Contraceptive and reproductive health practices of unmarried women globally, 1999 to 2018
Systematic review and meta-analysis

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Abstract

Background: Premarital sex practices and contraceptive prevalence rate (CPR) among unmarried women worldwide remain unclear, even though unmarried women tend to have multiple sex partners over time, which makes their sexual behaviors particularly important to the sexual and reproductive health of society more broadly.

Methods: We searched the MEDLINE, PubMed, and Google Scholar databases for relevant articles published between January 1, 1999 and December 31, 2018. Data on prevalence of premarital sexual intercourse, use of highly prevalent contraceptive methods, as well as CPR overall and at first sexual intercourse were extracted and estimated using a DerSimonian–Laird random effects model.

Results: Of the 3918 articles identified, 37 covering 19 countries were included. The estimated overall prevalence of premarital sexual intercourse was 41.9% (95% CI 34.2–49.6%). Pooled CPR was 57.0% (95% CI 44.3–69.8%) overall and 57.6% (95% CI 39.5–75.6%) at first intercourse. The overall prevalence of condom use was 51.2% (95% CI 42.7–59.7%), followed by oral contraceptives (20.5%, 95% CI 13.7–27.3%), withdrawal (12.7%, 95% CI 9.4–15.9%), and rhythm (12.1%, 95% CI 6.7–17.4%).

Conclusion: The findings of this global study indicate worrying trends in unprotected intercourse and contraceptive practices, suggesting the need for greater attention and resources aimed at educating unmarried adolescent women about sexual and reproductive health.

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Abbreviations: AIDS = acquired immune deficiency syndrome, CI = confidence interval, CPR = contraceptive prevalence rate, HIV = human immunodeficiency virus, OCP = oral contraceptive pill, SRH = sexual and reproductive health, STI = sexually transmitted infection.

Keywords: unprotected intercourse, contraceptive practices, unmarried women, worldwide, meta-analysis

1. Introduction

According to the Global Strategy for Women’s, Children’s and Adolescents’ Health of the United Nations,\textsuperscript{[1]} the health of young people, particularly the sexual and reproductive health (SRH) of young unmarried people, has become a global public health concern. As global development continues, the prevalence of premarital sexual intercourse among young people has risen, exposing adolescents to the challenges of contraceptive practices and unplanned pregnancies.\textsuperscript{[2]}

The World Health Organisation (WHO) reported that in developing regions, \textcircled{16} million girls aged 15 to 19 years and 2.5 million girls under 16 years gave birth in 2015.\textsuperscript{[3]} Simultaneously,
teenage sexually transmitted infections (STIs) and acquired immune deficiency syndrome (AIDS) have become major health concerns in the world. Studies from many parts of the world link these phenomena to limited access to SRH information and inadequate family planning and contraception. Poor knowledge of SRH, use of less-effective contraceptive methods, or failure to use any contraception at all contribute to this dangerous reproductive health situation among young people, particularly unmarried individuals. Several countries have implemented strategies to promote contraception and improve SRH among unmarried women, but they have proven ineffective in many regions.

Although some studies and systematic reviews have examined sexual intercourse behavior in various countries, a systematic review of contraceptive practices among unmarried women is lacking. Unmarried women are a particularly important population to understand because they may have more partners than older, married women and their sexual and reproductive health practices may be less stable over time. In other words, the behaviors of unmarried women may strongly influence the sexual and reproductive health of the larger population and may be more amenable to modification through appropriate public health campaigns and interventions. Therefore, we set out to conduct a systematic review and meta-analysis of the prevalence of premarital sexual intercourse, contraceptive prevalence rate (CPR), and rates of use of highly prevalent contraceptive methods. These results may be useful to guide policymakers aiming to improve SRH of unmarried women.

2. Methods

This systematic review and meta-analysis were conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The research protocol was registered in the PROSPERO international prospective register of systematic reviews (CRD42019132736).

2.1. Search strategy

We searched the MEDLINE, PubMed, and Google Scholar databases for articles published between January 1, 1999 and December 31, 2018 that reported contraceptive practices and reproductive health conditions of unmarried women worldwide. This date range was chosen because sexual activity often changes rapidly during this age span. Studies were excluded if they reported:

1. data on unmarried women only as a composite outcome, such that their data could not be separated from data on married women or unmarried men;
2. data on a specific population of unmarried women, such as sex workers or women living with cancer, HIV, or disability;
3. data on unmarried women in a clinic or hospital because of unplanned pregnancy or induced abortion; or
4. data for a sample smaller than 100 unmarried women.

Exclusion criteria (2), (3), and (4) were imposed to ensure that our study population would reasonably reflect the general population of unmarried women. In our analysis, we defined unmarried women as those who reported having had a lover or not, no matter how long they were together. We defined married women as those who were cohabiting with a male sexual partner or who had a husband at the time of the interview.

2.2. Eligibility criteria

For a study to be included in our systematic review and meta-analysis, it had to be a cross-sectional study (descriptive or analytical) focusing on SRH among unmarried women aged 14 to 25 years. If a study reported data on women over a broader age range, data were extracted only for women aged 14 to 25. This age range was chosen because sexual activity often changes rapidly during this age span.

Studies were excluded if they reported:

1. data on unmarried women only as a composite outcome, such that their data could not be separated from data on married women or unmarried men;
2. data on a specific population of unmarried women, such as sex workers or women living with cancer, HIV, or disability;
3. data on unmarried women in a clinic or hospital because of unplanned pregnancy or induced abortion; or
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2.3. Study selection and quality assessment

Two authors (MY Wang and Y Fan) independently screened the titles and abstracts of the search results based on the eligibility criteria. Duplicate references were removed, as were studies that failed to match our review criteria. The remaining studies were then read in full and assessed for quality. The methodological quality of the included studies was assessed independently by two researchers (MY Wang and Y Fan) based on the Cross-Sectional/Prevalence Study Quality Checklists. Studies awarded 3 or fewer stars were considered low-quality and excluded from our study. Any discrepancy in the study selection and quality assessment was resolved through discussion with the corresponding authors.

2.4. Data extraction

Data from all included studies were extracted and tabulated by two authors (MY Wang and Y Fan). The data included:

1. name of the first study author,
2. year of publication,
3. year of survey,
4. location of study,

Box 1. Keywords used for identification of articles that reported data on contraceptive and reproductive health practices of unmarried women worldwide during 1999 to 2018.

1. [unmarried OR adolescent OR adolescence OR teenager OR young OR college student OR single person]
2. [contraception OR contraceptive]
3. [#1 AND #2]
4. Filter: published between January 1, 1999 and December 31, 2018
5. target population,
6. age of participants,
7. sample size,
8. key results,
9. quality assessment,
10. outcome measurements,
11. prevalence of premarital sexual intercourse,
12. CPR,
13. CPR at first sexual intercourse and
14. prevalence of highly prevalent contraceptive methods.

For studies that reported SRH behavior of unmarried women worldwide at different time points, we extracted only baseline data in order to reduce effects of loss to follow-up.

To calculate the prevalence of premarital sexual intercourse, the number of women who were sexually initiated was divided by the total number of unmarried women. To calculate CPR, the number of women using at least one form of effective contraception was divided by the total number of sexually active unmarried women. To calculate the rate of use of each contraceptive method, the number of sexually active women using that particular method was divided by the total number of sexually active unmarried women in the study. We also examined CPR at first intercourse among sexually active unmarried women.

2.5. Meta-analysis

Meta-analysis was conducted using Stata 14 (StataCorp, College Station, TX) and a DerSimonian–Laird random-effects model was used because of the expected significant heterogeneity caused by differences in populations, geographic regions, and methods of outcome assessment. The meta-analysis subsequently indicated substantial heterogeneity (see Results), validating our use of the random-effects model. When appropriate, results were reported together with 95% confidence intervals (CIs).

2.6. Heterogeneity

Heterogeneity among studies was assessed using Cochran’s $Q$ test. As recommended by the Cochrane Collaboration, Cochran’s $Q$ test was considered to indicate heterogeneity when $P < .05$. To explore the potential causes of heterogeneity, we conducted subgroup analysis stratified by year of survey, study population, geographical region, and outcome measurements. In addition, sensitivity analysis was performed by repeating the meta-analysis after removing each study one by one in order to assess its influence.

2.7. Ethical review

The study was approved by the Human Research Ethics Committee of the Hospital.

3. Results

The process of selecting articles is shown in Figure 1. We identified 3918 articles through the initial search, from which 19 duplicate references were removed and 3862 references were excluded because they were ineligible or of low quality. In the end, 37 studies published between January 1, 1999 and December 31, 2018 were retained in our analysis (Table 1).

3.1. Characteristics of the included studies

All 37 studies were cross-sectional surveys involving a total of 123,254 unmarried females, with sample sizes ranging from a...
Table 1
Relevant studies on contraceptive prevalence rate and use of specific contraceptive methods by unmarried women aged 14 to 25 years around the world.

| Study            | Survey year | Country     | Population sampled | Age (years) | Sample size | Study quality | Survey method | Key results                                                                 |
|------------------|-------------|-------------|--------------------|-------------|-------------|---------------|---------------|-----------------------------------------------------------------------------|
| Narring et al, 2000 [16] | 1996        | Switzerland | Undergraduates     | 16–20       | 2075        | High          | Self-completed questionnaire | High premarital intercourse rate                                             |
| William et al, 2000 [17] | 1996        | Ghana       | Urban              | 15–24       | 829         | High          | Face-to-face interview      | High premarital intercourse rate low CPR                                     |
| Donald et al, 2002 [18]  | 2002        | Canada      | Undergraduates     | 15–19       | 922         | Medium        | Face-to-face interview      | High premarital intercourse rate                                           |
| Allen et al, 2003 [19]   | 2001        | Thailand    | Undergraduates     | 15–22       | 832         | High          | Self-completed questionnaire | Low CPR                                                                     |
| Kallipolitis et al, 2003 [20] | 2000        | Greece      | Undergraduates     | 17–25       | 297         | Medium        | Self-completed questionnaire | Inadequate knowledge of contraception                                      |
| Dei et al, 2004 [21]     | 2002        | Italy       | Junior high/high school students | 14–23       | 104         | Medium        | Self-completed questionnaire | Complex sexual behavior                                                     |
| Bender et al, 2005 [22]  | 1996        | Iceland     | General population | 17–20       | 1430        | High          | Self-completed questionnaire | Low level of contraceptive knowledge                                       |
| Byamugisha et al, 2006 [23] | 2005        | Uganda      | Undergraduates     | 18–25       | 379         | High          | Self-completed questionnaire | Low level of contraceptive knowledge                                       |
| Li et al, 2006 [24]      | 2006        | China       | Undergraduates     | 16–26       | 2365        | High          | Self-completed questionnaire | Low CPR and unreliable contraceptive methods                                |
| Matteson et al, 2006 [25] | 2003        | USA         | Urban              | 14–25       | 424         | Medium        | Self-completed questionnaire | Low CPR and high unwanted pregnancy rate                                    |
| Larsson et al, 2007 [26] | 2003        | Sweden      | Undergraduates     | 17–21       | 331         | High          | Self-completed questionnaire | High premarital intercourse rate                                            |
| Maria et al, 2007 [27]   | 2000        | Ethiopia    | General population | 15–24       | 3988        | Medium        | Self-completed questionnaire | Low CPR and low level of SRH knowledge                                      |
| Rocha et al, 2007 [28]   | 2002        | Brazil      | Urban              | 15–18       | 219         | Medium        | Self-completed questionnaire | Relatively high CPR and low level of contraceptive knowledge              |
| Wang et al, 2007 [29]    | 2002        | China       | Urban              | 15–24       | 503         | Medium        | Self-completed questionnaire | Low CPR and high unwanted pregnancy rate                                    |
| Olszewski et al, 2010 [30] | 2008        | Poland      | Undergraduates     | 18–27       | 1478        | High          | Self-completed questionnaire | Use of unreliable contraceptives                                            |
| Tafuri et al, 2011 [31]  | 2008        | Italy       | Junior high/high school students | 17–30       | 760         | Medium        | Self-completed questionnaire | High premarital intercourse rate                                            |
| Doku et al, 2012 [32]    | 2008        | Ghana       | Undergraduates     | 15–18       | 644         | Medium        | Self-completed questionnaire | High rate of premarital sex and risky sexual behaviour                      |
| Higgins et al, 2012 [33] | 2009        | USA         | General population | 18–29       | 419         | High          | Face-to-face interview      | Urgent need for preventive approach towards reproductive health            |
| Lu et al, 2012 [34]      | 2008        | China       | Migrants           | 18–29       | 831         | Medium        | Self-completed questionnaire | Low SRH knowledge                                                          |
| Desrosiers et al, 2013 [35] | 2007        | USA         | Urban              | 15–19       | 666         | Medium        | Face-to-face interview      | Delay between first sexual intercourse and contraceptive use                |
| Heili Blum, 2013 [36]    | 2006        | China       | Urban              | 15–24       | 263         | Medium        | Self-completed questionnaire | Considerable risk of unintended pregnancy and abortion                    |
| Yip et al, 2013 [37]     | 2011        | China       | Urban              | 18–27       | 532         | Medium        | Self-completed questionnaire | Premarital sex more prevalent                                              |
| Clark et al, 2014 [38]   | 2007        | New Zealand | Junior high/high school students | 15–18       | 1015        | Medium        | Self-completed questionnaire | Access to suitable contraception and education is required                  |
| Hood et al, 2014 [39]    | 2003        | USA         | Urban              | 15–25       | 734         | High          | Face-to-face interview      | Urgent need for a preventive approach towards reproductive health          |
| Melaku et al, 2014 [40]  | 2012        | Ethiopia    | Junior high/high school students | 15–21       | 807         | High          | Self-completed questionnaire | Relative high premarital intercourse rate but low CPR                     |
| Sidse et al, 2014 [41]   | 2011        | Senegal     | Urban              | 15–29       | 237         | Medium        | Face-to-face interview      | Low CPR                                                                     |
| Tsitsika et al, 2014 [42] | 2010        | Greece      | Junior high/high school students | 15–16       | 568         | High          | Self-completed questionnaire | Unreliable contraceptive methods                                           |

(continued)
minimum of 104 in Italy to a maximum of 74,589 in Brazil. The publication years of the 37 surveys were distributed as follows: 6 (16.2%) were published between 1999 and 2004, 8 (21.6%) between 2005 and 2009, 13 (35.1%) between 2010 and 2014, and 10 (27.1%) between 2015 and 2018. Of the 37 studies, 7 (18.9%) were conducted in Asia, 8 (21.6%) in North America, 9 (24.3%) in Africa, 10 (27.0%) in Europe, 2 (5.4%) in South America and 1 (2.8%) in Oceania, covering a total of 19 countries. The studies in 19 articles sampled student populations: 9 (47.4%) in Europe, 3 (15.7%) in Asia, 4 (21.0%) in Africa, 1 (5.3%) each in South America, North America, and Oceania.

### 3.2. Prevalence of premarital sexual intercourse

The highest prevalence of premarital sexual intercourse was reported in Italy (87.6%, 95%CI 85.3–89.9%), and the lowest in China (10.1%, 95%CI 9.5–10.7%) (Fig. 2). Data on prevalence of premarital sexual intercourse were pooled from 25 studies to obtain a pooled prevalence of 41.9% (95%CI 34.2–49.6%; Fig. 2).

### 3.3. CPR overall

Based on data from 23 articles reporting CPR, the rate fluctuated worldwide between 9.3% (95%CI 7.1–11.5%) in Ethiopia and 96.3% (95%CI 91.5–100%) in Greece. CPR for the total sample of 14,222 sexually active unmarried women from 13 countries was 57.0% (95%CI 44.3–69.8%; Fig. 3).

### 3.4. CPR at first sexual intercourse

A total of 8 studies examined CPR among unmarried women at their first sexual intercourse. The pooled CPR at first sexual intercourse was 57.6% (95%CI 39.5–75.6%; Fig. 4).

### 3.5. Prevalence of highly prevalent contraceptive methods

During 1999 to 2018, unmarried women around the world relied predominantly on condoms, oral contraceptive pills (OCPs), rhythm, and withdrawal as their contraceptive methods. Among the 37 studies, 23 reported data on condom use, 23 on OCP use, 15 on withdrawal, and 8 on rhythm (Figs. 5–8). For condom use, the highest rate was reported in Greece (89.0%, 95%CI 84.2–93.8%) and the lowest in Nigeria (2.7%, 95%CI 0–6.4%) (Fig. 5). For OCP use, the highest rate was reported in Iceland (59.5%, 95%CI 56.7–62.3%) and lowest in South Africa (1.9%, 95%CI 1.2–2.6%) (Fig. 6). The highest rates of rhythm and withdrawal were reported in China (24.9%, 95%CI 22.1–27.7%) and Greece (51.9%, 95%CI 39.3–64.5%) (Figs. 7 and 8). Overall prevalence of condom use was 51.2% (95%CI 42.7–59.7%), followed by OCPs (20.5%, 95%CI 13.7–27.3%), withdrawal (12.7%, 95%CI 9.4–15.9%), and rhythm (12.1%, 95%CI 6.7–17.4%).

### 3.6. Heterogeneity analysis

To explain the high heterogeneity among studies, we divided them into subgroups by year of survey, study population, geographical region, and outcome measurements. Homogeneity was not achieved in any of these subgroups. During the subgroup analysis, we found that the pooled prevalence of premarital sex was highest in Europe (59.1%, 95%CI 39.4–78.8%), followed by Oceania (54.6%, 95%CI 51.5–57.7%), North America (40.6%, 95%CI 30.4–50.9%), Africa (35.2%, 95%CI 17.8–52.5%), Asia (24.2%, 95%CI 15.6–32.9%), and South America (22.6%, 95%CI 22.3–22.9%) (Fig. 9). The pooled results may be less reliable for South America and Oceania, since only one study came from each of these regions.
| Study                          | Year of survey | Region          | Sample Size | Effect size (95% CI) Weight (%) |
|-------------------------------|----------------|-----------------|-------------|---------------------------------|
| Long et al., 2016             | 2013           | China           | 9052        | 10.1 (9.5, 10.7) 4.02           |
| Tsiikia et al., 2014          | 2010           | Greece          | 568         | 10.6 (8.1, 13.1) 4.01           |
| Melaku et al., 2014           | 2012           | Ethiopia        | 807         | 15.8 (13.3, 18.3) 4.01          |
| Maria et al., 2007            | 2000           | Ethiopia        | 3988        | 16.1 (15.0, 17.2) 4.02          |
| Li et al., 2006               | 2006           | China           | 2365        | 17.9 (16.4, 19.4) 4.02          |
| Wang et al., 2007             | 2002           | China           | 503         | 18.3 (14.9, 21.7) 3.99          |
| Young et al., 2018            | 2010           | Ireland         | 2071        | 21.2 (19.4, 23.0) 4.02          |
| Lu et al., 2012               | 2008           | China           | 831         | 21.4 (18.6, 24.2) 4.00          |
| Borges et al., 2016           | 2014           | Brazil          | 74589       | 22.6 (22.3, 22.9) 4.03          |
| Doku et al., 2012             | 2008           | Ghana           | 644         | 22.7 (19.5, 25.9) 4.00          |
| Yip et al., 2013              | 2011           | China           | 532         | 35.2 (31.1, 39.3) 3.98          |
| Frederiksen et al., 2017     | 2015           | USA             | 6317        | 35.5 (34.3, 36.7) 4.02          |
| Mendelsohn et al., 2018      | 2015           | South Africa    | 3613        | 37.3 (35.7, 38.9) 4.02          |
| Chimah et al., 2016           | 2016           | Nigeria         | 179         | 40.8 (33.6, 48.0) 3.89          |
| Allen et al., 2003            | 2001           | Thailand        | 832         | 43.1 (39.7, 46.5) 3.99          |
| Donald et al., 2002           | 2002           | Canada          | 922         | 46.0 (42.8, 49.2) 4.00          |
| Narring et al., 2000          | 1996           | Switzerland     | 2075        | 52.6 (50.5, 54.7) 4.01          |
| Clark et al., 2007            | 2007           | New Zealand     | 1015        | 54.6 (51.5, 57.7) 4.00          |
| Kallipolitis et al., 2003     | 2000           | Greece          | 297         | 55.2 (49.5, 60.9) 3.94          |
| Olszewski et al., 2010        | 2008           | Poland          | 1478        | 65.6 (63.2, 68.0) 4.01          |
| Larsson et al., 2007          | 2003           | Sweden          | 331         | 75.0 (70.3, 79.7) 3.97          |
| William et al., 2000          | 1996           | Ghana           | 829         | 78.4 (75.6, 81.2) 4.00          |
| Coronado et al., 2017         | 2014           | Spain           | 1423        | 81.6 (79.6, 83.6) 4.01          |
| Bender et al., 2005           | 1996           | Iceland         | 1430        | 82.6 (80.6, 84.6) 4.02          |
| Tafuri et al., 2011           | 2008           | Italy           | 760         | 87.6 (85.3, 89.9) 4.01          |
| Overall (95% CI)              |                |                 |             | 41.9 (34.2, 49.6) 100.00        |

Heterogeneity chi-squared = 16942.98, d.f. = 24 (p < 0.001), I-squared = 99.9%
Test for overall effect Z= 10.67 (p < 0.001)

Figure 2. Prevalence of premarital sexual intercourse among unmarried women worldwide.

| Study                          | Year of survey | Region          | No. of sexually active unmarried women | Effect size (95% CI) Weight (%) |
|-------------------------------|----------------|-----------------|---------------------------------------|---------------------------------|
| Maria et al., 2007            | 2000           | Ethiopia        | 642                                   | 9.3 (7.1, 11.5) 4.37           |
| Chimah et al., 2016           | 2016           | Nigeria         | 73                                    | 11.0 (3.8, 18.2) 4.31           |
| Byamugisha et al., 2006       | 2005           | Uganda          | 379                                   | 14.5 (11.0, 18.0) 4.36          |
| Nyarko, 2015                  | 2008           | Ghana           | 941                                   | 15.3 (13.0, 17.6) 4.37          |
| Wang et al., 2007             | 2002           | China           | 92                                    | 23.9 (15.2, 32.6) 4.29          |
| Sidze et al., 2014            | 2011           | Senegal         | 237                                   | 27.1 (21.4, 32.8) 4.34          |
| William et al., 2000          | 1996           | Ghana           | 650                                   | 37.6 (33.9, 41.3) 4.36          |
| Bender et al., 2005           | 1996           | Iceland         | 1181                                  | 37.8 (35.0, 40.6) 4.36          |
| Yip et al., 2013              | 2011           | China           | 187                                   | 49.2 (42.0, 56.4) 4.31          |
| Clark et al., 2007            | 2007           | New Zealand     | 554                                   | 53.9 (49.7, 58.1) 4.35          |
| Hoopes et al., 2018           | 2012           | USA             | 1067                                  | 60.8 (57.9, 63.7) 4.36          |
| Matteson et al., 2006         | 2003           | USA             | 424                                   | 66.3 (61.8, 70.8) 4.35          |
| Narring et al., 2000          | 1996           | Switzerland     | 1091                                  | 67.6 (64.8, 70.4) 4.36          |
| Doku et al., 2012             | 2008           | Ghana           | 146                                   | 67.6 (60.5, 75.2) 4.31          |
| Long et al., 2016             | 2013           | China           | 915                                   | 73.2 (70.3, 76.1) 4.36          |
| Hood et al., 2014             | 2003           | USA             | 734                                   | 73.3 (70.1, 76.5) 4.36          |
| Higgins et al., 2012          | 2009           | USA             | 419                                   | 80.0 (76.2, 83.8) 4.36          |
| Frederiksen et al., 2017      | 2015           | USA             | 2484                                  | 84.3 (82.9, 85.7) 4.37          |
| Melaku et al., 2014           | 2012           | Ethiopia        | 127                                   | 86.5 (80.6, 92.4) 4.33          |
| Rocha et al., 2007            | 2002           | Brazil          | 219                                   | 89.5 (85.4, 93.6) 4.35          |
| Coronado et al., 2017         | 2014           | Spain           | 1161                                  | 92.0 (90.4, 93.6) 4.37          |
| Young et al., 2018            | 2010           | Ireland         | 439                                   | 93.8 (91.5, 96.1) 4.37          |
| Tsitsika et al., 2014         | 2010           | Greece          | 60                                    | 96.3 (91.5, 100.0) 4.35         |
| Overall (95% CI)              |                |                 |             | 57.0 (44.3, 69.8) 100.00         |

Heterogeneity chi-squared = 8991.27, d.f. = 22 (p < 0.001), I-squared = 99.8%
Test for overall effect Z= 8.75 (p < 0.001)

Figure 3. Contraceptive prevalence rate (CPR) among unmarried women worldwide.
4. Discussion

4.1. Principal findings

The pooled prevalence of premarital sex among unmarried women worldwide in our meta-analysis was 41.9% (95% CI 34.2–49.6%). Subgroup analysis showed that the incidence of premarital sex was lower among Asian women (24.2%) and African women (35.2%) than among European women (59.1%). At the same time, recent data from the Guttmacher Institute indicate that the unintended pregnancy rate has fallen more in developed regions than in developing ones.[7] This may reflect a deficit of SRH policies and curricula in developing areas that are aimed at expanding adolescents’ knowledge about, and full access to, contraceptives—regardless of sex, age, or marital status.

In our study, the overall CPR was 57.0% (95% CI 44.3–69.8%) and the estimated overall CPR at first intercourse was 57.6% (95% CI 39.5–75.6%). Among different contraceptive methods, the most prevalent was condom use, which was 51.2% (95% CI 42.7–59.7%) in unmarried women. Since condoms are not only an effective contraceptive, but they can also prevent STIs and AIDS, they should be the most recommended method to young women who wish to use contraception. In addition, we noted that a percentage of young unmarried females still rely on the less effective contraceptive methods of withdrawal (12.7%, 95% CI 9.4–15.9%) and rhythm (12.1%, 95% CI 6.7–17.4%). Even in Europe and North America, the proportions of unmarried women using withdrawal were 15.3% and 8.7%, respectively, and the proportions using rhythm were 23.1% and 0.6%. These data may help explain the increasing number of unmarried women experiencing an unplanned pregnancy.[7] This suggests that supranational as well as national solutions are needed to advance effective contraceptive practices among unmarried women.

4.2. Strengths and weaknesses of the study

Since unmarried women tend to have multiple sex partners over time, their sexual behaviors are particularly important to the study. The table below summarizes the studies included in the meta-analysis:

| Study                  | Year of survey | Region       | No. of sexually active unmarried women | Effect size (95% CI) | Weight (%) |
|------------------------|----------------|--------------|---------------------------------------|----------------------|------------|
| Chimah et al., 2016    | 2016           | Nigeria      | 73                                    | 4.5 (0.9, 9.3)       | 12.54      |
| He & Blum, 2013        | 2006           | China        | 263                                   | 40.9 (35.0, 46.8)    | 12.48      |
| Lu et al., 2012        | 2008           | China        | 178                                   | 54.5 (47.2, 61.8)    | 12.39      |
| Li et al., 2006        | 2006           | China        | 423                                   | 56.0 (51.3, 60.7)    | 12.54      |
| Tafuri et al., 2011    | 2008           | Italy        | 666                                   | 73.7 (70.4, 77.0)    | 12.59      |
| Larsson et al., 2007   | 2003           | Sweden       | 248                                   | 75.0 (69.6, 80.4)    | 12.51      |
| Dei et al., 2004       | 2002           | Italy        | 104                                   | 76.0 (67.8, 84.2)    | 12.33      |
| Olczewski et al., 2010 | 2008           | Poland       | 969                                   | 80.0 (77.5, 82.5)    | 12.62      |
| Overall (95% CI)       |                |              |                                      | 57.6 (59.5, 75.6)    | 100.00     |

Heterogeneity chi-squared = 2175.89, d.f. = 22 (p < 0.001), I-squared = 99.0%
Test for overall effect Z= 11.80 (p < 0.001)

Figure 4. Contraceptive prevalence rate (CPR) at first sexual intercourse among unmarried women worldwide.

| Study                  | Year of survey | Region       | No. of sexually active unmarried women | Effect size (95% CI) | Weight (%) |
|------------------------|----------------|--------------|---------------------------------------|----------------------|------------|
| Young et al., 2018     | 2010           | Ireland      | 439                                   | 80.0 (76.3, 83.7)    | 4.40       |
| Overall (95% CI)       |                |              |                                      | 51.2 (42.7, 59.7)    | 100.00     |

Heterogeneity chi-squared = 2175.89, d.f. = 22 (p < 0.001), I-squared = 99.0%
Test for overall effect Z= 11.80 (p < 0.001)

Figure 5. Studies on condom use by sexually active unmarried women worldwide.
sexual and reproductive health of society more broadly. To the best of our knowledge, this is the first meta-analysis of contraceptive and reproductive health practices of unmarried women globally. The wide range in CPR reflects the heterogeneity in sexual and reproductive health practices around the world and therefore supports the need for analysis such as ours to guide appropriate interventions.

This meta-analysis has several limitations. First, although the final set of studies came from various geographical areas, numerous countries were not represented, especially those from Eastern Europe (including Russia), North Africa, the Middle East, and most of Latin America. Other populous countries such as Indonesia and Pakistan were also not included. This increases the risk that our sample is not representative of unmarried women around the globe. Second, we observed significant heterogeneity in our meta-analysis, which we could not fully control through subgroup analysis. The heterogeneity may have several explanations: Some surveys were conducted by face-to-face interviews while others involved self-completed questionnaires without expert intermediaries. It is possible that many participants, especially those taking self-completed questionnaires, may not have been able or willing to respond to all questions accurately. Regardless of the survey method, responses may not always have been truthful, especially because premarital sexual behavior remains a highly sensitive topic in many cultures. As a result, unmarried women in certain countries may be less likely to admit a history of sexual intercourse. Although we restricted our data to women aged 14 to 25 years, socioeconomic situation and cultural standing may vary substantially even within this range, perhaps contributing to the heterogeneity in our analysis.

4.3. Strengths and weaknesses of this study in relation to other studies
A previous systematic review of 21 studies in 12 low- and middle-income countries suggested that single adolescents receive...
| Study          | Year of survey | Region         | No. of sexually active unmarried women | Effect size (95% CI) | Weight (%) |
|---------------|----------------|----------------|----------------------------------------|----------------------|------------|
| Yip et al., 2013 | 2011           | China          | 187                                    | 1.6 (0.3, 3.4)       | 7.55       |
| Chima et al., 2016 | 2016           | Nigeria        | 73                                     | 2.7 (0.6, 4.4)       | 7.03       |
| Desrosiers et al., 2013 | 2007           | USA            | 666                                    | 2.9 (1.6, 4.2)       | 7.63       |
| Larsson et al., 2007 | 2003           | Sweden         | 248                                    | 3.0 (0.9, 5.1)       | 7.48       |
| Tafuri et al., 2011 | 2008           | Italy          | 666                                    | 5.7 (3.9, 7.5)       | 7.55       |
| Donald et al., 2002 | 2002           | Canada         | 424                                    | 7.5 (5.0, 10.0)      | 7.39       |
| Bender et al., 2005 | 1996           | Iceland        | 1181                                   | 9.1 (7.5, 10.7)      | 7.58       |
| Olczewski et al., 2010 | 2008           | Poland         | 969                                    | 10.9 (8.9, 12.9)     | 7.51       |
| Melaku et al., 2014 | 2012           | Ethiopia       | 127                                    | 12.6 (6.8, 18.4)     | 6.24       |
| Young et al., 2018 | 2010           | Ireland        | 439                                    | 14.6 (11.3, 17.9)    | 7.16       |
| Hoopes et al., 2018 | 2012           | USA            | 1067                                   | 15.9 (13.7, 18.1)    | 7.46       |
| Dei et al., 2004 | 2002           | Italy          | 104                                    | 17.0 (9.8, 24.2)     | 5.63       |
| Kalipolitis et al., 2003 | 2000           | Greece         | 164                                    | 34.1 (26.8, 41.4)    | 5.61       |
| Wang et al., 2007 | 2002           | China          | 92                                     | 35.9 (26.1, 45.7)    | 4.58       |
| Tsitsika et al., 2014 | 2010           | Greece         | 60                                     | 51.9 (39.3, 64.5)    | 3.60       |
| Overall (95% CI) |                |                |                                        | 12.7 (9.4, 15.9)     | 100.00     |

Heterogeneity chi-squared = 346.84, d.f. = 14 (p < 0.001), I-squared = 96.0%
Test for overall effect Z= 7.54 (p < 0.001)

**Figure 8.** Studies on use of withdrawal by sexually active unmarried women worldwide.

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| Study          | Year of survey | Sample Size | Effect size (95% CI) | Weight (%) |
|---------------|----------------|-------------|----------------------|------------|
| Africa        | 2012           | 807         | 15.8 (13.3, 18.3)    | 4.01       |
| Mota et al., 2007 | 2000           | 3988        | 16.1 (15.0, 17.2)    | 4.02       |
| Doku et al., 2012 | 2008           | 644         | 22.7 (19.5, 25.9)    | 4.00       |
| Mendelson et al., 2015 | 2015         | 3613        | 37.3 (35.7, 38.9)    | 4.02       |
| Chima et al., 2016 | 2016           | 179         | 40.8 (33.6, 48.0)    | 3.89       |
| William et al., 1996 | 1996           | 829         | 78.4 (75.6, 81.2)    | 4.00       |
| Subtotal (I-squared = 99.7%, P < 0.001) | | | 35.2 (17.8, 52.5) | 23.94 |
| Europe        | 2010           | 568         | 10.6 (8.1, 13.1)     | 4.01       |
| Young et al., 2018 | 2010           | 2071        | 21.2 (19.4, 23.0)    | 4.02       |
| Narrig et al., 1996 | 1996           | 2075        | 52.6 (50.5, 54.7)    | 4.01       |
| Kalipolitis et al., 2000 | 2000          | 297         | 55.2 (49.5, 60.9)    | 3.94       |
| Olczewski et al., 2008 | 2008          | 1478        | 65.6 (63.2, 68.0)    | 4.01       |
| Larsson et al., 2003 | 2003           | 331         | 75.0 (70.3, 79.7)    | 3.97       |
| Coronado et al., 2017 | 2014          | 1423        | 81.6 (79.6, 83.6)    | 4.01       |
| Bender et al., 1996 | 1996           | 1430        | 82.6 (80.6, 84.6)    | 4.02       |
| Tafuri et al., 2011 | 2008           | 760         | 87.6 (85.3, 89.9)    | 4.01       |
| Subtotal (I-squared = 99.8%, P < 0.001) | | | 59.1 (39.4, 78.8) | 36.00 |
| North America  | 2015           | 6317        | 35.5 (34.3, 36.7)    | 4.02       |
| Donald et al., 2002 | 2002           | 922         | 46.0 (42.8, 49.2)    | 4.00       |
| Subtotal (I-squared = 97.2%, P < 0.001) | | | 40.6 (30.4, 50.9) | 8.02 |
| South America  | 2014           | 74589       | 22.6 (22.3, 22.9)    | 4.03       |
| Subtotal (I-squared = 7%, P < 0.001) | | | 22.6 (22.3, 22.9) | 4.03 |
| Asia          | 2013           | 9052        | 10.1 (9.5, 10.7)     | 4.02       |
| Li et al., 2006 | 2006           | 2365        | 17.9 (16.4, 19.4)    | 4.02       |
| Wang et al., 2007 | 2007           | 503         | 18.5 (14.9, 21.7)    | 3.99       |
| Lu et al., 2012 | 2008           | 831         | 21.4 (18.6, 24.2)    | 4.00       |
| Yip et al., 2011 | 2011           | 532         | 35.2 (31.1, 39.3)    | 3.98       |
| Allen et al., 2003 | 2003           | 832         | 43.1 (39.7, 46.5)    | 3.99       |
| Subtotal (I-squared = 99.2%, P < 0.001) | | | 24.2 (15.6, 32.9) | 24.02 |
| Oceania       | 2007           | 1015        | 54.6 (51.5, 57.7)    | 4.00       |
| Subtotal (I-squared = 7%, P < 0.001) | | | 54.6 (51.5, 57.7) | 4.00 |
| Overall (95% CI) |                |             | 41.9 (34.2, 49.6)    | 100.00     |

Heterogeneity chi-squared = 346.84, d.f. = 14 (p < 0.001), I-squared = 96.0%
Test for overall effect Z= 7.54 (p < 0.001)

**Figure 9.** Estimated prevalence of premarital sexual intercourse among women from Africa, Europe, North America, South America, Asia and Oceania (25 studies), 1999 to 2018.
inadequate information about sexuality or SRH, which prevents them from adopting safer pregnancy prevention strategies and other good reproductive health practices. Another systematic review of 15 studies covering 9 African countries showed high prevalence of premarital sexual intercourse and low contraceptive use among young girls and women aged 10 to 24 years. These results from low- and middle-income countries are similar to ours, suggesting that our results from 37 studies in 19 countries in Africa, Asia, Europe, North America, South America, and Oceania may provide reliable insights into SRH practices among unmarried women. Our analysis also extends the literature by providing global insights into rates of use of specific contraceptive methods. All these findings call for greater attention and investment in appropriate SRH education for unmarried adolescents.

4.4. Meaning of the study

Despite its limitations, our study is the first meta-analysis of CPR and the rates of use of highly prevalent contraceptive methods among unmarried women globally. The findings from this global study help us understand the contraceptive practices, and by extension the reproductive health practices, of unmarried women worldwide over the past 20 years. Our study found persistent use of ineffective contraceptive methods or no contraception at all, as well as a relatively high prevalence of premarital sex, at least in some regions. These findings highlight the need for government and civil society to step up efforts to sensitize unmarried women and their partners to SRH and help them improve their SRH behaviors.

4.5. Unanswered questions and future research

This study raises at least three questions. First, we were unable to separate data on unmarried adolescents from those on unmarried young women, and studies suggest a global increase in premarital sex and unwanted pregnancy among adolescents in recent years. Further work should focus on premarital sexual intercourse and contraceptive practices among unmarried adolescent women. Second, further work should examine SRH practices and contraceptive use among unmarried women in regions where such research is sorely lacking, that is, Eastern Europe, North Africa, the Middle East, and most of Latin America. Third, studies of particularly large countries, such as USA and China, may uncover geographical variations in contraceptive practices that are important for guiding interventions and policy.

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