

# Identifying gaps in dual protection from sexually transmissible infections and unintended pregnancies among Australian women: an observational study

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## ABSTRACT

**Background.** Dual protection refers to the simultaneous prevention of sexually transmissible infection (STI) and unintended pregnancies. Optimal contraception and STI prevention strategies sometimes fail to align. **Methods.** Using data from a large nationally representative population-based survey, we analysed the contraception and STI prevention behaviours at the last vaginal intercourse among 2420 heterosexually active women aged 16–34 years who had participated in the Second Australian Study of Health and Relationships, 2012–13. **Results.** At their last vaginal intercourse, most women (95%) used contraception and half (49%) used condoms, either as a sole multipurpose method or in conjunction with another type of contraception. Condom use was highest (72%) among women whose most recent partner was a casual or occasional partner, followed by women with a regular partner (59%) and women with a cohabiting regular partner (40%). One-third of the women (34%) used condoms as a sole method, and 14% used oral contraceptives together with a condom. Few women used implants or intrauterine devices (8%) and, among them, very few women also used condoms (<1%). Among the women who used a condom at their last vaginal intercourse, 49% reported both the correct use for STI prevention and consistent condom use during the previous 6 months. Among women using condoms, correct and consistent use was also highest among women whose most recent partner was a casual or occasional partner (76%). **Conclusions.** Although almost all women used contraception and half used dual protection, few benefited from the protective effects of using condoms together with highly effective contraception.

**Keywords:** Australia, condoms, contraceptive use, health surveys, long-acting reversible contraception, safe sex, sexually transmissible infections, women.

## Introduction

Women experience both the disproportionate burden of sexually transmissible infection (STI) sequelae on their reproductive health and the overlapping burden of unintended pregnancies. Dual protection refers to the simultaneous prevention of STIs and unintended pregnancies, accomplished by correct and consistent condom use or the simultaneous use of condoms and another contraceptive method.<sup>1,2</sup> The World Health Organization recommends the regular monitoring of dual protection to evaluate the effectiveness of family planning and STI control programs.<sup>3</sup>

In many high-income countries, syphilis and gonorrhoea have resurged among women over the last decade.<sup>4,5</sup> In Australia, chlamydia remains the most diagnosed STI and, in recent years, cases among women aged 15–40 years have been relatively stable (1151.8 per 100 000 women in 2017). In contrast, between 2010 and 2017, in the same age group, gonorrhoea notifications increased 2.5-fold from 148.0 to 374.0 per 100 000 women and infectious syphilis notifications rose 5.7-fold from 1.1 to 5.5 per 100 000 women.<sup>5</sup> The reasons for this are complex and relate to changes in sexual norms and repertoires,

as well as travel overseas.<sup>6</sup> Multipurpose technologies address two or more sexual and reproductive needs.<sup>2,7</sup> However, biomedical products such as gel formulations and intravaginal rings remain in development, thus precluding widescale implementation.<sup>2,7</sup> These epidemiological shifts underscore the importance of raising awareness about STI prevention for women, particularly when initiating contraception. At present, condoms remain the only widely available contraceptive method offering protection from STI transmission.<sup>2</sup>

One-quarter of all Australian reproductive-aged women report having experienced an unintended pregnancy in the last 10 years.<sup>8</sup> Oral contraceptives and condoms are the most common contraceptive methods; the use of contraceptive implants and hormonal and copper-bearing intrauterine devices (IUDs) is low but increasing gradually.<sup>9,10</sup> Contraceptive implants and IUDs are highly effective.<sup>11–13</sup> Nevertheless, some researchers are concerned that the high contraceptive efficacy of modern methods contributes to lower condom use through behavioural risk compensation. Studies from a range of settings cross-sectionally link long-acting reversible contraceptives (LARCs) with lower condom use.<sup>14–18</sup> However, longitudinal studies assessing LARC initiation have suggested that the differing condom uptake reflects background levels of condom use before starting LARCs rather than risk compensation among women who choose these methods.<sup>19</sup> At a population level, the ongoing debate about risk compensation and LARCs obscures any comprehensive view of dual protection practice gaps because condoms and oral contraceptives remain the most prevalent contraceptive methods in Australia.

Population studies usually define dual protection as the use of two contraceptive methods, and estimate dual protection use at 7–21%.<sup>15,20,21</sup> In this study, however, we considered dual protection to be any method or combination of methods that simultaneously protect against both STIs and unintended pregnancies, including condoms used as a sole method. Using this definition, we identified practice gaps in sexual and reproductive health at a population level after developing a new framework to measure STI prevention, contraception and dual protection.

## Methods

### Study setting and participants

The methodology of the Second Australian Study of Health and Relationships (ASHR2) has been described in detail in a separate paper.<sup>22</sup> Briefly, ASHR2 is a cross-sectional national probability survey of 20 091 Australian residents aged 16–69 years. The data were collected in 2012 and 2013 via computer-assisted telephone interviews. The participants were sampled using random digit dialling, with a 66% response rate. The sample was weighted to match the Australian census for age, sex and area of residence. Aside from the overrepresentation of people with higher

education and a higher occupational status, the resultant sample broadly represents the Australian population.<sup>22</sup>

Our study included women aged 16–34 years at risk of unintended pregnancy; namely, women who reported having had intercourse with a man in the prior 12 months but were not pregnant, trying to fall pregnant or infertile (nor was their partner infertile) (see [Appendix 1](#)). The age group reflects the epidemiology of STI notifications in Australia. We used the upper age of 34 years because of the higher median age for gonorrhoea diagnosis compared with chlamydia in Australia, where 47% of gonorrhoea notifications are among people aged  $\geq 30$  years.<sup>5</sup> The sample size was determined by the number of women who met the inclusion criteria.

### Measures

We used each respondent's answer to a question about the contraceptive method used at their last vaginal intercourse to define the primary contraceptive method used. If that answer was not available, we used the response to a general question about primary contraceptive methods. Oral contraceptives, implants, IUDs (including hormonal and copper IUDs), vaginal rings and injections were classified as hormonal methods. The category of hormonal methods included a low number of women who were using copper IUDs; however, most of the women in ASHR2 (92%) who reported using an IUD were using a progestogen-releasing IUD.<sup>10</sup> Diaphragms, spermicides, withdrawal and breastfeeding were categorised as 'other methods'. In the Australian context, spermicides refer to contraceptives rather than multipurpose prevention technologies (MPTs). Condoms were included as a separate category when respondents reported using condoms as a primary method of contraception. The contraception effectiveness categories were adapted from Family Planning Alliance Australia,<sup>23</sup> which used the estimates of the probability of first-year contraceptive failure with typical and perfect use reported by Trussell.<sup>24</sup>

In our study, correct condom use referred to the application of a condom before any genital contact, whereas consistent condom use was indicated if the respondent reported 'always' when asked 'During the past 6 months, how often was a condom used when having vaginal intercourse with your (regular partner[s]/other partner[s])? Was that never, occasionally, often or always?'

### Analysis

We developed a framework by consulting peer-reviewed literature followed by discussions to reach consensus. A proportional Euler diagram was prepared using the 'Venneuler' package in RStudio 2019 (RStudio Inc., Boston, MA, USA) and formatted in Adobe Illustrator ver. 25.3 (Adobe Systems Inc., San Jose, CA, USA).

The flow chart in [Appendix 1](#) shows the missing data procedure with respect to the study population. We

excluded women from the sample if the missing data meant we could not determine whether dual protection was used at the last vaginal intercourse. Missing data for the other variables are reported in the following tables.

To compare condom prevalence by male partner type, we used Pearson's chi-squared<sup>2</sup> with Rao and Scott's second-order correction for the survey data. We modelled the correlates of condom use among the women who used other types of contraception. Using multivariate logistic regression (restricted to the women who used oral contraceptives, implants, IUDs, vaginal rings and injections, as secondary condom use was not reported among the other women), a bivariate model was used to screen variables for inclusion in the multivariate-adjusted model with an initial inclusion threshold of  $P < 0.10$ . Pearson's  $R$ -squared correlation coefficient was used to test for potential multiple collinearities between the independent variables using a threshold of  $r > 0.5$ . Backward elimination of the variables was then applied until all the variables in the model were significant at  $P < 0.05$  (except STI history, which we included a priori). We used Stata 14 statistical software (StataCorp, College Station, TX, USA) to conduct the analysis, with the survey estimates to account for the population weights.

## Ethics approval

Ethical approval for ASHR2 was obtained from La Trobe University (HEC 11-040) and ratified by the ethics committees of the University of New South Wales Sydney, the University of Sydney and the University of Sussex.

## Results

Overall, 2420 women met the study criteria of being at risk of unintended pregnancy. A flow chart of the study population is presented in [Appendix 1](#).

### Dual protection, contraception and STI prevention

Using the definition of dual protection, meaning any method or combination of methods that provide protection from unintended pregnancy and STIs, we found that half the women in our study had some measure of protection from unintended pregnancies and STIs at their last vaginal intercourse (see [Table 1](#) and [Fig. 1](#)). The most common dual protection modalities were condoms alone (19% correct and

**Table 1.** Contraception and sexually transmissible infection prevention used at last vaginal intercourse among women aged 16–34 years, Second Australian Study of Health and Relationships.

Contraception	STI prevention			Row total	
	No condom (%)	Correct and consistent condom use (%)	Incorrect or inconsistent condom use (%)	(%)	(n)
<b>Most effective</b>					
IUD	3.8	0.0	0.1	3.8	93
Permanent method <sup>A</sup>	3.4	0.0	0.0	3.4	82
Implant	4.1	0.2	0.2	4.5	110
	11.3	0.2	0.3	11.7	285
<b>Less effective</b>					
Oral contraceptive	28.9	6.1	7.8	42.8	1036
Medium-acting method <sup>B</sup>	1.5	0.2	0.1	1.8	43
	30.4	6.3	7.9	44.6	1079
<b>Least effective</b>					
Condom	0.0	18.6	15.7	34.3	830
Other methods <sup>C</sup>	0.043	0	0	4.3	104
	4.3	18.6	15.7	38.6	934
<b>Not effective</b>					
No method	5.0	0.0	0.0	5	121
Column total	50.9	25.1	24.0	100	2420

Note: the numbers and proportions are weighted. The denominator is women aged 16–34 years who reported having had intercourse with a man in the prior 12 months but who were not pregnant, trying to fall pregnant or infertile (nor was their partner infertile).

<sup>A</sup>Has had tubal ligation/occlusion or partner has had a vasectomy.

<sup>B</sup>Injections or vaginal ring.

<sup>C</sup>Diaphragm, spermicide, withdrawal, breastfeeding.

IUD, intrauterine device (copper and hormonal); STI, sexually transmissible infection.

consistent use, 16% incorrect or inconsistent use) and oral contraceptives with condoms (6% oral contraceptives and correct and consistent condom use, 8% oral contraceptives and incorrect or inconsistent condom use). Few women (<1%) benefited from using LARCs and condoms together.

In terms of contraception, 5% of the women reported not using any contraception. The predominant contraceptive methods were oral contraceptives (43%) and condoms (34%), whereas the use of other methods, including LARCs, were less common. In terms of STI prevention, approximately one-quarter (24%) of the women used condoms correctly and consistently, whereas another quarter (25%) used condoms incorrectly or inconsistently. The Euler diagram in Fig. 1 depicts the weighted prevalence of each method.

### Condom use and partner characteristics

Condom use differed by partner type and was highest among the women with casual partners. The women with a non-cohabiting partner also reported higher condom use than those with a cohabiting partner (see Table 2).

### Correlates of dual protection use

The correlates of condom use among the women using hormonal contraception are shown in Table 3 (Appendix 2 outlines the differences in the sociodemographic, relationship and behavioural characteristics between the women stratified by primary contraceptive method). After adjusting for age (Appendix 3 shows a cross tabulation of relationship status and age), heterosexual relationship status, STI history and contraceptive method, the women aged 16–19 years and 20–24 years had approximately four-fold increased odds of condom use, whereas the women with a casual partner had six-fold increased odds. After adjusting for the same variables, LARC use was independently associated with lower odds of condom use (implants adjusted odds ratio 0.22, 95% CI: 0.08–0.61; IUD adjusted odds ratio 0.08, 95% CI: 0.01–0.63).

### Discussion

By defining dual protection to include condoms alone as a type of dual protection, we found that 49% of sexually

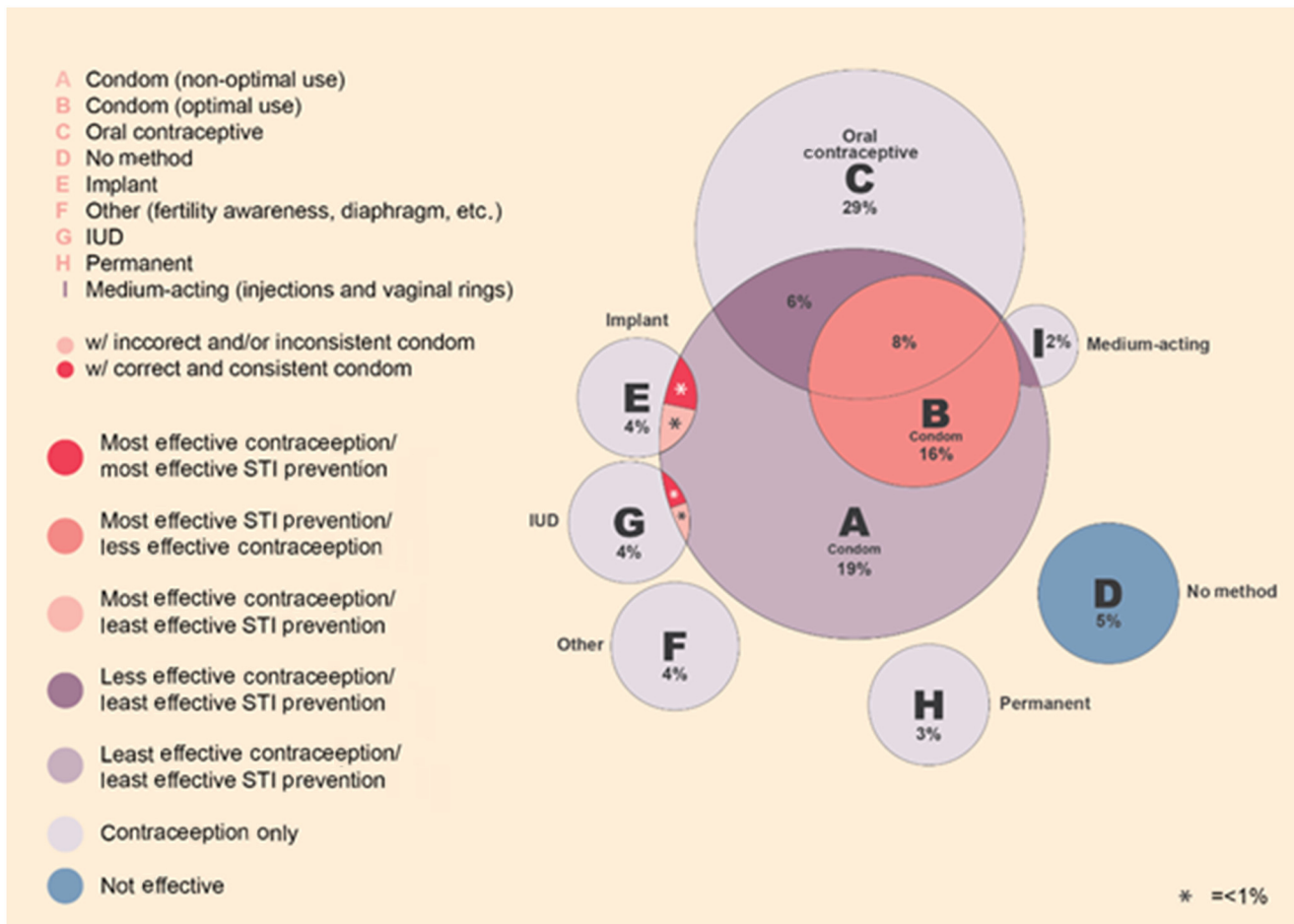


Fig. 1. Contraception and STI prevention behaviour at last vaginal intercourse among women aged 16–34 years.

**Table 2.** Condom use at last vaginal intercourse by partner type among women aged 16–34 years, Second Australian Study of Health and Relationships.

	Regular male partner, living together 1420 (306) <sup>A</sup>		Regular male partner, not living together 726 (220) <sup>A</sup>		Occasional or casual male partner 275 (114) <sup>A</sup>		Row total 2420 (640) <sup>A</sup>		
	(%)	(95% CI)	(%)	(95% CI)	(%)	(95% CI)	<i>P</i>	(%)	(95% CI)
Condom (sole or dual)	39.6	(32.6–47.0)	59.2	(49.8–67.9)	71.5	(59.5–81.0)	<0.001	49.1	(43.7–54.4)
Correct and consistent condom use <sup>B</sup>	32.5	(22.4–44.6)	57.8	(45.5–69.1)	76.0	(63.0–85.6)	<0.001	48.8	(41.1–56.7)

Note: the proportions are weighted. The denominator is women aged 16–34 years who reported having had intercourse with a man in the prior 12 months but not pregnant, trying to fall pregnant, or infertile (nor was their partner infertile). Bold text indicates  $P < 0.05$ .

<sup>A</sup>Weighted (unweighted).

<sup>B</sup>Among women using condoms.

**Table 3.** Correlates of simultaneous condom and contraceptive use at last vaginal intercourse among women aged 16–34 years, Second Australian Study of Health and Relationships.

	Proportion using dual protection				Crude OR (95% CI)	Adjusted OR (aOR; 95% CI)
	( <i>n</i> )	( <i>n</i> <sup>A</sup> )	(%)	(95% CI)		
Overall	1282	343	27.8	(21.8–34.7)	N/A	N/A
Age (years)						
16–19	158	58	46.1	(29.9–63.2)	<b>7.96 (2.60–24.38)</b>	<b>3.81 (1.05–13.79)</b>
20–24	483	112	38.9	(27.3–52.0)	<b>5.95 (2.13–16.50)</b>	<b>3.97 (1.32–11.93)</b>
25–29	332	88	19.8	(10.7–33.7)	2.29 (0.73–7.14)	1.95 (0.60–6.31)
30–34 (Ref)	308	85	9.7	(4.3–20.4)		
Area of residence						
Major city (Ref)	918	237	29.0	(21.8–37.4)		–
Regional/remote	351	103	25.3	(15.4–38.6)	0.83 (0.40–1.72)	–
Missing, refused or do not know	14	3	–	–	–	–
Relationship status						
No regular male partner	135	60	56.9	(41.7–71.0)	<b>6.45 (2.77–15.04)</b>	<b>6.05 (2.28–16.04)</b>
Non-live-in male partner	386	119	39.1	(27.8–51.7)	<b>3.13 (1.44–6.78)</b>	2.11 (0.84–5.28)
Live-in male partner (Ref)	762	164	17.0	(10.3–26.8)		
Education						
Lower secondary (Ref)	101	33	26.0	(11.8–47.9)		–
Secondary	480	135	37.6	(26.8–49.8)	1.72 (0.58–5.10)	–
Postsecondary	701	175	21.4	(14.4–30.7)	0.78 (0.26–2.29)	–
Country of birth						
English-speaking country (Ref)	1142	319	28.7	(22.4–35.9)		–
Non-English-speaking country	141	24	20.6	(6.4–49.6)	0.65 (0.16–2.56)	–
Primary method of contraception						
Oral contraceptives (Ref)	1036	262	32.6	(25.4–40.7)		
Medium-acting method	43	14	18.3	(5.7–45.3)	0.46 (0.12–1.81)	0.29 (0.07–1.17)
Implant	110	37	8.7	(3.4–20.4)	<b>0.20 (0.07–0.57)</b>	<b>0.22 (0.08–0.61)</b>
IUD	93	30	1.9	(0.3–13.0)	<b>0.04 (0.01–0.32)</b>	<b>0.08 (0.01–0.63)</b>
Ever been pregnant						
No (Ref)	740	212	36.9	(28.5–46.1)		–
Yes	542	131	15.5	(8.7–26.0)	<b>0.31 (0.15–0.67)</b>	–

(Continued on next page)

**Table 3.** (Continued).

	Proportion using dual protection				Crude OR (95% CI)	Adjusted OR (aOR; 95% CI)
	(n)	(n <sup>A</sup> )	(%)	(95% CI)		
Ever terminated a pregnancy						
No (Ref)	1122	298	29.6	(23.0–37.0)	1	–
Yes	160	44	15.7	(5.4–38.0)	0.44 (0.13–1.54)	–
Missing, refused or cannot recall	1	1	–	–	–	–
Number of sexual partners in previous year						
One partner (Ref)	1070	225	25.6	(18.8–33.8)	1	–
Two or more partners	208	117	40.2	(31.4–49.6)	<b>1.95 (1.12–3.40)</b>	–
Missing, refused or cannot recall	9	1	–	–	–	–
STI history in previous year						
No test (Ref)	833	197	27.3	(19.9–36.3)	1	1
STI test	410	127	27.8	(18.3–39.7)	1.02 (0.52–2.03)	0.60 (0.28–1.30)
Had STI	37	17	43.0	(15.8–75.3)	2.01 (0.47–8.67)	1.12 (0.19–6.60)
Missing, refused or cannot recall	3	2	–	–	–	–
First sexual intercourse <16 years						
No (Ref)	1047	263	27.6	(20.9–35.5)	1	–
Yes	235	80	28.8	(17.7–43.3)	1.06 (0.51–2.22)	–
STI knowledge score						
Lower (Ref)	341	88	21.0	(11.9–34.5)	1	–
Higher	941	255	30.3	(23.1–38.6)	1.63 (0.75–3.55)	–
Received sex education at school						
No (Ref)	218	51	29.7	(15.9–48.6)	1	–
Yes	1044	281	28.0	(21.5–35.6)	0.92 (0.38–2.23)	–
Missing, refused or cannot recall	21	11	–	–	–	–

Note: the denominator is women aged 16–34 years who reported: (i) having had intercourse with a man in the prior 12 months but were not pregnant, trying to fall pregnant or infertile (nor was their partner infertile); and (ii) using hormonal contraceptive methods at last vaginal intercourse. Hormonal contraceptive methods = oral contraceptives, medium-acting methods (vaginal rings and contraceptive injections), contraceptive implants or IUDs (hormonal and copper).

<sup>A</sup>Unweighted. Bold text indicates  $P < 0.05$ .

IUD, intrauterine device (copper and hormonal); OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval; Ref, reference category.

active Australian women aged 16–34 years benefited from dual protection at their last vaginal intercourse. Almost all the women used contraception; however, only a small proportion (12%) chose to use a highly effective method. Furthermore, only half the women who used condoms (i.e. 49% of the women using condoms and 24% of all the women) used condoms correctly and consistently. Correct and consistent condom use improves the prevention of both STIs and unintended pregnancies; with perfect use, the first-year contraceptive failure rate of condoms is 2% compared to 18% with imperfect use.<sup>24</sup> Although condom use was lower among the women using LARCs, a much larger absolute proportion of the women used either oral contraceptives without condoms or used condoms as a sole method either inconsistently or incorrectly.

In terms of population coverage, the two largest groups without ideal dual protection comprised women who used

oral contraceptives without a condom and those who used a condom as their sole contraceptive method either incorrectly or inconsistently. Both methods depend on user adherence for maximal contraceptive efficacy. Additionally, incomplete usage, breakage, slippage and user errors such as using oil-based lubricants affect the ability of condoms to protect against STI acquisition.<sup>25</sup> Although first-year contraceptive failure rates are lower for oral contraceptives (6%) than condoms, US population studies conducted in 2002–03 (predating contemporary implants and hormonal IUDs) suggest that adding condoms to current contraceptives would also confer substantial population-level contraceptive benefits.<sup>26</sup> Although the aforementioned findings refer to the use of older contraceptive methods and effectiveness estimates, the results could likely be generalised to the Australian context as one-quarter of women reportedly experienced an unintended pregnancy in the 10 years, even

though a substantial proportion (41%) were using contraception, mostly oral contraceptives, at the time.<sup>8</sup> Improving correct and consistent condom use should therefore improve dual protection at a population level.

Our study found that using a condom at the last vaginal intercourse was strongly linked with reporting a non-regular partner. Motivators for condom use are known to be complex, and other unmeasured factors such as ease of use, affordability, partner willingness, self-efficacy and access are also important considerations.<sup>27,28</sup> Women often use condoms with partners they do not know, regardless of whether they use LARCs or other types of contraception.<sup>28,29</sup> This concurs with our finding that the women with casual and non-cohabiting partners used condoms more than those with cohabiting partners and suggests that the women in our study understood and mitigated STI risk with newer and potentially non-monogamous partners. Qualitative research has indicated that women consider relationship factors and trust when deciding whether to use dual protection and apply similar decision-making processes regardless of whether they are using shorter- or longer-acting methods of contraception.<sup>30</sup> A longer relationship duration is also associated with the use of hormonal contraceptive methods and presumably other long-acting methods as opposed to condoms or dual methods, which implies a higher prioritisation of pregnancy prevention as relationships increase in duration.<sup>31</sup> Accordingly, although only half (49%) of the women in our study used condoms, condoms were most likely to be used by those with a higher STI risk profile.

One potentially modifiable factor we found to be related to lower dual protection was whether women used shorter- or longer-acting contraceptive methods. As shown in [Table 3](#), after we adjusted for age, relationship status and having ever been pregnant, LARC use was negatively correlated with dual protection. This negative independent association between LARCs and dual protection indicated that the differences in age, relationship and pregnancy history failed to account for the lower uptake of condoms among the women who used LARCs. Different rates of dual protection between women who use LARCs and women who use oral contraceptives have been reported in several other studies.<sup>14,16,21,32</sup> Because LARCs are not liable to user error after insertion, the need for backup contraceptive protection may be less of a concern among LARC users than oral contraceptive users. Women using LARCs may therefore be inadvertently missing out on the protective effects against STIs made possible using condoms.

### Strengths and limitations

The estimations of uptake, patterns of use and correlates of dual protection among a representative group of Australian women were the main strengths of this study. The findings may also be relevant to other countries that offer similar contraceptive methods. Nevertheless, this study had several limitations.

First, the ASHR2 data collection occurred in 2012–13; a recent analysis of Australian Pharmaceutical Benefits Scheme dispensing data from women aged 15–44 years estimated that in 2018, uptake of hormonal LARCs was 10.8%, which is slightly higher than our study (8.3%).<sup>33</sup> The recent study included women aged 35–44 years, who tend to have higher use of IUDs than younger women.<sup>33</sup> Conversely, the later study excluded copper IUDs, which were used by approximately 8% of IUD users in our study.<sup>33</sup> Second, the cross-sectional study design assessed dual protection at one point in time and was unable to assess whether initiating LARC resulted in reduced condom use due to behavioural risk compensation. Third, although a strength of this study was the whole-of-population denominator, it is important to recognise that women choose contraception for a variety of reasons, and those in more enduring relationships may not place the same emphasis on STI prevention. Fourth, because we used an event-based definition of dual protection, some women whom we classified as using dual protection may not have habitually used dual protection. Other studies have suggested that only around half the people who used dual methods at their last sexual event consistently use dual protection.<sup>21</sup> Finally, although STI prevention was based on self-reported condom use, we used established literature to estimate the method failure probability for other user-dependent methods because adherence information was not measured in ASHR2.<sup>24,34</sup> Condom use may also have been overreported due to social desirability bias. Notwithstanding, almost all the ASHR respondents reported answering more than 90% of all survey questions honestly; respondents were not asked which questions they had answered dishonestly.<sup>22</sup>

### Conclusion

Unintended pregnancy and STIs are both substantial public health challenges. Using a comprehensive definition of dual protection that included condoms alone as a type of dual protection and applying it to a nationally representative sample of Australian women, we determined the dual protection coverage and identified the gaps in coverage in this population. Doing so demonstrated that despite the cross-sectional link between LARCs and lower condom use, because few women use LARCs, interventions to increase dual protection should also focus on women using other types of contraception, especially women who use oral contraceptives and condoms. Because LARC use in Australia remains similar today, our study's findings are relevant to contemporary prevention. Recent qualitative research has indicated that a key determinant of condom use is availability.<sup>30</sup> Health services should therefore consider distributing condoms when providing contraception. Another key consideration is partner willingness to use condoms; future research could explore condom negotiation dynamics.

Although few interventions have increased dual protection,<sup>35</sup> promoting correct and consistent condom use may prove to be a cost-effective strategy to increase dual protection coverage.

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**Data availability.** The data that support this study will be shared upon reasonable request to the corresponding author.

**Conflicts of interest.** DB has attended advisory committees and been supported to attend educational events by Bayer Healthcare and MSD as part of her role at Family Planning NSW.

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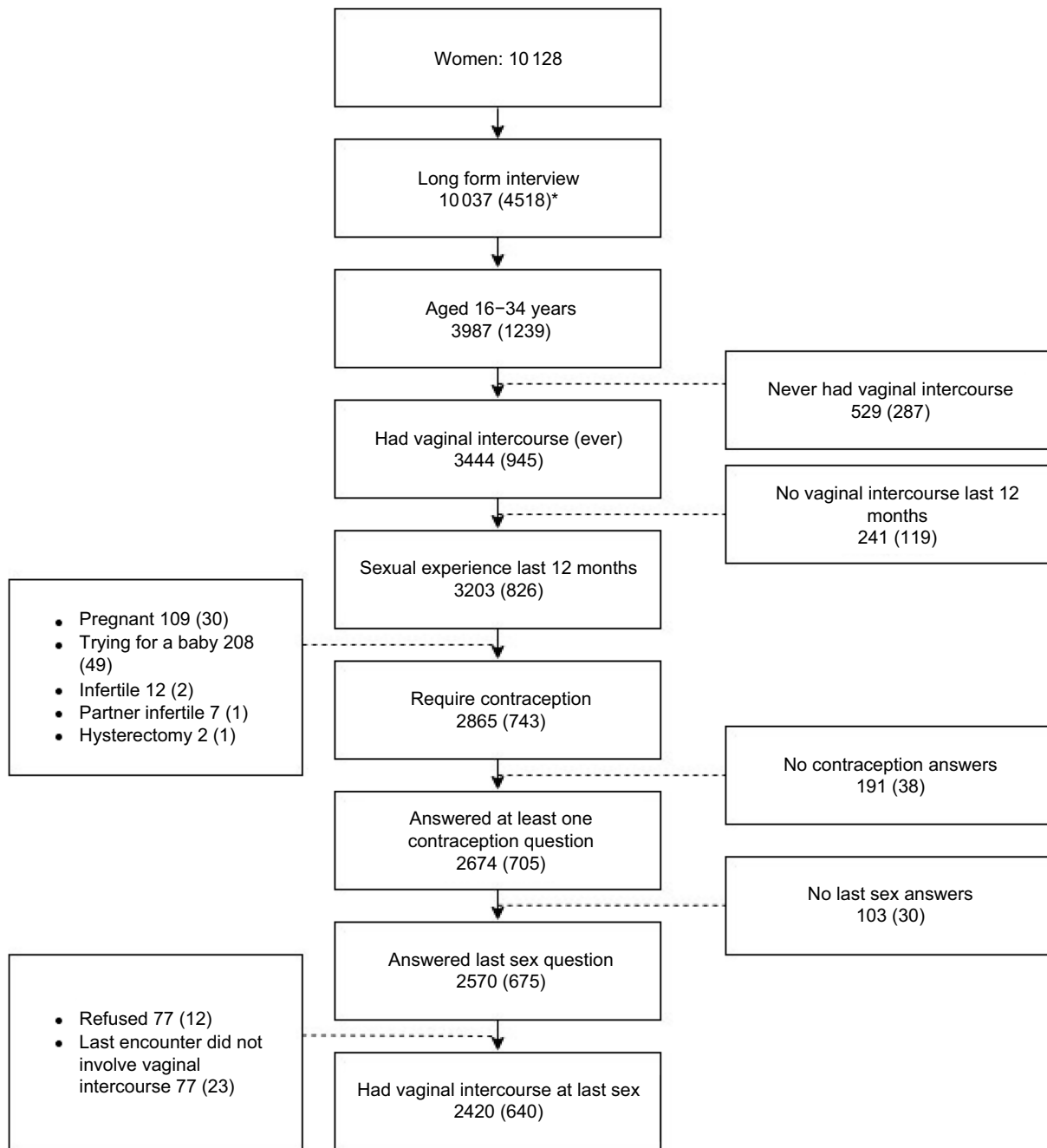
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**Appendix I. Overview of study population**



\*Weighted (unweighted)

## Appendix 2. Characteristics of women aged 16–34 years by use of hormonal contraceptive methods and condoms, Second Australian Study of Health and Relationships

	Oral contraceptive N = 1036 (262 <sup>A</sup> )		Medium-acting N = 43 (14 <sup>A</sup> )		Implant N = 110 (37 <sup>A</sup> )		IUD N = 93 (30 <sup>A</sup> )		Condom N = 830 (210 <sup>A</sup> )		P value
	(%)	(95% CI)	(%)	(95% CI)	(%)	(95% CI)	(%)	(95% CI)	(%)	(95% CI)	
Age (mean/95% CI)	24.7	24.0–25.4	23.6	21.5–25.8	27.1	25.1–29.1	29.7	28.2–31.2	25.3	24.5–26.0	<0.001
Age (years)											<0.001
16–19	13.1	8.9–18.7	13.6	3.6–39.8	14.1	5.0–34.0	1.7	0.2–11.7	16.2	10.6–24.1	
20–24	42.1	33.9–50.7	34.5	10.1–71.1	20.3	9.9–37.0	11.2	4.2–26.7	26.0	18.0–35.9	
25–29	25.8	19.2–33.7	41.0	12.8–76.8	23.9	10.3–46.2	22.3	8.8–45.9	36.6	27.9–46.2	
30–34	19.1	13.8–25.7	10.9	2.9–33.0	41.7	23.3–62.6	64.8	42.3–82.2	21.2	15.0–29.1	
Area of residence											0.888
Major city	71.0	62.6–78.2	92.2	69.9–98.4	66.4	45.6–82.4	74.5	52.4–88.6	73.5	63.8–81.3	
Regional/ remote	28.0	20.9–36.4	7.8	1.6–30.1	30	15.0–51.0	25.5	11.4–47.6	25	17.3–34.6	
Missing, refused or do not know	1.0	0.2–4.7	0	–	3.6	0.5–21.6	0	–	1.5	0.3–6.9	
Relationship status											0.024
No regular male partner	10.4	7.1–14.8	25.5	8.7–55.1	12.2	5.3–25.6	3.2	0.7–12.9	19.8	13.3–28.3	
Non-live-in regular male partner	32.2	25.2–40.1	32.1	8.8–69.8	28.3	13.3–50.5	7.9	2.6–21.9	31.0	23.0–40.3	
Live-in regular male partner	57.5	49.3–65.2	42.5	13.8–77.3	59.5	39.1–77.1	88.9	74.5–95.6	49.2	39.8–58.7	
Education											0.024
Lower secondary	7.5	4.2–12.9	12.4	3.3–36.9	11.1	3.1–32.6	6.6	1.8–21.6	12.6	7.7–19.9	
Secondary	37.1	29.4–45.6	66.4	36.1–87.3	45.2	26.9–64.9	18	5.3–46.2	32.8	24.7–42.1	
Postsecondary	55.4	47.0–63.5	21.2	7.1–48.6	43.6	24.9–64.4	75.4	49.9–90.4	54.6	45.1–63.8	
Country of birth											
English-speaking country	89.1	82.5–93.5	73.5	25.8–95.7	94.1	68.3–99.2	89.0	60.8–97.7	85.4	76.8–91.1	0.6605
Non-English-speaking country	10.9	6.5–17.5	26.5	4.3–74.2	5.9	0.8–31.7	11.0	2.3–39.2	14.6	8.9–23.2	
Ever been pregnant											<0.001
No	64.2	55.5–72.1	54.8	21.4–84.3	41.3	23.6–61.7	6.1	1.8–19.0	60.1	50.6–68.9	
Yes	35.8	27.9–44.5	45.2	15.7–78.6	58.7	38.3–76.4	93.9	81.0–98.2	39.9	31.1–49.4	
Ever terminated pregnancy											0.463
No	89.3	83.1–93.4	73.5	25.8–95.7	89.5	74.5–96.1	71.6	46.9–87.8	86.4	78.8–91.6	
Yes	10.7	6.6–16.9	26.5	4.3–74.2	10.5	3.9–25.5	27.8	11.8–52.8	13.6	8.4–21.2	
Missing, refused or cannot recall	0	–	0	–	0	–	0.6	0.1–4.0	–	–	
Number of sexual partners in previous year											0.915
One partner	83.4	79.0–87.0	71.9	42.0–90.0	83	68.4–91.7	90.1	76.2–96.3	83.1	78.0–87.1	
Two or more partners	16.2	12.6–20.4	28.1	10.0–58.0	17	8.3–31.6	9.9	3.7–23.8	16.8	12.8–21.8	
Missing, refused or cannot recall	0.4	0.1–3.0	0	–	0	–	0	–	0.1	0.0–0.8	
STI history in previous year											0.545
No test	63.8	55.5–71.5	72.4	42.8–90.2	58.3	37.9–76.2	81.4	65.2–91.1	70.5	61.6–78.1	
STI test	32.6	25.2–41.0	24.6	8.3–53.9	41.7	23.8–62.1	16.8	7.7–32.8	24.5	17.4–33.3	
Had STI	3.3	1.6–6.4	3.0	0.4–20.0	0	–	1.7	0.4–7.6	4.9	2.5–9.4	
Missing, refused or cannot recall	0.3	0.1–1.3	0	–	0	–	0	–	0.1	0.0–1.0	

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	Oral contraceptive N = 1036 (262 <sup>A</sup> )		Medium-acting N = 43 (14 <sup>A</sup> )		Implant N = 110 (37 <sup>A</sup> )		IUD N = 93 (30 <sup>A</sup> )		Condom N = 830 (210 <sup>A</sup> )		P value
First sexual intercourse <16 years	0.067										
No	84.3	78.2–89.0	89.1	66.6–97.1	64.4	44.1–80.6	68.8	44.8–85.7	82.7	75.9–87.9	
Yes	15.7	11.0–21.8	10.9	2.9–33.4	35.6	19.4–55.9	31.2	14.3–55.2	17.3	12.1–24.1	
STI knowledge score 8 questions	0.581										
Lower	24.4	18.2–32.0	26.5	4.3–74.2	43.3	24.6–64.2	31.3	14.6–54.8	27.1	19.4–36.4	
Higher	75.6	68.0–81.8	73.5	25.8–95.7	56.7	35.8–75.4	68.7	45.2–85.4	72.9	63.6–80.6	
Received sex education at school	0.393										
No	16.3	10.9–23.5	5.1	0.7–30.6	23.8	10.0–46.9	22.4	8.5–47.5	14.7	9.3–22.5	
Yes	82.6	75.4–88.0	87.8	63.6–96.7	75.3	52.6–89.4	71.8	48.0–87.5	82.2	74.3–88.1	
Missing, refused or cannot recall	1.1	0.4–3.0	7.1	1.5–27.4	0.9	0.1–6.2	5.8	1.6–18.3	3.1	1.4–7.0	

Note: the denominator is women aged 16–34 years who reported: (i) having had intercourse with a man in the prior 12 months but were not pregnant, trying to fall pregnant or infertile (nor was their partner infertile); and (ii) using hormonal contraceptive methods or condoms at last vaginal intercourse. Hormonal contraceptive methods = oral contraceptives, medium-acting methods (vaginal rings and contraceptive injections), contraceptive implants or IUDs (hormonal and copper).

<sup>A</sup>Weighted (unweighted). Proportions are weighted. Bold text indicates  $P < 0.05$ .

IUD, intrauterine device (copper and hormonal); CI, confidence interval.

### Appendix 3. Cross tabulation of relationship status by age among women aged 16–34 years, Second Australian Study of Health and Relationships

Age (years)	Regular male partner, living together (%)	Regular male partner, not living together (%)	Occasional or casual male partner (%)	Row total (%)
16–19	23.2	60.6	16.2	100
20–24	43.2	42.7	14.1	100
25–29	67.0	20.6	12.4	100
30–34	85.2	10.4	4.5	100

Note: the proportions are weighted. The denominator is women aged 16–34 years who reported having had intercourse with a man in the prior 12 months but not pregnant, trying to fall pregnant, or infertile (nor was their partner infertile).