

# HIV prevention in Mexican schools: prospective randomised evaluation of intervention

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## Abstract

**Objective** To assess effects on condom use and other sexual behaviour of an HIV prevention programme at school that promotes the use of condoms with and without emergency contraception.

**Design** Cluster randomised controlled trial.

**Setting** 40 public high schools in the state of Morelos, Mexico.

**Participants** 10 954 first year high school students.

**Intervention** Schools were randomised to one of three arms: an HIV prevention course that promoted condom use, the same course with emergency contraception as back-up, or the existing sex education course. Self administered anonymous questionnaires were completed at baseline, four months, and 16 months. Students at intervention schools received a 30 hour course (over 15 weeks) on HIV prevention and life skills, designed in accordance with guidelines of the joint United Nations programme on HIV/AIDS. Two extra hours of education on emergency contraception were given to students in the condom promotion with contraception arm.

**Main outcome measures** Primary outcome measure was reported condom use. Other outcomes were reported sexual activity; knowledge and attitudes about HIV and emergency contraception; and attitudes and confidence about condom use.

**Results** Intervention did not affect reported condom use. Knowledge of HIV improved in both intervention arms and knowledge of emergency contraception improved in the condom promotion with contraception arm. Reported sexual behaviour was similar in the intervention arms and the control group.

**Conclusion** A rigorously designed, implemented, and evaluated HIV education course based in public high schools did not reduce risk behaviour, so such courses need to be redesigned and evaluated. Addition of emergency contraception did not decrease reported condom use or increase risky sexual behaviour but did increase reported use of emergency contraception.

## Introduction

Most recent efforts to prevent sexually transmitted infections (including HIV) and pregnancy in adolescents have been school based projects that promoted either condoms or abstinence. Recent meta-analyses show that these strategies have not been evaluated rigorously, especially in developing countries.<sup>1-6</sup>

Reviews of projects to prevent teenage pregnancy and studies to promote abstinence have produced mixed results, with only some interventions delaying the onset of sexual activity, increasing condom use, or decreasing unplanned pregnancy (see [bmj.com](http://bmj.com)).

Unplanned pregnancy and sexually transmitted infections (including HIV) in adolescents are of major

concern in Mexico; in 2003, 17% of births (> 400 000) were to women under the age of 20,<sup>7</sup> and in 2000, 42% of young men and 26% of young women between 15 and 19 years reported having had a sexual relationship, with only 47% of these young men and 15% of young women using a condom during their first sexual intercourse.<sup>8</sup>

Emergency contraception is available over the counter in Mexico as a morning after pill. We found no published studies comparing the effect of programmes that promote condom use, with and without emergency contraception back-up, on risk behaviour in adolescents in schools. We analysed the effect on sexual behaviour of a high school based programme for preventing HIV and other sexually transmitted diseases by promoting the use of condoms with and without emergency contraception as back-up.

## Methods

Our cluster randomised trial began in the autumn of 2001. Forty public high schools—about 75% of such schools in the state of Morelos—were randomised to three arms. From our sample size calculation we estimated the minimum number of schools at 12 per arm (see [bmj.com](http://bmj.com)). We selected schools and asked them to participate, on the basis of stratified random sampling (stratified by degree of urbanisation), with sampling proportional to school size. All invited schools participated. We assigned the category of the government's assessment of poverty (see [bmj.com](http://bmj.com)) and degree of urbanisation to the communities where the schools are located. None of the schools had offered such specific and detailed education about emergency contraception or HIV prevention before. All participating 10th grade students were asked to respond to the questionnaires (in Mexico, high school comprises the 10th to 12th grades, ages 15 to 18). The overall response rate for each round of data collection was more than 95% of students attending school on the day the questionnaire was administered.

Ten of the 40 schools were randomised as control schools and continued with biology based sex education. We randomised 15 schools to receive the HIV education course with condom promotion and 15 schools to the same course plus a module on emergency contraception and improved access to such contraception. Two of these 30 schools initially randomised as intervention schools did not teach the intervention course, even though their teachers had been trained successfully. The primary analysis was an

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Tables A-C showing the actually treated analysis are on [bmj.com](http://bmj.com)



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intention to treat analysis. We also report an actually treated analysis, in which these two schools were included as control schools (see [bmj.com](http://bmj.com)).

Participating schools chose 106 teachers to take part in a week long (40 hour) training session between November 2001 and January 2002. Teachers from the 15 schools randomised to teach emergency contraception had an extra two hour training module. Questionnaires given before and after training showed improved knowledge.

The curriculum was based on teaching life skills and followed the guidelines of the UN programme on HIV/AIDS for effective school based programmes.<sup>3 4</sup> Almost half of the time in class focused on the consequences of unprotected sex and how to avoid it. Other classes dealt with the social pressures that influence sexual behaviour and provided practice in communication, negotiation, and refusal skills.

In February 2002, the teachers began to teach the 15 week, 30 hour course (16 weeks, 32 hours for the promotion with contraception arm). Students completed a 93 item anonymous questionnaire during class on three occasions: baseline in February 2002, immediately after intervention in June 2002, and one year later in June 2003. The questionnaires covered knowledge and attitudes about HIV, AIDS, and emergency contraception; sexual experience; and the use of condoms at first and most recent intercourse. We also asked about tobacco, alcohol and drug use, compensated sex (exchange of sex for money, goods, or favours), social networks, socioeconomic status, and intention to continue in school.

Monitoring of the progress of the intervention in each school consisted of 424 telephone calls to teachers, 212 visits to schools to speak with teachers and head teachers, and 25 direct class observations.

#### Data analysis

All analyses took the cluster sample design into account. We asked about biology, transmission, and

prevention of HIV; emergency contraception; and attitudes about condoms. For the behavioural variables included in the baseline questionnaire, we estimated the difference in differences at school level by using fixed effects logistic regression models to correct for intraschool correlation and to take potential trends into account. We included a dichotomous variable for each intervention and another to distinguish the baseline survey from the follow-up survey. We used age at baseline instead of age at the time of the survey to avoid confusion with the time trend. See [bmj.com](http://bmj.com) for details.

#### Results

Our sample comprised 10 954 students at baseline (February 2002), 9372 students immediately after the intervention (June 2002), and 7308 students at one year follow-up (June 2003). Between baseline and first follow-up, 14.4% (1582/10 954) of students dropped out, and 22% (2064/9372) dropped out between the second and third follow-up. This is mainly because of the high dropout rates in Mexican schools. The dropout rate from the first to second year of high school in Morelos was about 37% for students who entered school in 2000 (higher than the estimated national dropout of 30%). Mean age was 16.7 at follow-up, and 44% of the students were male compared with 48% at baseline (see table 1). Overall 17% (692/4031) of young women and 27% (841/3105) of young men reported sexual activity, with no significant differences between the three arms. At baseline 10% (511/5323) of young women and 24% (1175/4942) of young men reported sexual activity.

We found no significant differences between intervention groups at baseline, but significant differences were seen at follow-up. We also found important sex differences (table 1).

Among students who reported sexual activity at the 16 month follow-up, overall the groups did not differ

**Table 1** Characteristics of students who participated in a school based HIV prevention programme in Mexico at 16 months' follow-up; intention to treat analysis. Values are numbers (percentages; 95% confidence intervals) unless stated otherwise

Characteristic	Control group		Condom promotion group		Condom promotion with emergency contraception group	
	Female students	Male students	Female students	Male students	Female students	Male students
Sex		868/1867 (46; 44 to 49)		117/2619 (43; 35 to 50)		11320/2998 (44; 40 to 48)
Age (years)	16.7 (16.6 to 16.8) n=981	16.8 (16.6 to 16.9)	16.8 (16.8 to 16.9)* n=1433	16.9 (16.8 to 17.0) n=1066	16.7 (16.7 to 16.8) n=1640	16.9 (16.8 to 17.0)† n=1257
Reported having a partner	422/979 (43; 38 to 48)	302/837 (36; 33 to 39)†	767/1451 (53; 50 to 56)*	428/1074 (40; 36 to 44)†	760/1648 (46; 44 to 49)	486/1281 (38; 35 to 41)†
Age of partner (years)	18.6 (18.2 to 19.0) n=415	17.1 (16.8 to 17.3)† n=297	19.2 (18.8 to 19.6) n=759	17.0 (16.8 to 17.2)† n=427	19.0 (18.7 to 19.2) n=752	16.9 (16.8 to 17.0)† n=481
Knowledgeable about HIV (score 0-45)	41.6 (39.9 to 41.4)	40.2 (39.5 to 40.9)†	40.8; 40.5 to 41.1)	40.6 (40.2 to 41.0)	41.6 (41.2 to 42.0)*	41.2 (40.7 to 41.7)*†
Knowledgeable about emergency contraception	585/935 (63; 56 to 69)	490/788 (62; 57 to 67)	853/1402 (61; 56 to 66)	593/1009 (59; 53 to 64)	1313/1584 (83; 78 to 87)*	939/1213 (77; 72 to 83)*†
Would use a condom	395/529 (75; 67 to 82)	327/570 (57; 51 to 64)†	641/855 (75; 72 to 78)	418/734 (57; 54 to 60)†	789/980 (81; 77 to 84)	518/895 (58; 53 to 63)†
Would stop sex to put on a condom	665/716 (93; 92 to 94)	554/691 (80; 76 to 84)†	1039/1115 (93; 92 to 95)	733/881 (83; 80 to 86)†	1263/1343 (94; 92 to 96)	861/1052 (82; 78 to 86)†
Would make sex conditional on condom use	838/857 (98; 97 to 99)	612/674 (91; 88 to 93)†	1235/1266 (98; 96 to 99)	788/860 (92; 90 to 93)†	1441/1469 (98; 97 to 99)	975/1051 (93; 91 to 95)†
Sexually active	162/965 (17; 14 to 19)	220/823 (27; 22 to 31)†	270/1440 (19; 16 to 22)	288/1035 (28; 23 to 32)†	260/1626 (16; 13 to 19)	363/1247 (29; 26 to 33)†

Schools were identified as primary sampling units to adjust for the cluster design.

\*P<0.05 between intervention group(s) and the comparison group.

†P<0.05 between men and women within the group.

significantly in condom use at first or last intercourse (see table on bmj.com). A higher proportion of young men in the condom promotion with contraception group reported using a condom with a sex worker or casual partner (85%; 81/95) than in the control group (70%; 39/56). A higher proportion of young women in the condom promotion with contraception group (35%; 89/256) than in the control group (21%; 33/158) reported using emergency contraception. A higher proportion of these women also reported a partner five or more years older than themselves (31% (77/245) *v* 23% (35/149)). Slippage and breakage of condoms was common in all groups.

The proportion of students who reported intercourse with a risky partner (either compensated sex, sex with a sex worker, or sex with a stranger) did not differ significantly; however, young women in the condom promotion group (30%; 75/247) and condom promotion with contraception group (31%; 77/245) reported a sexual partner five or more years older more often than young women in the control group (23%; 35/149), although the difference was significant only in the condom promotion with contraception group.

We estimated the impact of each intervention on selected outcome variables by using multivariate logistic regression and a fixed effects model to correct for cluster design (table 2). Knowledge of emergency contraception increased in the group that was taught about it, and young women in this group reported using this form of contraception. Both interventions had a significant impact on knowledge of HIV but not on sexual behaviour (except for use of emergency contraception). Education about emergency contraception had no significant effect on the use of condoms. Use of condoms decreased with age and time, although this result was affected by the dropout rate. Young men were significantly less positive about the use of condoms than women, but they were significantly more likely to report that they used a condom when they last had sex. A significantly lower proportion of sexually active adolescents reported the intent to use

condoms than young people who were not sexually active.

## Discussion

We directly evaluated and compared the impact on adolescents of comprehensive education on HIV prevention, including condom promotion, with the same comprehensive education with emergency contraception back-up. Neither strategy affected the use of condoms (positively or negatively) at one year follow-up. Our study adds to the growing body of evidence that current HIV prevention efforts based in school do not alter risky behaviour, and suggests that current interventions educate effectively but do not change sexual behaviour.

### Limitations and strengths of the study

One weakness of our study is the absence of biological outcomes that were measured before and after intervention, which are useful markers of risky sexual behaviour and can help validate self reported behavioural data. Self reported data on behaviour are subject to reporting bias and overestimate the effectiveness of interventions. Given that most well designed studies that have measured reported sexual behaviour have not shown improvements, positive results are unlikely to be seen with the use of biological markers.

Several other limitations deserve mention. Firstly, although teachers were trained and closely monitored, our observation of classes was limited. Despite the intensive training, teachers rarely change their preconceptions about adolescent sexuality. In Mexico, young women are not meant to have sex before marriage, whereas boys are encouraged to do so. Secondly, we have no measure of student attendance at the course, although it was part of the required curriculum. Thirdly, although the course was intensive and longer than the recommended 14 hours (it was 30 hours), it was not followed up or reinforced the next year. Fourthly, the central message of the course was self determination of decision making, with responsible

**Table 2** Multivariate logistic regression to estimate impact of school based HIV prevention programme in Mexico on selected outcome variables; intention to treat analysis, fixed effects model to correct for cluster design. Values are odds ratios (confidence intervals) except for knowledge of HIV

Outcome variable	Knowledge of HIV† (n=16 708)	Knowledgeable about emergency contraception (n=16 129)	Would use condom (8226)	Would stop sex to put on a condom (n=12 220)	Used condom at first intercourse (n=3024)	Used condom at last intercourse (n=2985)	Had used emergency contraception (n=2871)
Condom promotion=1	1.17 (0.87 to 1.45)*	1.06 (0.90 to 1.26)	1.09 (0.85 to 1.38)	1.35 (1.03 to 1.79)*	1.18 (0.80 to 1.74)*	1.14 (0.77 to 1.68)*	1.22 (0.74 to 2.02)*
Condom promotion with emergency contraception=1	1.18 (0.89 to 1.48)*	2.82 (2.36 to 3.37)*	0.97 (0.77 to 1.24)	1.16 (0.89 to 1.52)	1.11 (0.76 to 1.64)	1.05 (0.71 to 1.54)	2.16 (1.30 to 3.59)*
Follow-up=1	1.50 (1.27 to 1.73)*	2.52 (2.21 to 2.87)*	1.72 (1.43 to 2.07)*	1.33 (1.08 to 1.63)*	1.02 (0.75 to 1.38)	0.71 (0.52 to 0.96)*	0.95 (0.63 to 1.42)
Male=1	-0.10 (-0.22 to 0.01)	0.98 (0.91 to 1.04)	0.53 (0.48 to 0.58)*	0.43 (0.39 to 0.48)*	0.83 (0.71 to 0.97)*	1.43 (1.22 to 1.67)*	0.72 (0.60 to 0.88)*
Age at baseline	-0.06 (-0.13 to 0.01)	1.01 (0.97 to 1.06)	0.93 (0.88 to 0.98)*	1.04 (0.98 to 1.10)	0.95 (0.88 to 1.03)	0.90 (0.84 to 0.97)*	0.94 (0.85 to 1.05)
Ever sexually active=1	0.52 (0.37 to 0.67)*	1.45 (1.33 to 1.59)*	0.66 (0.59 to 0.74)*	0.75 (0.67 to 0.85)*	NA	NA	NA
Probability‡	<0.001	<0.001	<0.001	<0.001	0.0243	<0.001	<0.001

NA=not applicable because these models only include sexually active participants.

†Treated as a continuous variable (0-36) so regression is not logistic; significance is measured as a value different from 0.

\*P<0.05.

‡Measured by using  $\chi^2$  or the F test (knowledge about HIV only). Significance of each regression as a whole.

action. Some experts believe this message is too vague. Fifthly, although the questionnaires were anonymous, confidential, and completed in the presence of adults, privacy may not have been optimal. Sixthly, only a small proportion of students were newly sexually active during the course, and these students cannot be identified, although they are the most likely to benefit from the course during the period of observation. In addition, although condoms and emergency contraception are available without prescription at any pharmacy, access to both forms of contraception is probably limited for young Mexicans for cultural, psychological, and economic reasons, and this could have affected our results. Finally, since data collection was school based, the follow-up survey did not include students who received the intervention in 10th grade and dropped out of school before the questionnaire was administered in 11th grade.

Lack of follow-up of dropouts caused some loss of power, but it probably did not bias the results. However, the dropout rate does affect our capacity to estimate trends, as our follow-up sample is a subset of the baseline sample. Dropout rates did not differ between the three arms of our study (see [bmj.com](http://bmj.com)).

**Implications**

Combining the condom and emergency contraception messages did not increase risky sexual behaviour, which refutes the notion that providing information and access to emergency contraception will increase frequency of sexual activity, number of partners, or sex without a condom.

Immediately after the intervention, condom use at last sex was significantly increased in the condom promotion with contraception group only, but this effect was lost at one year follow-up, so longer term effects need evaluation.

Innovative approaches designed to decrease adolescent risk behaviour are urgently needed—for example, integrating school based efforts with community based strategies, and including components that directly consider social norms, both within the school and within the broader community.

Evaluations need to incorporate biological outcomes, abstinence pledges might focus more on safety than abstinence alone and large scale programmes currently being rolled out must be phased in as cluster randomised trials to permit rigorous evaluation.

**Conclusion**

New strategies are urgently needed to combat HIV and other sexually transmitted diseases and unplanned pregnancy among adolescents. Great care should be taken in using data related to school based education and prevention, especially when evidence of benefit relies on changes in knowledge or self reported behavioural change, or both. Current cost effectiveness analyses assume that existing school education approaches are more effective than current data support. It is time to consider and evaluate new approaches to HIV prevention interventions based in schools.<sup>9</sup>

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**What is already known on this topic**

School based HIV prevention studies have had mixed results in terms of ability to influence risky sexual behaviour

Most of these studies have been in Western countries

The effect of a combined message to adolescents of promoting condom use with emergency contraception as back-up is not known

**What this study adds**

A 15 week course on HIV prevention based in public high schools in Mexico showed no effect on sexual behaviour

Adding a module on emergency contraception did not affect condom use but did increase reported use of emergency contraception

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*Endpiece*

**Computers and compassion**

Computers are magnificent tools for the realisation of our dreams, but no machine can replace the human spark of spirit, compassion, love, and understanding.

Louis Gerstner

Submitted by Rajesh K Choudhary, staff grade surgeon, Darlington