

BMJ Open Rate of condom use among sexually active adolescents: a nationwide cross-sectional study in Taiwan from 2012 to 2016

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ABSTRACT

Objective Adolescents' sexual behaviours are associated with sexually transmitted infections and unwanted pregnancies. This study aimed to estimate the sexual intercourse and condom use rates at first and last sex among Taiwanese adolescents in grades 7–12.

Design A secondary data analysis of the Taiwan Global School-Based Student Health Survey's 2012–2016 data. The survey was anonymous, cross-sectional and nationwide.

Setting Taiwan high school students (grades 7–12).

Participants The sample comprised 27 525 students from junior high schools (grades 7–9), and senior high schools, comprehensive schools, vocational high schools and night schools (grades 10–12).

Main outcome measures The rate of ever having had sexual intercourse; the rates and factors of condom use at first and last sex.

Results The sexual intercourse rate in each school type (in ascending order) was junior high school (1.62%), senior high school (4.14%), comprehensive school (9.08%), vocational high school (14.03%) and night school (41.09%). Condom use rate decreased from 57.07% (95% CI=54.31% to 59.83%) at first sex to 25.72% (95% CI=23.34% to 28.10%) at last sex ($p<0.0001$). The condom use rate (in ascending order) was junior high school (first sex: 37.67%, last sex: 19.76%), night school (55.83%, 22.62%), vocational high school (61.13%, 25.78%), comprehensive school (62.83%, 28.61%) and senior high school (68.38%, 34.96%). Older age at sexual debut was associated with condom use at first and last sex, and having one sexual partner was associated with condom use at last sex, as revealed by logistic regression analysis.

Conclusions This study highlights an urgent need to instil a proper understanding of protected sex while adolescents are still in their formative years. Despite the low sexual intercourse rate (4.95%), there is lower condom use at last sex than at first sex, which indicates that many sexually active adolescents are not practising protected sex, especially among junior high school students.

INTRODUCTION

Adolescent sexual behaviour is an important public health issue because of its association with the risk of contracting sexually transmitted

Strengths and limitations of this study

- The Taiwan Global School-Based Student Health Survey (GSHS) was cross-sectional and based on a large nationally representative sample.
- The survey was anonymous and therefore encouraged honest responses to sensitive questions (such as sexual behaviours) from participants.
- Cross-country comparisons of the rates of sexual intercourse and condom use among adolescents based on GSHS data should be cautious because of the following reasons:
 - 'Sexual intercourse' was not defined explicitly; therefore, its exact meaning is open to interpretation by the participants and varies across cultures.
 - Inadequate details about sexual behaviours and condom use, such as knowledge, attitude and frequency of the behaviours.

infections (STIs), unintended pregnancies, abortions, non-consensual encounters, co-use of illicit or dangerous substances, and subsequent psychological stress.¹ Examples of high risk sexual behaviours include unprotected sexual intercourse, having sexual intercourse with multiple partners and men who have sex with men.^{1 2} In Taiwan, the number of newly reported cases of human immunodeficiency virus / acquired immunodeficiency syndrome (HIV/AIDS) increased from 2012 to 2016,³ and about 29% of all new cases of HIV infection occurred in adolescents and young adults (aged 15–24 years) in 2016.⁴ The estimated incidence rate of HIV among adolescents aged 13–24 years was about 20 per 100 000 population during this period.⁵ Condoms are the most effective method to protect against STIs. Condom use at last high-risk sex is one of the indicators of the Millennium Development Goals' monitoring that was established by the United Nations International Children's Emergency Fund to tackle STIs.⁶ In Taiwan, the sexual intercourse

rates among adolescents aged 13–15 years increased from 2.2% (male) and 1.8% (female) in 2006 to 5.4% (male) and 5.3% (female) in 2016.⁷ Furthermore, the contraception use rate among these adolescents increased from 56.2% (male) and 58.1% (female) in 2006 to 74.8% (male) and 77.7% (female) in 2016.⁷ However, the predominant form of contraception was not reported. More importantly, whether sexually active adolescents in Taiwan actually practise protected sex (ie, use condoms) remains unclear.

It has long been speculated that adolescent sexual behaviours are associated with school type and education programmes.⁸ In Taiwan, public education has been compulsory from primary school to junior high school since 1968. Since 2014, a full 12-year compulsory education programme has been implemented. Junior high school students in grade 9 take a high school entrance examination to continue their education, which is designed as a screening tool to assign students to various school programmes for grades 10–12. Students who aspire to receive higher education mostly attend regular senior high schools. Other educational opportunities include vocational high schools and comprehensive schools, which are workplace oriented and emphasise vocational skills. Night school curricula vary, ranging from vocational to academic courses. Therefore, in this study, we aimed to identify the sexual intercourse and condom use rates at first and last sex among Taiwanese adolescents across school types by using nationally representative data of grade 7–12 students. To our knowledge, this study is the first to examine the rate at which sexually active adolescents in Taiwan practise protected sex by using the data from a large nationally representative sample.

METHODS

We performed a secondary analysis of the 2012–2016 data of the Taiwan Global School-Based Student Health Survey (GSHS). The Taiwan GSHS is a nationwide cross-sectional study that surveys the health behaviours of grade 7–9 (aged 12–15 years) and grade 10–12 (aged 15–18 years) students every other year.⁹

The survey was conducted by the Health Promotion Administration (HPA), Ministry of Health and Welfare of Taiwan, in collaboration with the United States Centers for Disease Control and Prevention.⁹ The Taiwan GSHS was translated into Chinese from the English version. The HPA first categorised schools into four geographical levels (ie, big city, small city, urban town and rural town) according to the population density of their locations. Next, the HPA used a two-step ‘probability proportional to size’ method at each geographical level for sampling, where the sample schools were drawn before the sample classes.⁹ They invited all students from the sample classes to participate. The survey was anonymous and no identifying information was collected. Additional details of the Taiwan GSHS’s methodology are reported elsewhere.⁹

From 2012 to 2016, there were 29 040 participants, and the response rates were 93.3% in 2012, 89.6% in 2013, 93.7% in 2014, 90.2% in 2015 and 92.6% in 2016.¹⁰ Junior high school students were surveyed in 2012, 2014 and 2016, and grade 10–12 students (including senior high school, comprehensive, vocational high school and night school students) were surveyed in 2013 and 2015. As illustrated in figure 1, this study included a total of 27 525 students, after excluding those who did not indicate their gender (n=62) and those who gave contradictory answers to the eight survey questions (online supplemental table S1, online supplemental material) about sexual behaviours (n=1453).

We selected three sections of questions from the GSHS (online supplemental table S2): demographics, substance use and sexual behaviours. The demographic variables included gender, age, degree of urbanisation, school type and grade. Regarding substance use, we looked into whether the participants were current smokers (defined as smoking cigarettes on at least 1 day during the past 30 days)¹¹ and current heavy alcohol users (defined as consuming ≥ 5 drinks of alcoholic beverages per day in the past 30 days).¹² The variables regarding sexual behaviours were ever having had sexual intercourse, number of sexual partners, condom use, and non-condom use at first sex and last sex. The outcome variables were ever having had sexual intercourse and condom use at first and last sex. However, since questionnaires of Taiwan GSHS did not explicitly define ‘sexual intercourse’, its exact meaning was open to interpretation by the subjects.

We used the X^2 test to examine the association between the students’ gender and the outcome variables (sexual intercourse and condom use at first and last sex) in each school type. We conducted McNemar’s test to investigate the consistency of condom use at first and last sex for students who had one sexual partner and those who had more than one sexual partner. In univariate analysis, we used X^2 test to examine the association between demographics, risk/protective factors and outcome variables (condom use at first and last sex). Regarding multivariate analysis, we used logistic regression with forward selection to locate important factors for condom use at first and last sex. The adjusted odds ratio (AOR) with 95% CI shows the direction and magnitude of the association between demographics, risk/protective factors and outcome variables (condom use at first and last sex). We conducted all analyses using SAS V.9.4 (SAS Institute). The significance level was 0.05.

Patient and public involvement

No patients were involved.

RESULTS

Sexual intercourse rate by gender, school type and grade

Overall, the sexual intercourse rate was 4.95% (figure 1). The ascending order of sexual intercourse rate by school type was junior high school (1.62%), senior high school

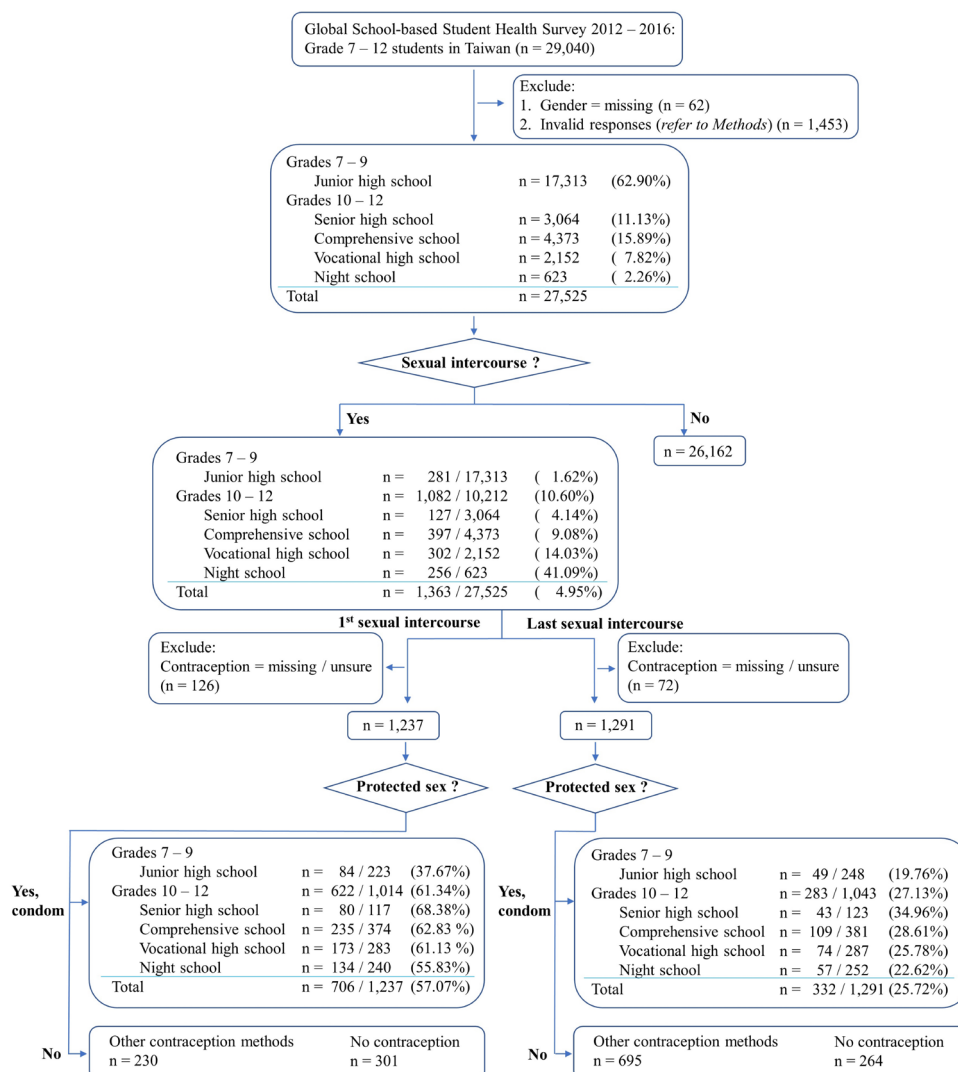


Figure 1 Flow chart of analysis illustrating the overall rates of ever having had sexual intercourse and condom use among adolescents in Taiwan from 2012 to 2016.

(4.14%), comprehensive school (9.08%), vocational high school (14.03%) and night school (41.09%).

In general, male students reported higher rates of sexual intercourse (5.33%) than female students (4.53%) (table 1). However, there was significant interaction between gender and school type ($p=0.0279$), which indicated that the apparent difference in rate of sexual intercourse between both genders depended on different school types or vice versa. Therefore, the main effect of gender or that of school type on sexual intercourse was meaningless. When stratified by school type, male students in senior high school had a significantly higher rate of sexual intercourse (4.92%) than female students (3.4%) ($p=0.0352$). There was a borderline difference in sexual intercourse rate among students at vocational high school between both genders ($p=0.0613$). However, when the sexual intercourse rates were further stratified by grade and school type, the rates of sexual intercourse between both genders did not differ significantly (figure 2).

Condom use at first and last sexual intercourse

The overall condom use rate decreased from 57.07% at first sex to 25.72% at last sex (figure 1). The condom use rates were not statistically different between male and female adolescents at both first and last sex, with $p=0.3164$ and $p=0.9545$, respectively (table 1). In terms of school type, the ascending order of the condom use rate was junior high school (first sex: 37.67%, last sex: 19.76%), night school (55.83%, 22.62%), vocational high school (61.13%, 25.78%), comprehensive school (62.83%, 28.61%) and senior high school (68.38%, 34.96%) (figure 1). Moreover, across all school types, condom use rates did not differ significantly between male and female students (table 1).

Univariate analysis showed that school type, age at first sexual intercourse, number of sexual partner(s), and being current smoker (in the past 30 days) were all significantly associated with condom use at first and last sex. We also noted that alcohol consumption was significantly associated with condom use at first sex ($p=0.0037$) but not

Table 1 Rates of ever having had sexual intercourse, condom use at first and last sex among adolescents in Taiwan from 2012 to 2016, by gender

	Male (%)	Female (%)	P value
Sexual intercourse	775/14531 (5.33)	588/12994 (4.53)	*
Grades 7–9			
Junior high school	156/9027 (1.73)	125/8286 (1.51)	0.2534
Grades 10–12			
Senior high school	74/1505 (4.92)	53/1559 (3.4)	0.0352†
Comprehensive school	240/2518 (9.53)	157/1855 (8.46)	0.2245
Vocational high school	132/1048 (12.6)	170/1104 (15.4)	0.0613
Night school	173/433 (39.95)	83/190 (43.68)	0.3836
Condom use at first sexual intercourse			
Total	384/688 (55.81)	322/549 (58.65)	0.3164
Grades 7–9			
Junior high school	41/118 (34.75)	43/105 (40.95)	0.3397
Grades 10–12	343/570 (60.18)	279/444 (62.84)	0.3877
Senior high school	40/65 (61.54)	40/52 (76.92)	0.0754
Comprehensive school	142/224 (63.39)	93/150 (62.00)	0.7847
Vocational high school	72/121 (59.50)	101/162 (62.35)	0.6276
Night school	89/160 (55.63)	45/80 (56.25)	0.9268
Condom use at last sexual intercourse			
Total	186/725 (25.66)	146/566 (25.80)	0.9545
Grades 7–9			
Junior high school	26/133 (19.55)	23/115 (20.00)	0.9291
Grades 10–12	160/592 (27.03)	123/451 (27.27)	0.9296
Senior high school	27/70 (38.57)	16/53 (30.19)	0.3343
Comprehensive school	67/227 (29.52)	42/154 (27.27)	0.6345
Vocational high school	27/125 (21.60)	47/162 (29.01)	0.1546
Night school	39/170 (22.94)	18/82 (21.95)	0.8603

P values were obtained from χ^2 test.

*The interaction between gender and school type is statistically significant ($p=0.0279$) when tested with logistic regression (model: sexual intercourse= $\beta_0+\beta_1$ school type+ β_2 gender+ β_3 school type \times gender).

† $P<0.05$.

at last sex ($p=0.4314$). Regarding number of sexual partner(s), the condom use rate at first and last sex among those with one sexual partner was statistically significantly higher than that of those with multiple sexual partners. At first sex, the condom use rates among those with one sexual partner and multiple sexual partners were 61.72% and 53.71% ($p=0.0048$), respectively. At last sex, the condom use rate among those with one sexual partner (31.17%=202 of 648) was higher than that of those with multiple sexual partners (20.34%=130 of 639) ($p<0.0001$) (table 2).

In multivariate analysis of condom use at first sex, the following respondents were more likely to use condom at first sexual intercourse: those who first had sex at age 12–13 (AOR 4.74, 95% CI=2.02 to 11.1), age 14–15 (AOR 10.6, 95% CI=4.72 to 23.8) and age 16 years or above (AOR 18.3, 95% CI=8.20 to 40.9) when compared with those who had sex at age 11 years or younger (table 2).

Regarding condom use at last sex, the multivariate analysis indicated that adolescents who had one sexual partner (AOR 1.60, 95% CI=1.23 to 2.07) when compared with those who had more than one, and those who first had sex at age 16 years or above (AOR 2.00, 95% CI=1.05 to 3.83) when compared with those who had sex at age 11 years or younger were more likely to use condom at last sex (table 2).

When investigating the decrease in the condom use rate, we observed that about two-thirds of adolescents who used condoms at first sex ($n=702$) switched to using a non-condom contraceptive method (410 of 702, 58.4%) or having no contraception (28 of 702, 4.0%) at last sex. In contrast, those who did not use any contraception ($n=293$) at first sex remained not using any contraception (178 of 293, 60.8%) at last sex, and those who used non-condom contraception ($n=212$) at first sex mostly did not change their method of birth control (150 of 212, 70.7%)

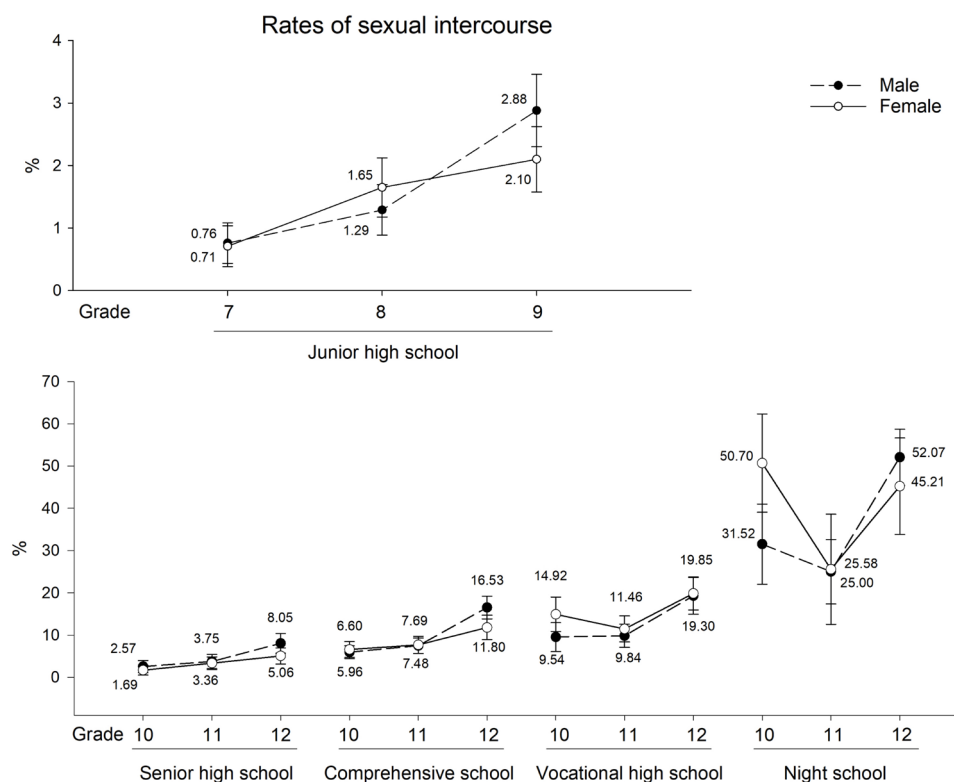


Figure 2 The rate of ever having had sexual intercourse of Taiwan adolescents from 2012 to 2016, by gender, school type and grade.

at last sex. Moreover, students with one sexual partner were more likely to use condoms both at first and last sex (27.7%=168 of 606) than those with multiple sexual partners (16.0%=96 of 598) ($p<0.0001$) (table 3).

DISCUSSION

Sexual intercourse

This nationwide cross-sectional study revealed that the overall rate of ever having had sexual intercourse among adolescents (grades 7–12) in Taiwan was 4.95% (5.33% of males and 4.53% of females) during 2012–2016. Our rates are similar to several studies in other Asian countries and regions, such as South Korea (grades 7–12: 3.9% overall, opposite-sex intercourse; 5.5% of males, 2.2% of females),¹³ Hong Kong (grades 7–12: 5.2% overall, 5.6% of males, 4.7% of females),¹⁴ and other Southeast Asian countries.¹⁵ On the other hand, our rates are considerably lower than those of developed Western countries.^{16 17} For instance, in the USA, the sexual intercourse rate among grade 9–12 students is 41.2% (43.2% of males and 39.2% of females).¹⁷ Our rates are also lower than that of Australia, where it is geographically close to Southeast Asian countries but culturally similar to that of Great Britain and the USA. In Australia, the rates of anal or vaginal sex were 43.7% (male) and 48.5% (female) among year 10–12 heterosexual students.¹⁸ It is possible that Confucian culture plays an important role in adolescent sexual behaviours in Asian countries,¹⁹ and this

could potentially explain the discrepancy between our results and those obtained from Western countries.

More importantly, we observed that the rates of sexual intercourse varied greatly with different school types in Taiwan. Our analysis found that the sexual intercourse rate was lowest among junior high school students and that it generally increased with the grade. This was reasonable because more adolescents engaged in intimate sexual behaviours as they matured. Among the grade 10–12 students, night schools had the highest sexual intercourse rate (41.09%), followed by vocational high school (14.03%), comprehensive school (9.08%) and senior high schools (4.14%). We speculated that the highest rate of sexual intercourse among night school students (41.09%) was probably because some of them were married. As previously hypothesised,⁸ the students' educational and career aspirations and the school type may be associated with their sexual behaviours. Our findings highlight that academically oriented schools (eg, senior high schools) tend to have lower sexual intercourse rates than those that place a heavier emphasis on vocational skill training (eg, comprehensive and vocational high schools).

After stratifying by school type and grade, the difference in rates of sexual intercourse between both genders was statistically non-significant, although male students seemed to have a higher overall rate (5.33%) than female students (4.53%). This finding is inconsistent with previous reports, where male adolescents generally

Table 2 Univariate and multivariate analysis of condom use at first and last sexual intercourse among adolescents in Taiwan, 2012–2016

	Univariate			Multivariate		
	Condom (1st sex)	Condom (last sex)		Condom (1st sex)	Condom (last sex)	
	Yes (%)	Yes (%)	P value	AOR (95% CI)	AOR (95% CI)	P value
Total	706/1237 (57.07)	332/1291 (25.72)	—	—	—	—
Gender						
Male	384/688 (55.81)	186/725 (25.66)	0.3164	—	—	—
Female	322/549 (58.65)	146/566 (25.8)				
School type						
Junior	84/223 (37.67)	49/248 (19.76)	<0.0001	NS	NS	—
Senior	80/117 (68.38)	43/123 (34.96)				
Vocational	173/283 (61.13)	74/287 (25.78)				
Comprehensive	235/374 (62.83)	109/381 (28.61)				
Night	134/240 (55.83)	57/252 (22.62)				
Sexual behaviours						
Age at 1st sex			<0.0001	<0.0001	Reference	<0.0001
≤11 years old	7/64 (10.94)	12/73 (16.44)			Reference	0.0019
12–13	53/144 (36.81)	23/160 (14.38)			4.74 (2.02 to 11.1)	0.0004
14–15	233/412 (56.55)	106/436 (24.31)			10.6 (4.72 to 23.8)	<0.0001
≥16	405/585 (69.23)	190/610 (31.15)			18.3 (8.20 to 40.9)	<0.0001
No of sexual partner			0.0048	<0.0001	NS	—
1	374/606 (61.72)	202/648 (31.17)			1.60 (1.23 to 2.07)	0.0005
>1	326/607 (53.71)	130/639 (20.34)			Reference	
Substance use						
Current smoker			0.0013	0.0009	NS	—
No	412/671 (61.4)	207/701 (29.53)				
Yes	289/553 (52.26)	123/576 (21.35)				
Heavy alcohol use			0.0037	0.4314	NS	—
No	587/995 (58.99)	271/1038 (26.11)				
Yes (≥5 drinks/day)	112/231 (48.48)	57/241 (23.65)				

Subjects who did not respond to the questions (ie, missing data) were not included in this table.

At first sex, the number of missing data in the following questions: age at first sex—32, no of sexual partner—24, current smoker—13, heavy alcohol use—11.

At last sex, the number of missing data in the following questions: age at first sex—12, no of sexual partner—4, current smoker—14, heavy alcohol use—12.

P values of univariate analysis were obtained by χ^2 test, while those of multivariate analysis were calculated by logistic regression with forward selection.

AOR, adjusted OR; NS, non-significant.

Table 3 Inconsistent use of condom at first and last sexual intercourse among adolescents in Taiwan from 2012 to 2016, by number of sexual partner

First sexual intercourse	Total	Last sexual intercourse			P value
		No contraception	Condom	Other methods	
Overall					
Total	1207	241	316	650	<0.0001
No contraception	293	178	25	90	
Condom	702	28	264	410	
Other methods	212	35	27	150	
No of sexual partners >1					
Total	598	131	124	343	<0.0001
No contraception	158	93	15	50	
Condom	326	18	96	212	
Other methods	114	20	13	81	
One sexual partner					
Total	606	109	192	305	<0.0001
No contraception	134	85	10	39	
Condom	374	9	168	197	
Other methods	98	15	14	69	

P values were obtained from McNemar's test.

The overall total (1207) does not equal to the total (598+606=1204) at the lower half of the table because subjects who did not respond to the questions about (1) the number of sexual partners, (2) the method of contraception use at first and last sexual intercourse were not included in McNemar's test.

had a higher sexual intercourse rate than female adolescents.¹⁹ In Confucian societies, where chastity is emphasised heavily, unmarried women engaging in sexual intercourse are highly stigmatised.¹⁹ Meanwhile, countries (eg, Taiwan) which were traditionally influenced by Confucianism are becoming westernised, possibly leading to increasing acceptance of premarital sexual behaviours among female adolescents.²⁰ Taken together, this might potentially explain our finding that male and female adolescents did not differ significantly in rates of sexual intercourse after stratifying by school type and grade. Nevertheless, the degree to which Western culture involved in shaping Taiwan adolescents' sexual behaviours deserves further investigation.

Condom use and implications

Despite the low sexual intercourse rate, we found that the practice of protected sex (as indicated by the condom use rate) was not common among adolescents in Taiwan when compared with data obtained from Western^{21–23} and Southeast Asian countries.¹⁵ In this study, only a quarter of sexually experienced respondents had used a condom at last sex (male: 25.66%, female: 25.80%), which was approximately half of those who used condoms at first sex (male: 55.81%, female: 60.47%). In contrast, in Western countries such as the USA, the condom use rates at first sex among adolescents (age 15–17 years) are as high as 77% (male) and 74.6% (female)²² and the rates at last sex (age 13–19 years) are 61% (male) and 47% (female).²¹ In a study of nationwide surveys conducted in 33 countries from 2013 to 2014, developed Western countries, such as Great Britain, Denmark, Finland, France, Spain and

Switzerland, were found to typically have a condom use rate of over 40% at last sex among adolescents aged 14–16 years.²³ Moreover, countries participating in the GSHS in the Southeast Asian and Western Pacific regions generally have a higher condom use rate (at last sex) than the rate (25.72%) we obtained.¹⁵ For instance, the condom non-use rates at last sex among GSHS participants aged 12–15 years in Nepal, Bangladesh, Thailand, Cambodia, Laos and Malaysia were estimated to be 52.6% (2015), 58.7% (2014), 33.8% (2015), 56.2% (2013), 46.7% (2015) and 66.8% (2012), respectively.¹⁵ In Australia, despite being culturally Western but geographically proximal to Southeast Asia, the rates of condom use were considerably higher than our rates (In Australia, the condom use rates were 78.1% (male) and 77.5% (female) at first sex, and 65.1% (male) and 56.8% (female) at last sex).¹⁸ In summary, the above comparisons show that Taiwanese adolescents' condom use (both at first and last sex) is not as prevalent as in Western developed countries and other countries participating in the GSHS.

Sex education is critical to the practice of protected sex among adolescents. Although the use of contraception is covered in Taiwan sex education, the importance of safe sex and correct use of condom are not emphasised, and abstinence-only sex education remains the mainstream of sex education in Taiwan.^{24 25} In fact, condom vending machines and free condom programmes are not available in high schools in Taiwan. This is probably because providing condom vending machines for students might be mistakenly seen as encouraging students to have sex. These reasons might have contributed to the relative low rate of condom

use among adolescents in Taiwan when compared with the rates in Western and GSHS-participating countries.

In addition to cross-country comparisons, we investigated how school type and the students' gender were associated with the condom use rate. Across school types, the condom use rate at first and last sex varied considerably. Notably, night schools had the highest sexual intercourse rate and the second lowest condom use rate at both first and last sex. Moreover, despite having the lowest sexual intercourse rate, sexually experienced junior high school students were the least likely to use condoms at first and last sex. Our multivariate analysis also revealed that adolescents who initiated sex at a younger age tended not to use condom. In fact, we found that age at first intercourse had the strongest association with condom use at first and last sex. This highlights the urgent need to instil a proper understanding of protected sex while adolescents are still in their formative years, especially in junior high schools.

Our study also showed that the students' gender did not seem to influence the condom use rate at first and last sex. It has long been assumed that gender equality plays an important role in condom use.²³ Our study suggests that across all school types and grades, male and female adolescents in Taiwan are of equal standing in terms of condom use decisions, in contrast to studies conducted elsewhere.²⁶

Apart from gender, substance use (ie, being current smoker and heavy alcohol use) was not found to be associated with condom use at first and last sex in our multivariate analysis (table 2). This contrasts with previous studies, which reported adolescents who engaged in risky sexual behaviours were more likely to use substances.²⁷ There are many factors that are associated with both adolescent sexual behaviours and substance use, including mental disorders (especially attention-deficit/hyperactivity disorder), trauma, sexual abuse, etc.^{2 27–29} Therefore, whether the association between condom use and substance use exists among adolescents across different cultures and countries deserves further research.

The decrease in the condom use rate and increase in the non-condom contraception rate at last sex were possibly due to the adolescents being more concerned about potential pregnancy than the contraction of STIs, as speculated in previous studies.³⁰ Our data support this hypothesis; most participants in our study who used condoms at first sex (58.16%) changed to using non-condom contraceptive methods at last sex (33.97%) (table 3). Our results also suggest that adolescents with one sexual partner were more likely to use condoms at last sex than those with multiple sexual partners (tables 2 and 3). This might be because those who stayed with a single sexual partner were more likely to understand the importance of protected sex and the risk associated with having multiple sexual partners than those who did not. Nevertheless, adolescents with multiple sexual partners who did not use condoms could potentially pose a huge public health risk in Taiwan, since having multiple sexual partners and sexual intercourse without using condoms are associated with the susceptibility to STIs.³¹

Strengths and limitations

A strength of this study is that our analysis was based on a large nationally representative sample. Moreover, no identifying information was collected in the survey to encourage honest response. The GSHS used in this study allows multinational comparisons between the sexual intercourse and condom use rates of Taiwan students and those of others. However, there are several limitations to our study.

First, sex is a sensitive issue in Taiwan; therefore, sexual behaviour data collected by the GSHS might be under-reported and susceptible to recall bias. Second, since sexual intercourse was not defined explicitly, its exact meaning is open to interpretation by the participants. The GSHS did not ask about the gender of the participants' sexual partner(s). Thus, 'sexual intercourse' might be misinterpreted as other forms of sex ie, oral intercourse, or activities other than vaginal-penile penetration). Additionally, researchers using GSHS data regarding sexual intercourse from different countries should be very cautious because interpretation of sexual intercourse varies across cultures. Third, there was a large difference in the number of male and female participants in comprehensive and night schools. Since our data are a representative sample of grade 10–12 students, having more male students than female students in comprehensive and night schools implied a real male predominance in these school types. This male predominance can be partially explained by the fact that men tend to be the main source of family income in Taiwan. Moreover, having more male students than female students in comprehensive and night schools may introduce selection bias. However, we believe that the selection bias should be at minimum because most of our results (ie, the rates of sexual intercourse and condom use) were already stratified by school type. Fourth, the GSHS questionnaires did not contain sufficient details of knowledge, attitude and practice of condom use (and other sexual behaviours) among adolescents. Therefore, our comparison of the condom use rate at first and last sex is insufficient for drawing definite conclusions regarding condom use consistency. Additionally, respondents might use condoms and other contraceptive methods simultaneously, leading to biased responses. Fifth, the Taiwan GSHS did not have questions regarding the gender of the sexual partner(s) of the subjects. As a result, we were unable to analyse adolescent non-vaginal–penile sexual intercourse. To address these limitations, we recommend incorporating questions with a clear definition of sexual intercourse, questions about the frequency of condom use and gender of sexual partner(s) in future GSHS.

In conclusion, the finding of lower sexual intercourse and condom use rates at first and last sex than in many developed countries indicates that the practice of protected sex is not prevalent among Taiwanese adolescents. This is further supported by our findings that most adolescents who used condoms at first sex switched to non-condom contraception at last sex and that adolescents

who initiated sex at younger age and with multiple sexual partners were less likely to use condoms.

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ONLINE ONLY SUPPLEMENTARY MATERIAL

Contents

- **Table S1.** Taiwan GSHS Questions that were used to determine whether respondents had sexual intercourse and to evaluate the validity of responses
- **Table S2.** The variables in GSHS involved in data analyses
- **References**

Tables S1-S2: The questions in these tables were obtained from the Centers for Disease Control and Prevention of the United States.¹ However, the questions were written in Chinese when presented to the subjects.

Table S1. Taiwan GSHS Questions that were used to determine whether respondents had sexual intercourse and to evaluate the validity of responses:

Question	Option
1. Have you ever had sexual intercourse?	A. Yes B. No
2. How old were you when you had sexual intercourse for the first time?	A. I have never had sexual intercourse B. 11 years old or younger C. 12 years old D. 13 years old E. 14 years old F. 15 years old * G. 16 or 17 years old * H. 18 years old or older
3. During your life, with how many people have you had sexual intercourse?	A. I have never had sexual intercourse B. 1 person C. 2 people D. 3 people E. 4 people F. 5 people G. 6 or more people
4. The first time you had sexual intercourse, what method of birth control did you use to prevent pregnancy?	A. I have never had sexual intercourse B. No method was used to prevent pregnancy C. Birth control pills D. Condoms E. Depo-Provera (or any injectable birth control, Nuva Ring (or any birth control ring), Implanon (or any implant), or any IUD F. Withdrawal G. Some other method H. Not sure
5. The last time you had sexual intercourse, did you or your partner use a condom?	A. I have never had sexual intercourse B. Yes C. No
6. The last time you had sexual intercourse, did you or your partner use any other method of birth control, such as withdrawal, rhythm (safe time), birth control pills, or any other method to prevent pregnancy?	A. I have never had sexual intercourse B. Yes C. No D. I do not know
7. After having sexual intercourse, have you or your partner ever used emergency after-sex contraceptive pills to prevent pregnancy?	A. I have never had sexual intercourse B. Yes C. No D. I do not know

8. Have you or your sexual partner ever had an induced abortion?	A. I have never had sexual intercourse B. Yes C. No D. I do not know
No sexual intercourse:	Answered 'No' for Qn. 1 and 'I have never had sexual intercourse' for Qn. 2-8
Had sexual intercourse:	Answered 'Yes' for Qn. 1 and other than 'I have never had sexual intercourse' for Qn. 2-8
Invalid response:	Contradictory response such as answered 'Yes' for Qn. 1 and answered 'I have never had sexual intercourse' for any one of Qn. 2-8

** In 2012, option G became '16 years old or older' without option 'H. 18 years old or older'. However, starting from 2013, option G and H were '16 or 17 years old' and '18 years old or older' respectively. Therefore, in our analyses throughout this paper, we combined the data of option 'G. 16 or 17 years old' and 'H. 18 years old or older' into '16 years old or older'.*

Table S2. The variables in GSHS involved in data analyses

Variable	Question / Description	Option
Demographics	What is your sex?	A. Male B. Female
	How old are you?	A. 11 years old or younger B. 12 years old C. 13 years old D. 14 years old E. 15 years old *F. 16 years old *G. 17 years old *H. 18 years old or older
	Degree of urbanization **	Big city / Small city / Urban town / Rural town
	In what grade are you?	A. Grade 1 # B. Grade 2 # C. Grade 3 #
	School type **	Junior high school / Senior high school / Vocational high school / Comprehensive school / Night school
Knowledge about sexually transmitted diseases	Do you agree with the following statement: "Even if they had received the cervical cancer vaccine, women still need to have a Pap smear regularly"?	A. Yes B. No C. I do not know
Substance use	During the past 30 days, on how many days did you smoke cigarettes?	A. 0 days B. 1 or 2 days C. 3 to 5 days D. 6 to 9 days E. 10 to 19 days F. 20 to 29 days G. All 30 days
	During the past 30 days, on the days you drank alcohol, how many drinks did you usually drink per day?	A. I did not drink alcohol during the past 30 days B. Less than one drink C. 1 drink D. 2 drinks E. 3 drinks F. 4 drinks G. 5 or more drinks
Sexual behaviors	Have you ever had sexual intercourse?	A. Yes B. No

During your life, with how many people have you had sexual intercourse?	A. I have never had sexual intercourse B. 1 person C. 2 people D. 3 people E. 4 people F. 5 people G. 6 or more people
The first time you had sexual intercourse, what method of birth control did you use to prevent pregnancy	A. I have never had sexual intercourse B. No method was used to prevent pregnancy C. Birth control pills D. Condoms E. Depo-Provera (or any injectable birth control, Nuva Ring (or any birth control ring), Implanon (or any implant), or any IUD F. Withdrawal G. Some other method H. Not sure
The last time you had sexual intercourse, did you or your partner use a condom?	A. I have never had sexual intercourse B. Yes C. No
The last time you had sexual intercourse, did you or your partner use any other method of birth control, such as withdrawal, rhythm (safe time), birth control pills, or any other method to prevent pregnancy?	A. I have never had sexual intercourse B. Yes C. No D. I do not know

** In 2012, option F was 16 years old or older. However, from 2013 to 2016, option F was changed to 16 years old and option G (17 years old) and option H (18 years old or older) were added.*

*** The data for 'Degree of urbanization' and 'School type' were entered by those who collected the data, they were not answered by students.*

Grade 1, 2 and 3 mean Grade 7, 8 and 9 when GSHS was conducted in 2012, 2014 and 2016. Grade 1, 2 and 3 mean Grade 10, 11 and 12 when GSHS was conducted in 2013 and 2015.

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1. Taiwan - Global School-based Student Health Survey (GSHS) 2016 [Available from: <https://www.cdc.gov/gshs/countries/westpacific/taiwan.htm> accessed 2 Nov 2020.