

Two alternative models were tested: 1) the model of three independent factors and 2) three-factor model allowing intercorrelations between them. Five different indices of adjustment were considered to measure the fit of the models. Table 2 presents the indices for the three-factor model allowing intercorrelations since this was the model which obtained the best indices with non-standard adjustment index (NNFI) (Bentler & Bonnett, 1980), an IFC and a comparative incremental fit index (IFI) (Bollen, 1989) greater than .90 as suggested by Hu and Bentler (1998). The absolute fit indices were also multiple values at or above the recommended. In order to establish intergroup differences according to age and sex through a questionnaire, it is crucial to first establish that the factor structures are identical. For this purpose, factor invariance analysis to test whether the three-factor model for the 10 items of HIV-KS was equal for boys and girls. All factorial loads were limited to be equivalent for boys and girls, as were the correlations between the three factors of HIV-KS. The indicators of goodness of fit revealed that the multiple three-factor model fitted well for both genders. Also, it appeared that the three-factor model was equivalent for younger and older students. The sample was divided into three age groups: 15 or younger, 16 and 17 or older, without differentiating between gender because there was no significant difference in the number of boys vs. girls for each age group. The same indicators

Table 1. Exploratory Factor Analysis.

	Oral Transmission	VIH Effects	Other routes of transmission
1. Drinking from a glass that has been used by a person with HIV represents a risk	.910		
2. It is dangerous to share food or water with people with HIV/AIDS.	.732		
3. Giving a wet kiss to a person with HIV is a risk for HIV transmission.	.553		
4. The window period lasts one week.		.668	
5. The window period is the time it takes the body to produce antibodies after HIV transmission.		.564	
6. People who have been infected by HIV go through an asymptomatic period of 6 months.		.442	
7. HIV is transmitted through the air.			.690
8. HIV is transmitted through vaginal and seminal secretions and blood.			.522
9. It is advisable to stop visiting a person with HIV to prevent transmission of HIV.			.490
10. Washing your clothes with those of an HIV or AIDS sufferer implies a risk of contracting the disease.			.342

showed an appropriate fit in the three age groups. Therefore it can be concluded that the factorial structure of HIV-KS is invariant for age and gender (Table 2).

INTERNAL CONSISTENCY

Table 3 presents the α coefficients of reliability (Cronbach's alpha) for each factor for the total sample and by gender. Internal consistency was comparable for boys and girls, reliability is only acceptable for the effects of HIV factor ($\alpha = .50$) only for the girls. The coefficients for the total sample were .71 for the scale, .78 for factor 1, Oral Transmission, .57 for factor 2, effects of HIV, and .61 for factor 3, other

Table 2. Fit statistics for confirmatory factor models.

	NNFI	CFI	IFI	GFI	RMSEA
First-order CFA model	.945	.963	.963	.978	.033
Two-Group model (Gender)	.942	.968	.969	.978	.030
Three-Group model (Age)	.883	.939	.939	.954	.028

NOTE: NNFI: Non-normed Fit Index; CFI: Comparative Fit Index; IFI: Incremental Fit Index; RMSEA: Root Mean Square Error of Approximation.

Table 3. Scale reliability

	Oral transmission	VIH effects	Other routes of transmission	HIV-KS Total
Total sample	.78	.57	.61	.71
Boys	.76	.62	.64	.72
Girls	.79	.50	.57	.70

Table 4. Item-scale correlation (IS-R), Corrected correlation item-scale (IS-Rc), Item-test correlation (IT-R), Corrected correlation item-test (IT-Rc), Means (M) and Standard deviations (SD).

	Item	IS-R	IS-R _c	IT-R	IT-R _c	M	SD
Oral Transmission	1	.71	.70	.72	.56	.44	.50
	2	.68	.63	.69	.57	.52	.50
	3	.53	.52	.54	.46	.44	.50
VIH Effects	4	.43	.44	.45	.20	.10	.30
	5	.39	.40	.41	.15	.12	.33
	6	.33	.33	.35	.16	.07	.26
Other Routes of Transmission	7	.48	.46	.48	.34	.89	.32
	8	.39	.34	.40	.27	.84	.36
	9	.46	.45	.51	.45	.82	.39
	10	.37	.35	.42	.39	.72	.45

NOTE: IS-R: Item-scale correlation; IS-Rc: Corrected correlation item-scale; IT-R: Item-test correlation; IT-Rc: Corrected correlation item-test; M: Mean; SD: Standard deviation.

routes of transmission. Table 4 shows the item-subscale correlations which were acceptable in a range from .30 to .72. Only 1 item was an item-test correlation of less than .30, indicating a good performance for most items.

The coefficient of reliability is known to be affected by the variability of the group and the length of the test (Novick & Lewis, 1967). In the present study, is an extremely homogeneous group (adolescents between 14 and 18 years) is valued and there are few items per dimension (two dimensions of three and four items). These facts may explain the low reliability of the subscales of the questionnaire. However, considering that the total alpha is greater than .70, one can assume that the scale is reliable, but the use of the subscales separately is not recommended, outside the context of the HIV-KS scale.

CONVERGENT AND DISCRIMINANT VALIDITY

To assess the convergent validity of the scale, the HIV-KS scores were correlated with the Multicomponent AIDS Phobia Scale (MAPS) and the Questionnaire of Attitudes towards AIDS and Risk Behaviors (QAARB) due to the conceptual and practical relation between these concepts. The results show the statistically significant relation between the scales ($p < .01$), except for the dimension/subscale called Impact of HIV in relation to attitudes. This dimension also gets the lowest correlation with the MAPS scale (see Table 4).

Furthermore, in terms of discriminant validity, as expected theoretically, the HIV-KS scale does not correlate with the SDQ-II (see Table 5). The data show that having more knowledge about HIV/AIDS does not mean higher levels of self-concept, or vice versa.

TEST-RETEST RELIABILITY

A subsample consisting of 220 adolescents completed self-report measures after a period of 10 weeks during which there was no intervention. Thirty-eight boys and 44 girls were 15, 54 boys and 53 girls were 16, 13 boys and 18 girls were between 17 and 18. The test-retest reliability (Pearson correlation coefficient) was $r = .45$ ($p < .01$) for the full scale. For the oral subscale, it was $r = .51$ ($p < .01$) for the effects of HIV subscale, it was $r = .02$ ($p = .84$), and for other routes of transmission subscale, it was $r = .41$ ($p < .01$).

Table 5. Convergent and discriminant validity

	Oral transmission	VIH effects	Other routes of transmission	Total HIV-KS
MAPS	-.31**	-.13**	-.33**	-.35**
QAARB	.21**	.02	.27**	.28**
SDQ-II	.02	.05	.01	.03

**p < .01

DISCUSSION

The aim of this study was to develop and validate a scale to measure the degree of knowledge about HIV/AIDS among adolescents. The design and evaluation of preventive interventions requires the availability of appropriate tools to obtain reliable data on the level of information for adolescents. To date there are no validated instruments to specifically and consciously assess the degree of HIV/AIDS knowledge among Spanish adolescents. The tools available include either information as a scale between a set of issues related to HIV/AIDS or they are too long, or do not provide data on the psychometric properties. The results showed that the HIV-KS questionnaire is a reliable and valid instrument for measuring knowledge about HIV/AIDS in adolescents.

The study tested the dimensionality of the questionnaire and according to the results, it seems appropriate to take the factorial structure of HIV-KS as multidimensional, as with other scales in Spanish (Uribe, 2005). The reliability of the questionnaire estimated by Cronbach's alpha coefficient is high.

The HIV-KS scale is brief as it is made up of 10 dichotomous response items, it is easy to correct, interpret, and has adequate psychometric properties compared with other scales that assess the same construct (Volpe, Nelson, Kraus & Morrison-Beedy, 2007).

The factor analysis grouped the 10 items in three final factors that correspond to three areas that may be considered appropriate to assess the degree of knowledge an adolescent has about HIV/AIDS. The coefficients of reliability for each factor were high, indicating internal consistency of the items for the whole test. Factors that are evaluated with the questionnaire are shown as good predictors of the level of knowledge.

Appendix HIV-KS Scale

1. Drinking from a glass that has been used by a person with HIV represents a risk	T	F
2. It is dangerous to share food or water with people with HIV/AIDS.	T	F
3. Giving a wet kiss to a person with HIV is a risk for HIV transmission.	T	F
4. The window period lasts one week.	T	F
5. The window period is the time it takes the body to produce antibodies after HIV transmission.	T	F
6. People who have been infected by HIV go through an asymptomatic period of 6 months.	T	F
7. HIV is transmitted through the air.	T	F
8. HIV is transmitted through vaginal and seminal secretions and blood.	T	F
9. It is advisable to stop visiting a person with HIV to prevent transmission of HIV.	T	F
10. Washing your clothes with those of an HIV or AIDS sufferer implies a risk of contracting the disease.	T	F

NOTE: To calculate the total rate, add 1 point when the answer is "T" in items 5 and 8, and 1 point when the answer is "F" for items 1, 2, 3, 4, 6, 7, 9 and 10.

The first factor measures risk behavior knowledge in situations where there is contact with saliva. It provides information of interest on erroneous beliefs about transmission. The three items that make up this dimension evaluate the information regarding the possibility of infection by this route. This is a very specific belief about HIV transmission, which represents a common bias among adolescents, who often ask for information (Quiles & Espada, 2002). The second factor evaluates basic knowledge about the biological aspects of infection, and it includes questions about the infection from a physical point of view. For example, it assesses whether the teenager knows the difference between viruses and antibodies of the virus, the existence of an asymptomatic stage and the window period. The third factor assesses the information on the major routes of HIV transmission. It reviews ways in which a person may believe that HIV is transmitted through contact with blood or sexual fluids.

Some limitations should be considered in using the HIV-KS scale. Although the convergent validity with anxiety and attitudes to AIDS (MAPS and QAARB scales, respectively) was assessed, it was not high for all subscales of the HIV-KS scale.

In conclusion, the HIV-KS scale is simple to administer and correct and can be used in school contexts to quickly assess the extent of knowledge related to HIV/AIDS in adolescents. It is therefore proposed as a useful tool in future research and prevention programs.

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