

# BMJ Open Safe-sex belief and sexual risk behaviours among adolescents from three developing countries: a cross-sectional study

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## ABSTRACT

**Objectives:** This study intends to evaluate whether the belief that condoms are 100% effective in protecting against HIV infection is associated with sexual risk behaviours among youth.

**Methods:** A cross-sectional study was performed in representative samples of high-school students in the Philippines, El Salvador and Peru. Participants completed a self-administered questionnaire. Students were asked about the risk of HIV transmission if one has sex using condoms. They were also asked to indicate whether they had ever had sexual relations and whether they used a condom in their first sexual relation. The sample was composed of 8994 students, aged 13–18.

**Results:** One out of seven adolescents believed condoms are 100% effective (safe-sex believers). Those adolescents were 82% more likely to have had sex than those without such belief, after adjusting for confounders (OR=1.82; 95% CI 1.51 to 2.21). On the contrary, no association was found between risk perception and condom use. Subgroup and sensitivity analyses produced similar results.

**Conclusions:** This is, to the best of our knowledge, the first study conducted specifically to evaluate this phenomenon and that has used the same questionnaire and the same data collection protocol in three different developing countries from Asia, Central and South America. These results reasonably suggest that there could be an association between safe sex beliefs and sexual initiation. Longitudinal studies are needed to better understand this possible association as it could influence how to better promote sexual health.

## INTRODUCTION

Among adolescents, sexually transmitted infections (STIs) and unplanned pregnancies remain important public health problems, despite long-term efforts to prevent them. As there are several risk factors for STIs, prevention encompasses the delay of

## Strengths and limitations of this study

- Data refer to 8994 students belonging to representative samples of three different countries.
- Analyses are adjusted for several potentially confounding variables, thus reducing the odds of other variables explaining our results.
- Results are confirmed using subgroup and sensitivity analyses.
- As in any cross-sectional study, conclusions need to be confirmed using longitudinal data. We discuss in detail the plausibility of our findings.

the onset of sexual relationships among adolescents and, among sexually active youth, the reduction of the number of sexual partners and the increase of correct and consistent condom use.<sup>1–3</sup> The *Lancet* Consensus sought to prioritise the proper order of emphasis among these three messages,<sup>3</sup> but better knowledge about what determines these behavioural choices is needed to plan the best possible strategies.

Condoms offer better protection for HIV and pregnancy than for other STIs such as genital herpes or human papillomavirus. However, protection is not complete in any of these cases, even assuming optimal use.<sup>2 4 5</sup> Health educators, parents and the media in general could benefit from better understanding how adolescents are perceiving some condom promotion messages. On one hand, condom promotion seeks an increase in condom use among adolescents, thus reducing individual risks.<sup>6</sup> On the other hand, conveying the message that condoms offer complete protection might cause a perception of safety that may lead to an earlier onset of sexual relations or to a higher number of sexual partners (risk compensation phenomenon).<sup>7 8</sup> Hesitations about how



to classify these possible effects underlie, for example, the debates that took place concerning condom labels. Specifically, in 2005, the USA Food and Drug Administration proposed that labels should say: “When used correctly every time you have sex, latex condoms greatly reduce, but do not eliminate, the risk of pregnancy and the risk of catching or spreading HIV”,<sup>9</sup> while others argued that saying “do not eliminate” might cause people not to want to use condoms, which would increase risks.<sup>10 11</sup>

In this context, the present study aims to address, in three developing countries (the Philippines, El Salvador and Peru), one of the issues discussed in the debate: whether the fact of believing in condom’s 100% effectiveness is associated with sexual onset (having ever had sexual relationships) among adolescents and/or with condom use (having used a condom during the first sexual relationship) among sexually initiated adolescents.

All three countries have an HIV estimated prevalence for the general population below 1%, particularly affecting younger people.<sup>12–14</sup> With regard to other sexually transmitted infections, recent evidence from Peru has shown prevalences up to around 15% for the general population, with genital herpes virus being the most frequent.<sup>15</sup> Projections seem to show that these figures may increase as a result of early sexual initiation and multiple sexual partnerships: according to the last national data available, 9% of 15–24-year-old women in Peru and 2% in the Philippines reported having had sex before the age of 15, with even 16% of 15–19-year-olds in the Philippines reporting multiple sexual partnerships.<sup>14 16</sup> In all cases, condom use prevalence among young people is far from the recommended 100%.<sup>14 16 17</sup>

## METHOD

This article is related to an international cross-sectional study (Project YOURLIFE), on what youth think and feel about relationships, love and sexuality. This study has been described in detail elsewhere.<sup>18–20</sup> The following is a brief description of the methods.

### The sample

Project YOURLIFE is a cross-sectional survey that is being conducted in different countries. To date, Project YOURLIFE has been applied in the Philippines, El Salvador, Peru and Spain. In Spain, a different methodology and a somewhat different questionnaire were used; this country was therefore not included in the present paper.

In the Philippines, El Salvador and Peru, a multistage sampling of clusters of public and private schools within each country was performed.

In the Philippines, we targeted approximately 4000 students aged 13 to 24 from 28 public and private schools and universities within representative regions of the country. Specifically, seven out of the 17 political regions were chosen. Within each region, four centres were

identified, aiming a wide representation of youth sectors. Within each centre, all students in the selected year levels were invited to participate. A previous study gave more details and found that the participant sample was representative of the Filipino adolescent population.<sup>18</sup>

In El Salvador, we targeted around 3000 students aged 13 to 18. We invited all students of those ages from 30 randomly selected public and private schools within San Salvador, Santa Ana and San Miguel (the three main urban areas of the country).

In Peru, we targeted around 3000 students aged 13 to 18. We invited all students of those ages from 62 randomly selected public and private schools among all the schools in the country.

These sample sizes were chosen taking into account approximate sample size estimation criteria.<sup>21</sup> We based our estimates on the criteria that 10 respondents would be needed for each parameter included in a statistical model used to adjust for confounding. With these sample sizes we expected to obtain sufficient statistical power to account for a considerable amount of variables in a given model.

For this analyses, we only chose respondents aged 13 to 18 because these were the ages common to the three samples, and because they are the most relevant ages for this topic. We also excluded respondents with a missing value in the sexual initiation variable (<1.5%).

## Questionnaire and variables

Paper questionnaires (see online supplementary appendices 1–3) were used to gather information on aspects of young people’s lifestyles. The questionnaires, written in English (for the Philippines) or Spanish (for El Salvador and Peru), had primarily close-ended questions. They were pilot tested and adjusted to ensure comprehension, clarity and suitability to local conditions and to make sure no more than 45 min would be required to fill them.

### Safe-sex belief

Respondents were asked about their opinions on the risk of being infected with HIV if one has sex using condoms. There were five answer options, from “None=there is no risk at all” to “Very high=always happens or almost always”. There was also an “I don’t know” answer option. Adolescents responding ‘None’ were coded as having a ‘safe-sex belief’.

A similar question was asked regarding the risk of pregnancy.

### Sexual behaviour

The questionnaire defined ‘sexual relationships’ as ‘complete sexual relationships, also known as “making love”, “having sex”’. Adolescents who had ever had sexual relationships were coded as sexually initiated.

In El Salvador and Peru (but not in the Philippines), sexually initiated adolescents were also asked whether they used a condom during their first sexual relationship

(the Philippines was the first place where we implemented the study, and the questionnaire had not included that question yet. We included it thereafter).

### Other variables

The questionnaire also obtained sociodemographic information and included questions about the youth's leisure activities, opinions, sources of information and communication with parents about love and sex.

### Data collection

The study was implemented in the Philippines, El Salvador and Peru, using standardised data-collection protocols.<sup>18 20</sup>

Local data collectors travelled to each participating school to administer the survey sheets during class hours. Administering questionnaires in schools (ie, away from parents), and by persons other than the teachers, has the benefit of increasing the respondents' sense of privacy and their willingness to disclose sensitive information.<sup>22</sup>

Survey procedures were designed to protect student privacy by ensuring voluntary and anonymous participation. Schools were responsible for, and in charge of managing parental consent, according to their local laws and policies.<sup>23</sup> Students were informed that their participation was voluntary and anonymous, and that they could leave the room and/or leave the questionnaire unanswered. They were also told that they could leave any question unanswered if they wished. They were also informed that answering the questionnaire was considered as consent to participate in the study.

Two ethical approvals (in English and in Spanish) were obtained for the project from different committees (from the Philippines and Spain, respectively: the Ethics Committee of the University of Asia and the Pacific (The Philippines) and Ethics Committee of the University of Malaga (Spain)).

### Analysis

Bivariate analyses were assessed with  $\chi^2$  tests and Student *t* tests.

Multivariate non-conditional logistic regression models were fitted with safe-sex belief as the main independent variable and 'sexual initiation' (0: non-sexually-initiated respondents; 1: sexually-initiated respondents) as the dependent variable. In the models, we also introduced the main sociodemographic variables: sex, age, country, economic status, religiosity, school funding (public/private) and school type (coeducational/single-sex) as possible confounders. Several analyses were performed, each adjusting for an increasing number of confounders. Clusters of the sampling process (school classes) were taken into account to obtain robust indicators.

In order to confirm the heterogeneity of the associations across subgroups, interactions were tested between the main independent variable and the key correlates and subgroup estimates are shown in a forest plot.

Finally, the analyses were repeated with the variable 'safe-sex belief for risk of pregnancy' instead of 'safe-sex belief for risk of HIV transmission'.

All analyses were performed using Stata V.12;  $p < 0.05$  was considered statistically significant.

## RESULTS

The final sample used for this study was composed of 8994 youth, aged 13–18 (mean=15.5 years, SD=1.4), from the Philippines (3044), El Salvador (2591) and Peru (3359). More than half (54.8%) were female, 12.5% reported belonging to a family with high or very high economic status, 70.8% were Catholic, 53.2% belonged to public schools and 81.9% to coeducational schools. A fifth (20.2%) were sexually initiated (table 1).

Table 2 shows adolescents' perception of what the risk of HIV transmission is, if one has sex using condoms. The most frequent answers were 'medium risk' (23.7%) and 'low risk' (22%). However, 13.4% believed there is no risk at all.

Table 2 also shows, at each level of perceived risk, the prevalence of sexual initiation and the prevalence of condom use at first sex. The prevalence of sexual initiation was significantly different among groups ( $p < 0.001$ ), and it was considerably higher among those who believed there is no risk at all (30.4%) than in the other groups (14.7% to 22.2%). No differences were found in the prevalence of condom use at first sex ( $p = 0.534$ ).

Safe-sex belief (the belief that there is no risk at all if one has sex using condoms) was more frequent among males than among females (16.5% vs 10.8%,  $p < 0.001$ ), among Filipinos and Peruvians than among Salvadorians (16.5% and 14.8% vs 7.8%,  $p < 0.001$ ), among participants with low or no religiosity than among those with high religiosity (14.1% vs 12.4%,  $p = 0.017$ ), among participants from public schools than among those from private schools (16.4% vs 9.9%,  $p < 0.001$ ) and among participants from coeducational schools than among those from single-sex schools (14.5% vs 8.4%,  $p < 0.001$ ). No differences were found among age groups, between socioeconomic levels or among religions.

The association between having a safe-sex belief and sexual initiation was assessed in more depth. Specifically, several analyses were conducted in order to see which other variables were also associated with sexual initiation. In the crude analysis, sexual initiation was more frequent among participants with a safe-sex belief, among males, older participants, Salvadorians, participants with high economic status, with low religiosity and from coeducational schools (table 3).

Table 3 also presents the logistic regression models for sexual initiation. The last three columns show three different models, adjusting for an increasing number of confounders. Having a safe-sex belief was associated with having had sex. This association was found in the crude analysis as well as in the adjusted models. After adjusting

**Table 1** Distribution of respondents by key demographic characteristics

Characteristics	The Philippines (N=3044)	El Salvador (N=2591)	Peru (N=3359)	Total (N=8994)
Age (years) (range: 13–18)				
Mean (SD)	16.0 (1.3)	15.2 (1.6)	15.2 (1.1)	15.5 (1.4)
Sex				
Female, n (%)	1956 (64.3)	1130 (43.6)	1838 (54.7)	4924 (54.8)
Economic status				
High or very high, n (%)	246 (8.1)	404 (15.6)	476 (14.2)	1126 (12.5)
Religion				
Catholic, n (%)	2546 (83.6)	1305 (52.8)	2405 (72.6)	6256 (70.8)
Protestant, n (%)	299 (9.8)	738 (29.8)	373 (11.3)	1410 (16.0)
Others*, n (%)	145 (4.8)	110 (4.5)	192 (5.8)	447 (5.1)
No religion, n (%)	54 (1.8)	320 (12.9)	345 (10.4)	719 (8.1)
Religiosity				
High†, n (%)	1881 (61.8)	1290 (49.8)	858 (25.5)	4029 (44.8)
School funding				
Public, n (%)	1652 (54.3)	1582 (61.1)	1554 (46.3)	4788 (53.2)
School type				
Coeducational, n (%)	2951 (96.9)	1976 (76.3)	2436 (72.5)	7363 (81.9)
Sexual initiation				
Sexually initiated‡, n (%)	635 (20.9)	591 (22.8)	588 (17.5)	1814 (20.2)

\*Other religions include Jehovah's Witnesses, Mormons, Jews, Muslims and other religions, which vary across the different countries.

†Youth who have a religion, attend a temple at least once a week, and consider that "My faith is a very important influence that I am willing to take into account in my life".

‡Youth who have ever had complete sexual relations.

for sex, age, country, economic status, religiosity, school funding (public/private) and school type (coeducational/single-sex; model 3), the odds of having had sex is 82% higher among adolescents with a safe-sex belief than among those without a safe-sex belief (OR=1.82; 95% CI 1.51 to 2.21). Similar results were found after dropping respondents in the 'don't know/don't answer' category in the variable measuring the perceived risk of HIV transmission (data not shown).

**Table 2** Sexual initiation and condom use by perceived risk of HIV transmission

Perceived risk of HIV transmission if one has sex using condoms	Participants who responded each of the options n (%)	Sexually initiated* n (%)	Condom use† n (%)
No risk‡	1202 (13.4)	365 (30.4)	77 (43.3)
Low risk	1977 (22.0)	439 (22.2)	149 (46.0)
Medium risk	2128 (23.7)	406 (19.1)	138 (46.2)
High risk	1234 (13.7)	181 (14.7)	74 (49.0)
Very high risk	1087 (12.1)	195 (17.9)	52 (40.0)
DK/DA§	1366 (15.2)	228 (16.7)	38 (39.2)
Total	8994 (100.0)	1814 (20.2)	528 (44.8)

\*Sexually-initiated participants at each level of perceived risk. p Value ( $\chi^2$  test) <0.001.

†Among the sexually initiated, participants who used a condom at first sex at each level of perceived risk. This column includes participants from El Salvador and Peru only. p Value ( $\chi^2$  test) =0.534.

‡Safe-sex belief.

§Don't know/don't answer.

Interactions were tested between the main independent variable and the key correlates. The only significant interaction was found between having a safe-sex belief and country, showing that the association between having a safe-sex belief and sexual initiation was higher among Filipinos than among Peruvians (data not shown, see [figure 1](#)). We also conducted subgroup analyses, by repeating model 3 within separate categories according to sex, age, country and other variables ([figure 1](#)). The OR for the association between the main independent variable (safe-sex belief) and sexual initiation was consistent across these subgroups: in all the subgroups, the adjusted OR and the 95% CI were always above one (indicating a more frequent sexual initiation among adolescents with safe-sex belief).

Finally, the analyses were repeated with the variable 'safe-sex belief for risk of pregnancy', yielding similar results. These results can be found in online supplementary appendix 4.

## DISCUSSION

Studies assessing knowledge on sexual health tend to focus on whether people know about various STIs, the methods to avoid them and their respective effectiveness or risk behaviours.<sup>6 24 25</sup> In this article, we have analysed the knowledge that youth from three developing countries have about the effectiveness of condoms (one of the most common methods of preventing STIs and pregnancies). Specifically, we have focused on how many adolescents believe that condoms are 100% effective, and on the



**Table 3** Variables associated with sexual initiation

	Sexually initiated, n (%)	p Value*	ORs of having had sex		
			Crude	Model 1†	Model 2‡
Safe-sex belief‡					
No (N=7792)	1449 (18.6)	<0.001	(ref)	(ref)	(ref)
Yes (N=1202)	365 (30.4)		1.91 (1.61 to 2.26)	1.85 (1.55 to 2.19)	1.82 (1.51 to 2.21)
Sex					
Male (N=4070)	1178 (28.9)	<0.001	(ref)	(ref)	(ref)
Female (N=4924)	636 (12.9)		0.36 (0.30 to 0.44)	0.34 (0.29 to 0.40)	0.36 (0.31 to 0.42)
Age (years)	NA	NA	1.43 (1.35 to 1.52)§	1.51 (1.41 to 1.61)§	1.52 (1.42 to 1.64)§
Country					
The Philippines (N=3044)	635 (20.9)		(ref)	(ref)	(ref)
El Salvador (N=2591)	591 (22.8)	<0.001	1.12 (0.81 to 1.55)	1.29 (0.88 to 1.90)	1.29 (0.88 to 1.90)
Peru (N=3359)	588 (17.5)		0.81 (0.58 to 1.11)	1.02 (0.72 to 1.44)	0.89 (0.62 to 1.27)
Socioeconomic level					
Low-medium (N=7868)	1548 (19.7)	0.002	(ref)	(ref)	(ref)
High (N=1126)	266 (23.6)		1.26 (0.99 to 1.61)	1.51 (1.24 to 1.84)	1.56 (1.25 to 1.94)
Religiosity					
Low (N=4965)	1172 (23.6)	<0.001	(ref)	(ref)	(ref)
High (N=4029)	642 (15.9)		0.61 (0.55 to 0.69)	0.58 (0.53 to 0.64)	0.59 (0.54 to 0.64)
School funding					
Public (N=4788)	1001 (20.9)	0.063	(ref)	(ref)	(ref)
Private (N=4206)	813 (19.3)		0.91 (0.70 to 1.17)		1.04 (0.78 to 1.39)
School type					
Single-sex (N=1631)	270 (16.6)	<0.001	(ref)	(ref)	(ref)
Coeducational (N=7363)	1544 (21.0)		1.34 (0.90 to 2.00)		1.37 (0.94 to 2.00)

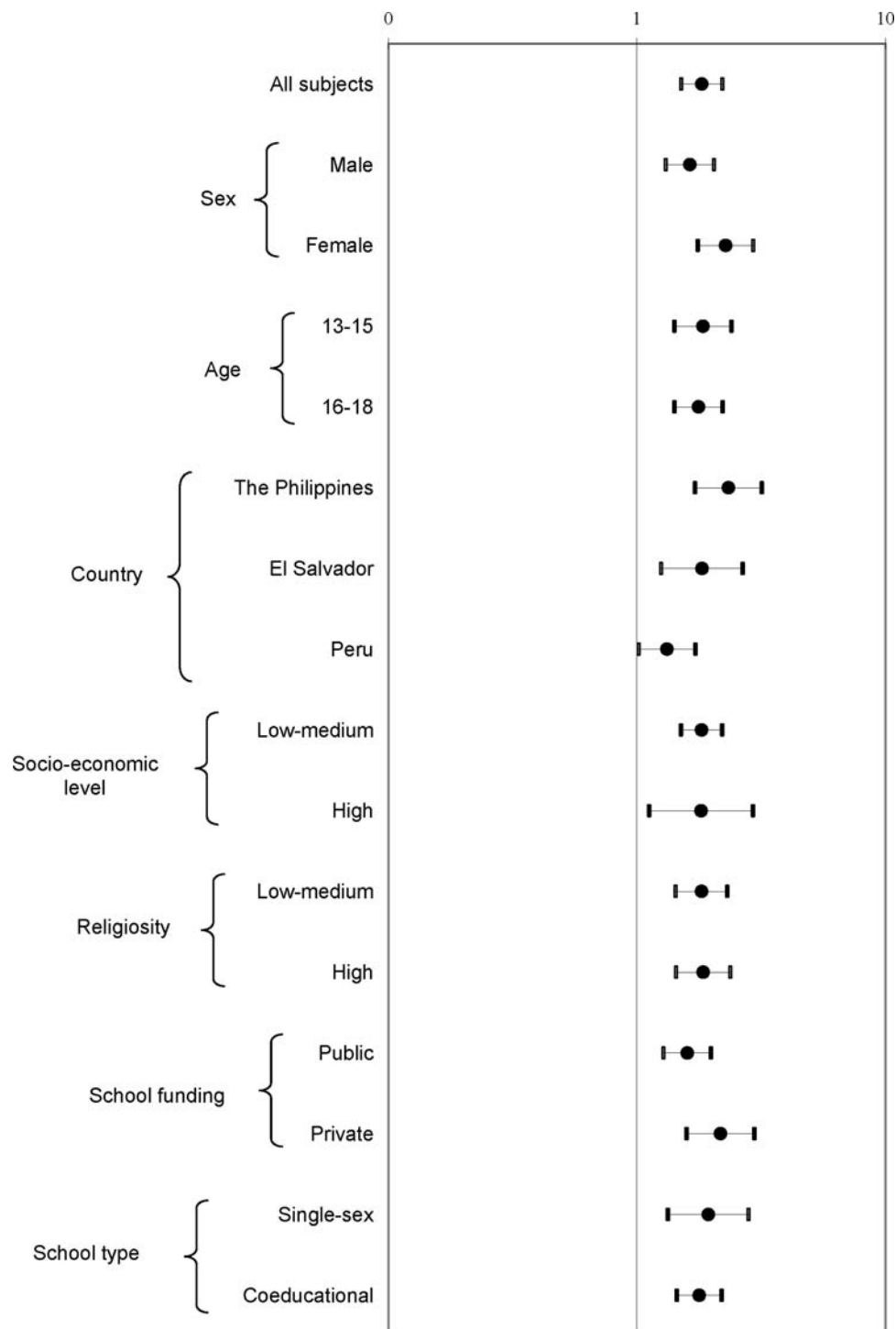
\*p Value of  $\chi^2$  Test.

†ORs (and 95% CI) adjusted for the variables indicated in each model. Model 1: Safe-sex belief, sex, age and country. Model 2: Safe-sex belief, sex, age, country, socioeconomic level and religiosity. Model 3: Safe-sex belief, sex, age, country, socioeconomic level, religiosity, school funding and school type.

‡YES, respondents who believe that, if one has sex using condoms, the probability of being infected with HIV is nil. NO, the rest of respondents.

§OR per every unit of change in age (years).

NA, not applicable; ref, reference.



**Figure 1** ORs<sup>a</sup> of having had sex for respondents with a safe-sex belief vs respondents without a safe-sex belief, across different subgroups. <sup>a</sup>ORs (and 95% CIs) adjusted for sex, age, country, socioeconomic level, religiosity, school funding and school type. Note: logarithmic scale.

behaviour of such adolescents, in particular, regarding sexual initiation and condom use.

In our sample, 13% of adolescents believe condoms are 100% effective to prevent STIs. Some campaigns that promote condom use might be placing too much emphasis on their effectiveness, to the point of conveying the message that their protection is complete.

Indeed, although agencies such as the WHO have used the term 'safer' sex instead of 'safe' sex for years,<sup>26</sup> unfortunately, many other organisations and prevention campaigns continue using the 'safe sex' message. The following examples illustrate this problem: 'How is HIV transmitted? ... Through unprotected sex',<sup>27</sup> thus suggesting that protected sex does not transmit HIV, or

'Using a condom *avoids* AIDS transmission',<sup>28</sup> thus ambiguously using the word 'avoids' instead of 'reduces the risk'. Research has shown that people often base their risk-related judgments on simplifying heuristics regarding the information they have received.<sup>29</sup> Ambiguous information only stressing condom safety may lead youth to think that sex using condoms is simply 'safe sex'.

After determining the prevalence of this safe-sex belief in our sample, we evaluated how it was related to sexual behaviour. Our data showed an association between this belief and having already had sexual relations. However, no association was found between this belief and condom use. Further research is needed, with larger samples of sexually initiated youth, to assess this topic.

Given the cross-sectional nature of the study, the association found may have different interpretations. One of them is that overconfidence in condom effectiveness might lead to an earlier sexual onset among adolescents. In fact, several studies have suggested the possibility of this behavioural phenomenon, known as 'risk compensation'. Risk compensation may occur when individuals change their behaviour in response to perceived changes in their vulnerability to a disease. An increase of overall risk can occur when technological preventive measures are introduced in public health and simultaneously the decrease in perceived risk increases riskier behaviours. For example, the adoption of health risk-reduction strategies, such as the use of seat belts, helmets or sunscreen use, may be partially offset by compensatory behaviours that increase risk, such as speeding, careless driving or excessive sunbathing.<sup>7 8 30</sup> This has to be taken into account whenever preventive measures are introduced in a given population. The benefits of certain preventive measures may end up being offset by riskier behaviours taken by the target populations, especially if they neglect other important preventive behaviours such as driving carefully or reducing sun exposure.

In the context of sexual behaviour and the efforts to contain HIV and other STIs, risk compensation behaviours have been described.<sup>31</sup> Campaigns promoting male circumcision, pre-exposure antiretroviral prophylaxis or condom use would also benefit from taking into account that target populations may incur in riskier behaviours if they feel excessively confident by the effectiveness of such measures or if they are unaware of other additional preventive behaviours.<sup>7 8 32</sup>

Regarding condoms, the cited articles show that users may feel invulnerable to infections, and have less interest in other more basic prevention measures such as, for example, delaying sexual initiation, avoiding casual sex or reducing the number of sexual partners. Studies suggest that risk compensation could be occurring in general populations exposed to some condom promotion campaigns.<sup>7 32</sup> According to these studies, such campaigns could increase sexual risk behaviours (earlier sexual initiation or higher number of sexual partners)

and thereby could undermine or even offset the overall potential protective effects of condoms.

In keeping with this theory, one of the possible interpretations of our data would suggest that a safe-sex belief might indeed increase sexual initiation among adolescents. The significance of sexual initiation among youth, from a public health perspective, is threefold: first, youth who begin sexual activity are at higher risk levels than those who are not sexually active, irrespective of condom use (albeit with higher risks when condoms are never used). Second, inconsistent condom use has been reported to be more prevalent among younger adolescents and is even more pronounced among those with poorer AIDS-related knowledge.<sup>33</sup> And third, it can lead to a greater likelihood of having multiple partners.<sup>7 32</sup>

An alternative interpretation of the association might be reverse causality. Being sexually active could compound the belief that condoms are completely safe. In this case, reverse causality could be explained by cognitive dissonance.<sup>34 35</sup> Cognitive dissonance can be present when a person feels a contradiction between knowledge they have on an issue and a specific opinion or behaviour concerning that issue (eg, having sex and believing that sex is risky). The presence of cognitive dissonance introduces pressure to reduce or eliminate this dissonance.<sup>34</sup> In the example cited above, pressure could be reduced by either not having sex or by believing it is not as risky after all. It could thus be argued that sexually initiated adolescents might 'justify' their choice by believing condoms are completely safe.

However, studies show the opposite effect: having sexual relations usually increases the knowledge adolescents have about the risks of sexual activity and the methods for their prevention. For example, studies published by Bertin and Van Rossem show that knowledge about HIV leads to delayed sexual initiation, while sexual initiation leads to better knowledge about HIV.<sup>33</sup> It is, therefore, less likely that being sexually active results in adolescents subsequently having the wrong belief that condoms are 100% effective. In any case, future longitudinal studies would surely help to confirm the relationship between these variables.

A third possible interpretation of the results is that other confounding variables might be influencing both having a safe-sex belief and sexual initiation. Our multivariate logistic regression models have sequentially been performed to take important and known confounders into account in the analysis (sex, age, country, socio-economic status, religiosity, school funding and school type). Furthermore, as explained in the methods section, our sample size was sufficient to simultaneously adjust for a good amount of possible confounders. Results are remarkably consistent across different models and subgroup analyses. Although residual confounding can never be completely ruled out in any study, it is unlikely that unknown confounders could completely explain our results.



In any case, there is a need for combining two important issues when conveying condom use messages: first, the need to use evidence-based messages, thus avoiding the so called 'safe sex' message, and second, the need to affirm the importance of consistency when using condoms. We believe both messages have to be strongly conveyed to ensure that abstinent youth as well as those sexually active get the right message.

Some additional limitations of our results have to be discussed. For example, our outcome measures: sexual initiation and condom use at first sex. We have not considered more specific risks such as paid sex, casual sex, multiple partners or inconsistency in condom use. This information would be more comprehensive, but it was not the main objective of this analysis. Our results with the outcomes studied are relevant by themselves.

Of course, we must remember that, with a cross-sectional study, we usually cannot confirm the direction of the association we have found. Furthermore, the results are all based on self-reported answers from adolescents and social desirability has to be discussed. However, self-reported questionnaires are state of the art methods to study issues such as sexual attitudes and practices. Furthermore, social desirability comes more into play when one has to state his/her preferences in front of an observer, but not to such an extent when facing an anonymously and personally-responded questionnaire. In the settings we used in our study, we believe social desirability was probably not a problem,<sup>22</sup> in any case not sufficient to explain the results.

The present study also has notable strengths. It is, to our knowledge, the first study implemented to evaluate the association between the perception of 100% effectiveness of condoms and sexual risk behaviours that has used the same questionnaire and the same data collection protocol in three different developing countries from Asia, Central and South America. Overconfidence in condom effectiveness might indeed be contributing to the increase of sexual initiation among adolescents from these countries, and these results could also be relevant in other settings.

Furthermore, samples were representative of student populations of those countries, and the sample sizes were sufficiently large to enable proper multivariate analysis, including the evaluation of effect modification and subsequent subgroup analyses. Representativeness is supported by sampling method, but it can also be tested by comparing demographic data from the sample and from national statistics. For example, in our sample, 83.6% of Filipinos, 52.8% of Salvadorians and 72.6% of Peruvians were Catholic, while according to the CIA World Factbook, the population percentages are 82.9%, 57.1% and 81.3%, respectively.<sup>36</sup> Results were confirmed with different sensitivity type analyses and were remarkably consistent across all alternative analyses.

If risk compensation associated with the belief that condoms are 100% effective is confirmed, public health authorities, the media, educators and parents could be

motivated to review how condom use promotion messages are being conveyed to youth, and how such messages could be more safely conveyed in the future.

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