Research Article

Knowledge, Attitudes, and Practices (KAP) on HIV/ AIDS in Adolescents Attending School in Medellín-Colombia

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I N F O

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A B S T R A C T

Introduction: Adolescents represent an increasing proportion of people living with HIV. Social psychology and medical sociology have developed several models to understand risk behaviours, including studies on knowledge, attitudes, and practices (KAP).

Objectives: i) Design and validate the psychometric properties of a KAP survey on HIV in a young population; and ii) Analyse the KAP profile on HIV in adolescents from Medellín, Colombia, and its associated factors

Method: A cross-sectional study and psychometric evaluation of 2411 adolescents was conducted. A KAP scale was designed with psychometric validity and reproducibility in the criteria of acceptability, applicability, usefulness, reliability (Cronbach's α), consistency and discriminant power (Spearman's Rho), and construct validity (λ coefficient from factor analysis). The KAP score was calculated, and its associated factors were identified using parametric tests.

Results: Adolescents from Medellín have good knowledge about HIV; however, they have negative attitudes towards the use of condoms and a low perception of the risk of becoming infected, despite their risky sexual practices such as unprotected sex or with drugs. The main factors associated with KAP were socioeconomic stratum, type of family (single-parent, nuclear or extended), source of consultation on health issues (internet, friends, home, health institution), education and age of the parents, age of first sexual intercourse, and use of contraceptive methods.

Conclusion: Local health authorities must design interventions aimed at practices, particularly the acceptability of condom use, to promote and facilitate access to HIV screening tests. In addition, this study designed and validated an instrument with excellent psychometric properties that can be used in subsequent research.

Keywords: HIV, Adolescents, Knowledge, Attitudes and Practices, Psychometrics, Scales

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Introduction

Adolescents represent an increasing proportion of people living with HIV, with 1.65 million cases and 140,000 new infections during 2022 in subjects aged between 10 and 19 years.[1] Among the factors contributing to this problem, the insufficient implementation of sexual education programs and restricted access to sources of health information stand out.[2] Research on adolescents' knowledge, beliefs, and behaviours is decisive in avoiding new infections, increasing screening, and combating stigma and discrimination against those infected.[3]

From social psychology and medical sociology, several models have been developed to understand risk behaviours. Among them, the information-motivation-behavioural (IMB) skills model has been specifically designed to understand the risks associated with HIV/ AIDS.[4] This model states that there are three fundamental determinants of preventive behaviour for this infection: i) information about the means of transmission and prevention, ii) motivation to act according to what is known about the prevention of infection, and iii) behavioural skills of HIV/ AIDS prevention that determine whether well-informed and motivated people will be able to initiate and maintain patterns of preventive behaviour.[4]

To operationalise this model, studies on knowledge, attitudes, and practices (KAP) toward HIV/ AIDS are important and are being conducted with increasing frequency in different countries. In Nigeria, it was reported that 93% of adolescents perceived that they were not at risk of contracting HIV, 81.5% reported stigmatising tendencies toward people living with HIV, and only 12% knew that condom use can prevent the transmission of the virus.[5] Another investigation among Korean adolescents found that 71.2% consider that the virus can be transmitted through mosquito bites, 54% are concerned about HIV infection, and less than half of those who have had sexual relations use condoms.[6] A systematic review of eight studies in China showed similar results in terms of lack of knowledge of HIV transmission routes, belief that the virus can be cured, and focusing more on knowledge about HIV/ AIDS than on developing and maintaining safe sexual behaviour.[7]

In Colombia, studies have been conducted in different cities such as Cúcuta, Cartagena and Medellín with results that show high heterogeneity in the KAP, variation according to sex, the mother's education, and the source of information on sexual health. Furthermore, some of these studies have limitations such as small sample sizes, realised more than eight years ago, or do not describe the psychometric properties of the instruments used.[8-11] This becomes more worrying when considering that in 2021, 1,956 cases of HIV were reported in the country in adolescents between 10 and 19 years old. The virus has become increasingly common in this age group due to factors such as the use of drugs, sex trafficking of minors, and sexual abuse.[12]

Taking the above into account, this study was designed with two objectives: i) to design and validate the psychometric properties of a KAP survey on HIV in a young population and ii) to analyse the profile of KAP on HIV in adolescents from Medellín, Colombia, and its associated factors.

Method

Type of Study: Analytical cross-sectional and psychometric evaluation

Subjects of Study: The study was conducted in two probabilistic samples from Medellín Colombia during the year 2023. The first corresponded to a population of 37 higher educational institutions (technological-technological and university), of which four were chosen. The second population were 527 basic educational institutions, of which 58 were sampled. This sample corresponds to the following parameters: population of 564 institutions (12 public higher education, 25 private higher education, 412 public basic education and 115 of private basic education), deviation of 20 points (on a scale of 0-100) for KAP scores, confidence of 95%, design effect of 1, precision of 5%, and sample size correction of 10%. Figure 1 shows the distribution of basic educational institutions according to type (public or private) and location, with their respective equivalence in the sample selected for the study (this process was not carried out for higher educational institutions given that their geographical location does not correspond to the location of the student's home).
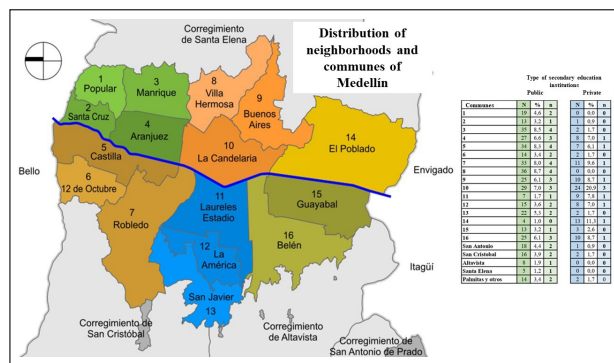

Figure 1.Distribution of Secondary Education Institutions

The sample size calculation was not carried out for the following reasons: i) an adequate sampling frame is not available since the number of students for each educational institution could not be obtained, and ii) when calculating the sample size based on the number of enrolled students, a smaller sample size would be obtained (compared to the number of students obtained by the procedure applied in this research), which would affect the external validity by type of institution and commune (communes with small schools would not be able to be represented in the sample).

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A random selection of institutions was carried out, and in each one, the following procedure was applied: in the selected schools, secondary education students (grades 9 to 11) were surveyed; in higher educational institutions (technical, technological, university), individuals enrolled in the first year were selected because the objective was to evaluate KAP in adolescents (attempted to exclude the effect of higher education). In the selected institutions, a day from Monday to Friday, a class schedule, and two classrooms per block were randomised. In each classroom, a survey was administered to adolescents who agreed to voluntarily participate in the study. With this procedure, a study population of 2,411 students was obtained; 72.8% (n = 1754) had secondary education, 16.6% (n = 401) had a technical or technological level, and 10.6% (n = 256) had university degrees.

Knowledge, Attitudes and Practices Scale

A primary source of information was used based on an anonymous survey, which was completed individually in a private place to avoid information bias. The survey included demographic, socioeconomic, and sexual health information for each adolescent or her/ his family and the KAP survey.

To construct the scale, a review of the literature in Colombia and Latin American countries was conducted to identify the items that could measure KAP on HIV/ AIDS. The initial version of the instrument was subjected to appearance validation to analyse its applicability according to the criteria of three experts in HIV/ AIDS studies, and acceptability was based on the criteria of 10 people from the population (adolescents). In this phase, the usefulness (ease and low cost of its application) of the scale was also evaluated. Subsequently, a pilot test was conducted with 100 people to analyse the clarity of the questions for the adolescent population. Finally, 200 responses were analysed to eliminate statistically redundant items (responses with correlation ≥ 0.7), and the final structure of the items that would measure the KAP on HIV in the population of this study was defined. Once the 2,411 survey responses were obtained, an analysis of the psychometric performance of the scale was carried out and a final elimination of the items that did not meet the consistency criterion (Spearman's Rho < 0.30) or construct validity for items with λ was carried out < 0.30 which indicates that it is not part of the factor structure or KAP components and for the items with λ ≥ 0.70 but that were not part of the same component of the KAP items (in the factorial solution they did not load on the KAP component to which they belonged) (Appendix 1) (Figure 2).
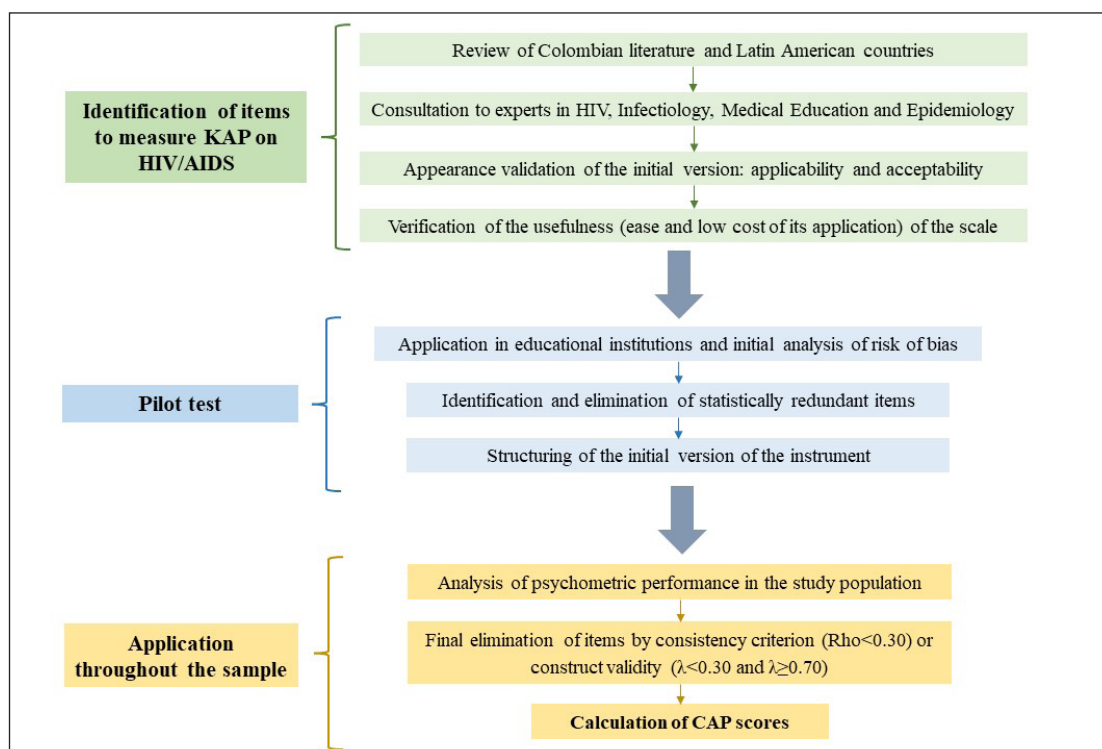

Figure 2.Scale Design and Validation

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With the items that completed the previous phases, the KAP score was determined by adding the positive responses (in the items that asked about negative aspects such as stigmatising attitudes, the score was inverted). Given the different number of items in each component, a transformation was made to a score from 0 to 10 with the following formula: [((sum - minimum score)/score range) X 100]; zero being indicative of the worst KAP and 10 being the best.

Ethics Approval and Consent to Participate

The study applied the guidelines of the Declaration of Helsinki and Resolution 8430 of the Colombian Ministry of Health, which state that this is a risk-free investigation. The participating institutions were endorsed, and the project was endorsed by the scientific committee of the Fundación Antioqueña de Infectología and all educational institutions. Each participant was informed of the purpose, risks, and benefits of the study, respect for the dignity of the study subjects, protection of their rights, and voluntariness of their participation through assent (14–17 years of age), or informed consent (18–20 years of age).

Analysis of Information

The description of socioeconomic and sexual health variables was performed with absolute frequencies (#) and relative frequencies (%). The psychometric evaluation included reliability with Cronbach's α, internal consistency and discriminant power with Spearmans' Rho correlations, and construct validity with factor loadings (λ coefficients) estimated by exploratory factor analysis using the principal components method. The KAP score was compared with dichotomous variables using the Mann Whitney U test, with polytomous variables using Kruskal Wallis H, and with continuous variables using Spearman's Rho (non-compliance with the assumption of normality was determined with Kolmogorov Smirnov with correction of Lilliefors). To avoid confusion problems and identify the explanatory factors of the KAP, linear regressions were performed.

The data were stored and analysed in a database in the Statistical Package for the Social Sciences for Windows, SPSS software version 29.0. A statistical significance level of 0.05 was considered in all analyses.

Results

In the study group, there was a greater proportion of men (51.9%), people from low socioeconomic strata (60.8%), fathers with primary schooling (40.9%) and mothers with incomplete secondary school (40.5%), single-parent families (49.1%), and moderate family dysfunction (71.8%). In adolescents, the main source of health information was the internet (56.6%); the most well-known STIs were HIV/ AIDS and gonorrhoea; the majority had their first sexual

relationship with their boyfriend (48.5%), or a friend (39.0%), used some contraceptive method (63.1%) in it, the condom was the most used method (78.8%) (Table 1). In some open questions, it was highlighted that the best ways to avoid HIV/ AIDS are to use condoms, have relations with only one person and avoid promiscuity, seek good health education, avoid having sexual relations with sex workers, and undergo HIV screening periodically. A low perception of the risk of contracting HIV was also found (35%); nearly half considered that they had no risk of becoming infected and 6.2% indicated a high risk of infection. It is also highlighted that 70% have not had a stable partner in the last three months (the majority have non-stable sexual partners) and only 30% use condoms in all their sexual relations.

In the knowledge items, the proportion of subjects with a favourable response was greater than 80%. In attitudes and practices, the responses were more heterogeneous with some items on isolation, exclusion of people with HIV/ AIDS, and having relationships under the influence of hallucinogens relatively low (around 20%), others in the middle zone such as attitudes related to condom use and HIV screening. In the psychometric properties, all the items presented high correlations with the score of their dimension and low correlations with that of attitudes and practices. Furthermore, the factor loadings were greater than 0.3, confirming the excellent reliability, internal consistency, discriminant power, and factorial validity of the KAP scale (Table 2).

In the bivariate analysis, the knowledge score presented statistically significant differences according to sex (better in men), type of family (worse in extended family), school grade (worse in technical-technological), the source of health information consulted (worse when consulted at school-university or with friends), knowledge of other STIs (better among those who know about syphilis and chlamydia) and the score was statistically higher in subjects who had already started their sexual life and used a condom. The knowledge score presented a positive correlation with the participant's age and her age at first sexual intercourse; and a negative correlation with the father's age and education, mother's education, socioeconomic strata, number of people in the home, and use of various contraceptive methods. Among the bivariate associations, some were presented as a confusion effect, ceasing to be significant in the multivariate adjustment; something similar to what was found in the bivariate analysis of the attitudes and practices scores (Appendix 2).

Knowledge was worse in people from a high socio-economic strata, with many people in the home, who consulted health information on the internet, and who used various contraceptive methods; while the following groups presented greater knowledge about HIV/ AIDS:

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greater education of the mother and adolescent, knowledge of other STIs and first sexual intercourse at an older age, contraceptives, using a condom, and with a friend or stranger (Table 3).

Table 1.Socio-Economic and Sexual Health Characteristics of the Study Group

Variable	Categories	n	%
Gender	Women	1134	47.0
	Man	1252	51.9
	Non-binary	25	1.0
Socio-economic strata	1	360	15.5
	2	1056	45.3
	3	698	30.0
	4	135	5.8
	5	81	3.5
Father's education	Primary	883	40.9
	Incomplete secondary	246	11.4
	Completed secondary	619	28.7
	Technician-technologist	258	11.9
	University	154	7.1
Mother's education	Incomplete secondary	928	40.5
	Completed secondary	781	34.1
	Technician-technologist	387	16.9
	University	196	8.6
Type of family	Single parent	1161	49.1
	Nuclear	795	33.6
	Extensive	409	17.3
Family functionality	Functional	489	20.5
	Moderately dysfunctional	1715	71.8
	Dysfunctional	185	7.7
Source of health information	Internet	1365	56.6
	Home	765	31.7
	Friends	273	11.3
	health institution	100	4.1
	University college	68	2.8
	Two or more of the above	132	5.5

Variable	Categories	n	%
Known STIs	HIV AIDS	2078	86.2
	Gonorrhoea	1668	69.2
	Syphilis	1057	43.8
	Herpes	746	30.9
	HPV	527	21.9
	Chlamydia	329	13.6
	HBV	91	3.8
Number of STIs known	0	302	12.5
	1	235	9.7
	2	574	23.8
	3	635	26.3
	≥ 4	665	27.6
Sexual relations	Has had sexual relations	1704	70.7
	Use of contraceptives during the first sexual relationship	1076	63.1
	Diagnosed with an STI	48	2.9
Who was your first sexual relationship with?	Boyfriend - Girlfriend	827	48.5
	Friend	664	39.0
	Unknown	193	11.3
	Familiar	20	1.2
Contraceptive - planning method used	Condom	1343	78.8
	Injectable and oral contraceptives	477	28.0
	Subdermal implant	278	16.3
	Others	22	1.3
Number of contraceptive methods used	0	93	5.5
	1	1128	66.2
	2	457	26.8
	3	26	1.5

Note: Variables that do not add up to all people surveyed correspond to missing data.

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Table 2.Description of the KAP Scale and Its Psychometric Properties

Items	Description % (n)	Consistency Rho	Discriminant Rho	Construct λ
Knowledge				
The greater the number of sexual partners, the greater the risk of contracting HIV/ AIDS.	87.1 (2099)	0.48[**a]	0.05/0.03[b]	0.40[**c]
If a person uses a condom correctly, they are protected from contracting HIV/ AIDS.	88.8 (2140)	0.45[**a]	0.08/0.01[b]	0.37[**c]
HIV/ AIDS can be contracted through transfusion of infected blood	96.6 (2328)	0.30[**a]	0.06/0.03[b]	0.66[**c]
People can have HIV/ AIDS in their bodies and not be sick	84.3 (2032)	0.54[**a]	0.02/0.02[b]	0.46[**c]
HIV/ AIDS is a disease that can cause death	92.9 (2241)	0.39[**a]	0.04/0.03[b]	0.61[**c]
There are treatments for HIV/ AIDS	89.4 (2155)	0.45[**a]	0.03/0.01[b]	0.37[**c]
Attitudes				
We should feel good about delaying or refusing to have sex.	68.8 (1658)	0.40[** a]	0.05/0.05[d]	0.52[**c]
Using condoms feels less pleasure	48.8 (1176)	0.49[** a]	0.11/0.17[d]	0.56[**c]
If your boyfriend/ girlfriend wants to have sex, it is better to agree so as not to lose him/ her.	31.2 (752)	0.46[** a]	0.16/0.04[d]	0.65[**c]
If you know a person who has HIV/ AIDS, you would stay away from them.	20.7 (499)	0.58[** a]	0.12/0.14[d]	0.77[**c]
HIV/ AIDS is a punishment for irresponsible behaviour	52.8 (1273)	0.48[** a]	0.12/0.03[d]	0.55[**c]
People with HIV/ AIDS should be isolated	19.4 (468)	0.59[** a]	0.10/0.16[d]	0.79[**c]
Practices				
Use the condom correctly	77.4 (1865)	0.57[** a]	0.10/0.07[e]	0.56[** c]
In your last relationship, you used contraceptive methods	55.5 (1337)	0.63[** a]	0.03/0.07[e]	0.59[** c]
Has had sexual relations under the influence of alcohol or hallucinogens	18.0 (433)	0.51[** a]	0.03/0.07[e]	0.48[** c]

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Have been tested for HIV/ AIDS	39.0 (940)	0.72[**][a]	0.10/0.20[e]	0.75[**][c]
The sexual partner has been tested for HIV	50.8 (1225)	0.81[**][a]	0.02/0.01[e]	0.85[**][c]
Summary of psychometric properties	Reliability	Consistency success (Rho ≥ 0.30) (%)	Discriminant success (Rho ≤ 0.20) (%)	Construct success (λ ≥ 0.30) (%)
	α Cronbach			
Knowledge	0.64	100	100	100
Attitudes	0.82	100	100	100
Practices	0.80	100	100	100

**p < 0.01
a Spearman's Rho of the item with the score of the KAP dimension to which it belongs.
b Spearman's rho of the item with attitude score/practice score.
c Factor loading of the item with the KAP dimension component to which it belongs.
d Spearman's Rho of the item with knowledge score/practice score.
e Spearman's Rho of the item with knowledge score/attitude score.

Table 3.Linear regression models to identify the explanatory factors of KAP

Dimension	Variables included in the model	Coefficients β[a]	p
Knowledge Score	Socioeconomic stratum of housing	-1.0/-0.07	0.021*
	Number of people in the household	-0.2/-0.11	< 0.001**
	Internet health information	-0.2/-0.07	0.009**
	Use of various contraceptive methods	-0.3/-0.15	< 0.001**
	Mother's education	0.1/0.10	0.001**
	Educational level of the adolescent	0.2/0.10	0.001**
	Know gonorrhoea	0.3/0.08	0.003**
	Know herpes	0.3/0.10	< 0.001**
	Age at first sexual intercourse	0.1/0.12	< 0.001**
	First sexual relationship with a friend or stranger	0.2/0.12	< 0.001**
	Use of contraceptives during the first sexual relationship	0.2/0.07	0.007**
	Did you use a condom in your last sexual relationship?	0.4/0.11	< 0.001**
Attitude Score	Family dysfunction	-0.4/-0.11	0.023*
	Adolescent sex (female)	-1.0/-0.24	< 0.001**
	Home health information	-0.6/-0.14	< 0.001**
	Health information from friends	-0.4/-0.07	0.009**
	First sexual relationship with a friend or stranger	-0.2/-0.08	0.010*
	Know hepatitis	-0.6/-0.06	0.020**
	Know syphilis	0.8/0.18	< 0.001**
	Get to know HPV	0.4/0.08	0.002**
	Has had sexual relations with a person of the same sex	0.7/0.11	< 0.001**

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	Educational level of the adolescent	0.3/0.09	0.002**
	Did you use a condom in your last sexual relationship?	0.5/0.11	< 0.001**
	Mother's education	1.0/0.09	0.001**
	Father's age	0.1/0.06	0.018*
Practice Score	Father's education	-0.2/-0.09	< 0.001**
	Home health information	-0.5/-0.10	< 0.001**
	Use of various contraceptive methods	-0.8/-0.20	< 0.001**
	Know gonorrhoea	-0.4/-0.08	0.001**
	Know syphilis	0.3/0.07	< 0.001**
	Get to know HPV	0.3/0.06	0.004**
	Know hepatitis	0.7/0.06	0.002**
	Age at first sexual intercourse	0.2/0.07	< 0.001**
	Did you use a condom in your last sexual relationship?	1.6/0.27	< 0.001**

*p < 0.05, **p < 0.01, [a] β Not standardised/β Typified

Attitudes were worse in students with dysfunctional families, women, those who sought health information at home or with friends, and those who had their first sexual relationship with friends or strangers. At the same time, better attitudes were recorded among those who had knowledge about syphilis and HPV, had relationships with people of the same sex, had a higher educational level, used condoms in the first sexual relationship, had a higher education of the mother, and father's age (Table 3).

The practices were worse in those whose parents had more education, information on home health, and were aware of gonorrhoea, whereas the best scores were recorded in those who knew about STIs (syphilis, HPV and HBV), used various contraceptive methods, were older at first sexual intercourse, and used a condom (Table 3).

In general, each dimension of the KAP scale presented different explanatory factors, except the following variables: (i) the higher educational level of the adolescent and his mother presented better knowledge and attitudes, while those who had their first sexual relationship with an unknown recorded greater knowledge and worse attitudes; (ii) those who use various contraceptive methods have a lower level of knowledge and healthy practices about HIV/AIDS, unlike those who began their sexual life at an older age who have better knowledge and practices. Those who knew about gonorrhoea had a better knowledge score but worse practices; (iii) prior knowledge of HPV and syphilis was correlated with better attitudes and practices; and (iv) only condom use in the last sexual intercourse was related to a higher KAP score (Table 3).

Discussion

In this study, it was found that a third of the population has a low perception of the risk of contracting HIV and nearly half of the adolescents consider that they have no risk of becoming infected, whereas the majority have unstable sexual partners with only 30% use condoms in all their sexual relations. HIV risk perception is an essential component of prevention. Studies in different regions of Africa have shown that although adolescents are exposed to multiple risk factors for HIV, they have a low perception of the risk of infection; therefore, they use few protective measures and undergo screening tests less frequently[13]. An explanation for this finding lies in the optimistic bias, which is a central issue in research on risk perception in adolescents. The theory of optimistic bias maintains that this population considers that HIV, cancer, and sexually transmitted diseases, among other health events, "can't happen to me", with the consequence that they systematically underestimate their risk compared with the real risk. They find the disease to be a very distant possibility and, therefore, do not see arguments to actively prevent it. Two reasons contribute to this situation: i) the general notion of invulnerability that accompanies adolescence and ii) the stigma and discrimination associated with HIV/AIDS, plus the social link of the disease with homosexuals and prostitution. In this sense, for an adolescent to admit that he/ she is at risk of contracting HIV means placing himself or herself in taboo categories culturally associated with poverty (prostitution) and immorality (homosexuality and prostitution)[14].

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In terms of knowledge, the proportion of subjects with a favourable response was greater than 80%. Adolescents recognise that the greater the number of sexual partners, the greater the risk of contracting HIV, and that if a person uses a condom well, they are protected from infection. Furthermore, knowledge was better in adolescents with mothers who had a high level of education. This finding coincides with other studies conducted in different African countries[15-17] and Colombia[10,11] that show that adolescents have increasingly better knowledge about the transmission routes of the virus, a finding that can be partially explained by exposure to various infection awareness campaigns. Regarding the mother's education, the evidence is consistent in showing that mothers influence adolescents' sexual beliefs and behaviours in the following ways: i) mothers have open conversations with their children in which they provide information about healthy sexual behaviour, ii) they shape the sexual behaviour of adolescents by example, iii) they monitor the behaviour of adolescents and iv) they seek to maintain active lines of communication and establish relationships of trust so that their children express doubts to them, especially in the transition stage from childhood to adolescence[18]. Consistent with this, outcomes have been described, such as a decrease in risky sexual behaviours, an increase in the use of condoms in sexual relations, and a decrease in the number of relationships and sexual partners[18-20]. In this sense, the involvement of mothers is a basic component of interventions aimed at increasing knowledge and reducing risky sexual behaviours in adolescents.

Regarding attitudes, it was found that about half of adolescents consider that the use of condoms decreases pleasure. The association between condom use and decreased sexual pleasure and satisfaction has been reported in adolescents and young people from different parts of the world, such as the United States[21], Mexico[22], and Colombia[10]. An outcome associated with this belief is the reduction in the probability of using condoms in future sexual relations, since pleasure plays a central role in motivating sexual activity and, therefore, any device that interferes with it will be avoided. However, it is important to remember that the experience of pleasure is inherently subjective. Therefore, condom marketing should be reoriented to emphasise aspects that can improve pleasure, such as the incorporation of retardants that prolong sexual relations or the use of heat-transducing materials that increase sensitivity[21]. Thus, acceptability among adolescents is improved, its use is increased, and the risk of sexually transmitted infections such as HIV is reduced.

Regarding issues related to discrimination towards people living with HIV, it was found that nearly 20% consider that people with HIV should isolate themselves and declare that if they knew someone with the infection, they would stay away from them. Attitudes were worse among students with dysfunctional families, women, and those seeking health information at home or with friends. Discrimination against people living with HIV/ AIDS is strongly associated with the source and quality of the information received and constitutes one of the main barriers for these people to seek treatment, access diagnostic tests, or approach health services. For this reason, the WHO suggests fighting them[23]. In this sense, adolescents' discriminatory attitudes are important and have been frequently described in the literature. For example, studies in Hong Kong found that 18.5% of adolescents believe that students with HIV/ AIDS should stay out of school, and around 40% of students would oppose people with HIV working in restaurants[24,25]. Another study in Botswana found that approximately 54% of adolescents maintain that no HIV-positive teacher should be allowed to teach[26]. Along the same lines, a study in China found that 42% of people would avoid physical contact with people with HIV[27]. Despite the magnitude of the problem, simple interventions in adolescents, such as virtual interaction through a documentary about people living with HIV, increased knowledge, and simple exercises, such as writing letters to be sent to groups of support from people with HIV, can significantly reduce discriminatory attitudes in adolescents[28]. In this sense, interventions of this type should be implemented for adolescents in the city.

In the practices, it was found that 18% of adolescents had sexual relations under the influence of alcohol or hallucinogens, 45.5% did not use contraceptive methods in their last sexual relationship, and 61% had never taken the test for detecting HIV/ AIDS. Taken together, these results reflect that adolescents in the city engage in risky sexual practices; therefore, there may be an underestimation of infection in this population group. Studies carried out in the United States have described that about 44% of young people do not know if they have the virus, only 5% of heterosexual high school students have ever been tested, and only 7% of LGBQ+ students have been tested for HIV[29,30]. Therefore, the CDC recommends testing for HIV in adolescents, recognises that schools play a key role in promoting it, and, to achieve this, educating students about HIV to increase their chances of getting tested in educational activities, including information about places and procedures to obtain free or low-cost tests, guarantee confidentiality to adolescents seeking testing, establish routes that help link adolescents with needs-sensitive health care systems of this population, and encourage students and their families to talk about HIV and other sexually transmitted infections[31].

The factors that explain the KAP were heterogeneous, but the consistency of the association with educational level, history of the first sexual relationship with a stranger, use

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of multiple contraceptive methods, age of initiation of sexual relations, and knowledge stand out of other STIs such as HIV, syphilis, and gonorrhoea. This finding contrasts with other research that shows that the factors associated with KAP for HIV prevention are gender, number of sexual partners, drug use, and the media[32]. The heterogeneity in the explanatory factors of KAP and the divergence with previous research reveals that those interested in sexual health education must recognise the complexity of this phenomenon, that the factors that modify it are dependent on the context, and that it is necessary to consider these aspects when designing interventions in this population group.

In the literature, there are multiple KAP studies on HIV in adolescents[9-11,17]; however, there is little research that rigorously evaluates the psychometrics of the instruments applied[33]. Studies have been conducted on specific population groups such as health workers[33], on topics related to stigma perceived by people living with HIV[34] or research that only accounts for knowledge[35], without including attitudes, or practices. Overall, studies conclude that current methods of measuring HIV knowledge are inadequate, and recommend that new instruments be developed and validated[35]. The scale used in this study to measure KAP on HIV/ AIDS in adolescents demonstrated excellent psychometric properties of reliability, internal consistency, discriminant power, and factorial validity. This instrument could be used in other research in the country or other countries to generate a baseline on KAP in adolescents. It could also be used as a measure against which the results of interventions aimed at modifying them are compared or in multicenter studies that evaluate whether psychometric properties are conserved in different cultures.

This study has the following limitations: i) the research was conducted on adolescents attending school, and although the educational coverage in the city in this population group is close to 90%[36], the subgroup of unschooled adolescents may have a worse KAP profile, ii) the study investigates issues related to sexual behaviour and social desirability bias may occur in adolescents, iii) the study has a cross-sectional design; therefore, it is possible that the associations between the variables do not reflect causality.

Conclusion

Adolescents in Medellín have good knowledge about HIV; however, they have negative attitudes towards the use of condoms and a low perception of the risk of becoming infected, despite their risky sexual practices, such as unprotected sex or under the influence of alcohol and drugs. It is necessary for local authorities to design interventions aimed at practices, particularly the acceptability of condom

use, to promote and facilitate access to HIV screening tests. In addition, this study designed and validated an instrument with excellent psychometric properties that can be used in subsequent research.

Conflict of Interest: None

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Appendix 1.Survey

Student Data

Name of the educational institution: _____

1. Age: _____ (year).

2. Gender: 0. Woman __   1. Man __

3. Semester or degree completed ___

4. Who or where do you turn when you need information about sexual and reproductive health: (you can check more than one answer)

1. Internet __

2. Household People __

3. People from the School __

4. Friends __

5. Another one _____

Household data

5. Socio-economic status_____

6. Number of people in your household _____

7. Age of his/ her father _____

8. Age of his/ her mother _____

9. Mother's education _____

10. Father's education_____ _____

11. Who does he live with? (you can mark more than one answer):

0. Father __

1. Mother __

2 Siblings __

3. Another one _____

Perception of family function (APGAR Test)

S. No.	Questions	No	Yes	Almost Always
12.	Are you satisfied with the help you receive from your family when you have a problem?	0	1	2
13.	Do you talk among yourselves about the problems you have at home?	0	1	2
14.	Are important decisions made together at home?	0	1	2
15.	Are you satisfied with the time you spend with your family?	0	1	2
16.	Do you feel that your family loves you?	0	1	2

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Knowledge about HIV

17. Name the sexually transmitted infections or diseases you know of

18. Please indicate yes or no to the questions in the following table:

Questions	Yes	No
Having sexual relations in some positions prevents the possibility of contracting HIV/ AIDS.	1	0
There are treatments against HIV/ AIDS.	1	0
If a person uses a condom correctly, they are protected from contracting HIV/ AIDS.	1	0
People can have HIV/ AIDS in their bodies and not be sick.	1	0
If a person receives a blood transfusion infected with HIV/ AIDS, they can contract the disease.	1	0
You believe that the greater the number of sexual partners, the greater the risk of contracting HIV/ AIDS.	1	0
You can tell at a glance if a person has HIV/ AIDS.	1	0
AIDS is a disease that can cause death.	1	0
Having sex without a condom is not a risk because the probability of becoming infected with HIV/ AIDS in my community is low.	1	0

19. What are the transmission mechanisms of HIV/ AIDS (you can check more than one answer)

0. Unprotected sexual contact__

1. Saliva of an infected person __

2. Transfusion of infected blood __

3. During childbirth or breastfeeding if the mother is infected __

4. Piercing or tattoos with infected material __

5. Bite of an infected mosquito ___

6. Other__ _____ Which_____

Attitudes

Question	Yes	No
A good reason to postpone sexual relations is the risk of contracting HIV/ AIDS.	1	0
We should feel good about delaying or refusing to have sex.	1	0
It's okay for teens to have sex without a condom if they know each other well.	1	0
Having to temporarily stop intercourse to put on a condom interrupts sexual pleasure.	1	0
I would be too embarrassed to buy a condom.	1	0
I would be too embarrassed to use a condom.	1	0
If my parents knew that I used a condom they would be very angry with me.	1	0
Using condoms feels less pleasure.	1	0
If your boyfriend/ girlfriend wants to have sex, it is better to agree so as not to lose him/ her.	1	0
If you know a person who has HIV/ AIDS, you would stay away from them.	1	0
Something would happen to me if I were in the same classroom with someone who has HIV/ AIDS.	1	0
People who have AIDS are homosexuals.	1	0

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If you knew that my boyfriend was infected with HIV/ AIDS, she would leave him	1	0
HIV/ AIDS is a punishment for irresponsible behaviour.	1	0
People with HIV/ AIDS should be isolated.	1	0
Health professionals who are infected should not care for people without the infection.	1	0
I would like to know more about HIV/ AIDS.	1	0
I would like to be tested for HIV/ AIDS.	1	0

20. Which of the following people are at greater risk of suffering from HIV/ AIDS infection (you can check more than one answer)

0. Prisoners ___

1. Consumers of psychoactive substances ___

2. Sex workers ___

3. Homosexuals ___

4. Other ___ Which _____

Practices

Questions	Yes	No
Has had sexual relations	1	0
You use contraceptive methods	1	0
Your sexual partner plans	1	0
Used contraceptives in the first sexual relationship	1	0
Has had sexual relations with someone of the same sex	1	0
Has a current stable partner for the last 3 months or more	1	0
Has had sexual relations under the influence of alcohol or a hallucinogenic drug	1	0
Have been tested for HIV/ AIDS	1	0
Has any of your sexual partners had a sexually transmitted infection?	1	0
Has any of your sexual partners been tested for HIV/ AIDS	1	0
You have been diagnosed with a sexually transmitted infection	1	0

21.What contraceptive methods do you use (You can check more than one)

1. Condom ___

2. Injection ___

3. Pills ___

4. Other ___ Which _____

5. None ___

22.What contraceptive methods did you use during your first sexual relationship?

1. Condom ___

2. Injection ___

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3. Pills___

4. Other ____ Which _____

5. None ___

23. How often do you use a condom?

0. Always ___

1. Frequently ___

2. Occasionally ___

3. Never ___

24. With whom was your first sexual relationship?

0. Friend ___

1. Familiar ___

2. Boy-Girl friend ___

3. Unknown ___

4. Known ___

5. Other ____ Which _____

25. Age at first sexual intercourse _____

26. Number of sexual partners ـــــ

27. Number of sexual partners in the last year ـــــ

28. Number of sexual partners in the last three months ـــــ

29. What is the best way to protect yourself against HIV/ AIDS? (you can mark more than one answer)

0. Condom use ___

1. Have relations with only one partner ___

2. Not having sexual relations ___

3. Don't be promiscuous ___

4. Adequate sexual education ___

Deleted Items

Knowledge	Values
Having sexual relations in some positions prevents the possibility of contracting HIV/ AIDS.	$\lambda = 0.90$
Having sex without a condom is not a risk because the probability of becoming infected with HIV/ AIDS in my community is low.	$\lambda = 0.91$
You can tell at a glance if a person has HIV/ AIDS.	$\lambda = 0.23$
Know the main routes of HIV transmission.	$\lambda = 0.29$
Attitudes	
It is okay for teens to have sex without a condom if they know each other well.	Rho= 0.24
I would be too embarrassed to use a condom.	Rho= 0.20
If my parents knew that I used condoms they would be very angry with me.	Rho= 0.16
Something would happen to me if I were in the same classroom with someone who has HIV/ AIDS.	Rho= 0.27

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People who have AIDS are homosexuals.	Rho= 0.23
Infected health professionals should not care for people without the infection.	Rho= 0.27
I would like to know more about HIV/ AIDS.	Rho= 0.25
I would like to get tested for HIV.	Rho= 0.23
A good reason to postpone sexual relations is the risk of contracting HIV.	$\lambda = 0.23$
Having to temporarily stop intercourse to put on a condom interrupts sexual pleasure.	$\lambda = 0.21$
I would be too embarrassed to buy a condom.	$\lambda = 0.21$
If I knew that my boyfriend was infected with HIV/ AIDS, I would leave him.	$\lambda = 0.02$
Practices	
Your sexual partner plans	$\lambda = 0.07$
High number of sexual partners	$\lambda = 0.29$
Has any of your sexual partners had a sexually transmitted infection?	$\lambda = 0.90$
You have been diagnosed with a sexually transmitted infection.	$\lambda = 0.88$

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Appendix 2.Bivariate Analysis to Identify Factors Associated with KAP Scores

	Variable	Knowledge	Attitudes	Practices
Sex	Woman	8.3 (8–10)	8.3 (7–10)	4 (4–10)
	Man	10 (8–10)	6.7 (3–8)	6 (4–8)
	p U MW[a]	< 0.001**	< 0.001**	0.004**
Type of family	Single parent	10 (8–10)	6.7 (5–8)	4 (4–8)
	Nuclear	10 (8–10)	6.7 (0–8)	8 (4–8)
	Extensive	8.3 (8–10)	8.3 (7–9)	6 (4–8)
	p H KW[b]	0.007**	< 0.001**	< 0.001**
School grade	Secondary	10 (8–10)	6.7 (5–8)	6 (4–8)
	Technique	8.3 (8–10)	8.3 (7–9)	6 (4–8)
	University	10 (8–10)	8.3 (8–10)	4 (4–8)
	p H KW[b]	< 0.001**	< 0.001**	< 0.001**
Source of health information				
Internet	No	10 (8–10)	6.7 (5–8)	4 (4–8)
	Yes	8.3 (8–10)	6.7 (5–8)	6 (4–8)
	p U MW[a]	0.161	0.470	0.020*
People from the School	No	10 (8–10)	6.7 (5–8)	6 (4–8)
	Yes	8.3 (8–10)	8.3 (7–9)	6 (4–8)
	p U MW[a]	0.030*	0.108	0.298
Household People	No	10 (8–10)	6.7 (5–8)	6 (4–8)
	Yes	10 (8–10)	6.7 (5–8)	4 (4–8)
	p U MW[a]	0.483	0.069	0.012*
Friends	No	10 (8–10)	6.7 (5–8)	6 (4–8)
	Yes	8.3 (8–10)	8.3 (7–9)	6 (4–8)
	p U MW[a]	0.047*	0.009**	0.539
Health institutions	No	10 (8–10)	6.7 (5–8)	6 (4–8)
	Yes	8.3 (8–10)	8.3 (7–10)	4 (2–8)
	p U MW[a]	0.124	< 0.001**	0.001**
Known STIs				
HIV/ AIDS	No	8.3 (8–10)	0 (0–67)	8 (8–8)
	Yes	10 (8–10)	8.3 (5–8)	4 (4–8)
	p U MW[a]	< 0.001**	< 0.001**	< 0.001**
Gonorrhoea	No	10 (8–10)	6.7 (0–8)	8 (4–8)
	Yes	10 (8–10)	8.3 (5–8)	4 (4–8)
	p U MW[a]	0.447	< 0.001**	< 0.001**

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Syphilis	No	8.3 (8–10)	6.7 (5–8)	4 (4–8)
	Yes	10 (8–10)	8.3 (7–10)	6 (4–8)
	p U MW[a]	0.006**	< 0.001**	0.028*
Herpes	No	10 (8–10)	6.7 (5–8)	6 (4–8)
	Yes	10 (8–10)	8.3 (7–10)	4 (4–8)
	p U MW[a]	0.891	< 0.001**	< 0.001**
HPV	No	10 (8–10)	6.7 (5–8)	6 (4–8)
	Yes	10 (8–10)	8.3 (7–10)	6 (4–8)
	p U MW[a]	0.547	< 0.001**	0.573
Chlamydia	No	8.3 (8–10)	6.7 (5–8)	6 (4–8)
	Yes	10 (8–10)	8.3 (7–10)	4 (4–8)
	p U MW[a]	0.003**	< 0.001**	0.013*
Hepatitis	No	10 (8–10)	6.7 (5–8)	6 (4–8)
	Yes	10 (8–10)	8.3 (7–10)	6 (4–8)
	p U MW[a]	0.400	< 0.001**	0.912
Has had sexual relations	No	8.3 (8–10)	8.3 (7–9)	10 (8–10)
	Yes	10 (8–10)	6.7 (5–8)	4 (2–6)
	p U MW[a]	< 0.001**	< 0.001**	< 0.001**
Who was your first sexual relationship with?	Boy-Girlfriend	8.3 (8–10)	8.3 (7–9)	4 (2–6)
	Friend	10 (8–10)	5 (0–3)	6 (4–8)
	Unknown	10 (8–10)	5 (5–5)	4 (4–4)
	Familiar	8.3 (8–10)	6.7 (5–8)	4 (2–5)
	p H KW[b]	< 0.001**	< 0.001**	< 0.001**
Planned in the first sexual relationship	No	8.3 (8–10)	8.3 (7–9)	4 (2–6)
	Yes	10 (8–10)	6.7 (5–8)	6 (4–6)
	p U MW[a]	< 0.001**	< 0.001**	< 0.001**
Current contraceptive method				
Condom	No	8.3 (8–10)	6.7 (7–8)	4 (2–4)
	Yes	10 (8–10)	5.7 (5–8)	6 (4–6)
	p U MW[a]	< 0.001**	< 0.001**	< 0.001**
Injectable or oral contraceptives	No	10 (8–10)	6.7 (5–8)	4 (4–6)
	Yes	8.3 (8–10)	8.3 (7–9)	5 (4–8)
	p U MW[a]	< 0.001**	< 0.001**	< 0.001**
Subdermic implant	No	10 (8–10)	6.7 (5–8)	4 (4–6)
	Yes	8.3 (8–10)	8.3 (7–9)	4 (2–4)
	p U MW[a]	< 0.001**	< 0.001**	< 0.001**

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Spearman's Rho coefficient			
Age	0.14**	-0.01	-0.23**
Father's age	-0.10*	0.18**	0.10**
Mother's age	0.02	0.17**	0.02
Father's education	-0.15**	0.35**	-0.04
Mother's education	-0.10**	0.36**	-0.10**
Socioeconomic stratum of housing	-0.14**	0.26**	-0.01
Number of people in the household	-0.12**	0.10**	0.10**
Family functionality	0.02	-0.10**	0.01
Number of STIs known	-0.04	0.44**	-0.11**
Age at first sexual intercourse	0.17**	0.01	0.02
Use various contraceptive methods	-0.16**	0.23**	-0.13**

*p < 0.05, **p < 0.01, a p U Mann-Whitney, bp H Kruskal-Wallis