Pregnancy intention and contraceptive use among married and unmarried women in Japan

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**Objectives:** To elucidate the patterns of contraceptive use in both married and unmarried women in Japan; and to examine which factors are associated with using no or unreliable contraceptives while adjusting for pregnancy intention.

**Methods:** Using cross-sectional data from the Biodemography Project conducted in Japan in 2014, we analyzed current contraceptive behavior and pregnancy intention among 1,746 (1,361 married and 385 unmarried; aged 20–44 years old) women with a male partner.

**Results:** Sixty-four percent of married and 30% of unmarried women did not have current or future pregnancy intention, among whom only 39% and 47% respectively were using reliable contraceptives, i.e. consistent users of either condoms and/or oral contraceptives. In a multivariable logistic regression analysis, future pregnancy intention (vs. current pregnancy intention) and university level education (vs. high school or less) were significantly associated with lower odds ratio of using unreliable/no contraception for both married and unmarried women. While having intention not to become pregnant was associated with significantly lower odds ratio of using no or unreliable contraceptives in married women, such association was not found in the unmarried. Among unmarried women older age was significantly associated with unreliable/no contraceptive use.

**Conclusions:** Unreliable/no contraceptive use is common among both married and unmarried women in Japan even for those with no current pregnancy intention. Further research is needed to determine whether they are at increased risk of unintended pregnancy.

**Key words:** Japan; unintended pregnancy; contraceptive use; marital status; internet survey

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**I BACKGROUND**

Unfulfilled pregnancy intentions, i.e. unintended pregnancy and infertility, potentially reduce quality of life for both women and men (Monga et al., 2004; Schwartz et al., 2008). Of the 208 million pregnancies worldwide in 2008, 41% were estimated to be unintended (Singh et al., 2010). Unintended pregnancy, often related to using no or unreliable contraception, is associated with worse antenatal care (Gipson et al., 2008). On the other hand, in 2010, 1.9% of women worldwide aged 20–44 years of age were estimated to have primary infertility and 10.5% secondary infertility (Mascarenhas et al., 2012). These facts suggest that despite recent developments in family planning and medicine, there are still large numbers of women across the world whose pregnancy intentions are not ful-

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While numerous couples in Japan suffer from infertility, unintended pregnancy is also widespread in this setting. Japan is one of the lowest low fertility countries in the world, where the age of having a first child continues to rise (National Institute of Population and Social Security Research, 2014). According to a national survey of married women in Japan in 2010, more than half of childless women had ever worried about their own infertility (National Institute of Population and Social Security Research, 2011). On the other hand, results from a survey targeting 35-49-year old women in Yamagata, Japan, showed that 46.2% of women had experienced unintended pregnancy (Goto et al., 2002). Other data also suggest that unintended pregnancy is common in Japan. For example, data from the 2010 nation-wide survey indicated that 50% of couples who married when the wife was younger than 25 years old reported that pregnancy was the reason for getting married (National Institute of Population and Social Security Research, 2010), which highlights the phenomenon of non-marital conceptions and bridal pregnancy, i.e. shotgun marriages, in Japan (Raymo and Iwasawa, 2008). Considering that out-of-wedlock childbearing is very rare (Hertog and Iwasawa, 2011) and that Japanese couples do not usually plan to have their first child before marriage, the majority of these pre-marital pregnancies can be considered as unintended ones. Therefore, unintended pregnancy might have a significant impact on fertility trends in Japan, even though some of these pregnancies end in induced abortion (Sato and Iwasawa, 2006).

Unintended pregnancy is closely linked to a lack of reliable contraceptive use. Goto et al. (2002) showed that in Yamagata, Japan, 15.4% of pre-menopausal women (among whom 96.3% were married) with no pregnancy intention were not using any form of contraception. There seems therefore to be a gap between not wanting to become pregnant and using appropriate contraception. Although unintended pregnancy is common in Japan, to the best of our knowledge, there have been no previous studies on pregnancy intention and contraceptive use that have focused on both married and unmarried women in this setting.

Trend of unintended pregnancy is closely linked to the fact that use of oral contraceptives is still not common in Japan. While low-dose combined oral contraceptives were approved for market purchase by the Ministry of Health, Labor and Welfare in Japan in 1999 (Matsumoto et al. 2007), in a 2002 survey among a nationally representative sample of 696 women aged 16 to 49 years only 3.5% of participants answered that they were currently using oral contraceptives (Japan Family Planning Association Inc., 2014). In another national survey conducted in 2005, only 1.4% of unmarried women who had ever had sex used oral contraceptive pills at last sexual intercourse (National Institute of Population and Social Security, 2014). In a more recent survey in 2011 that targeted students, the proportion of female students who were using oral contraceptives among those always using any form of contraception was 2.3% in high school and 11.3% in university (Tsuchida, 2013). It has also been noted that Japanese women tend to use oral contraceptives to control menstrual pain and/or hormonal abnormalities, rather than to avoid becoming pregnant (Matsumoto and Yamabe, 2010). The present study provides updated information on oral contraceptive use in both married and unmarried women in Japan.

The aim of the present study was twofold: first, to elucidate patterns of contraceptive use in relation to pregnancy intention while targeting both married and unmarried women in Japan and, second, to examine which factors are associated with
using no or unreliable contraception while adjusting for pregnancy intention.

II MATERIALS AND METHODS

1. The Biodemography Project

A web-based questionnaire survey called the Biodemography Project was conducted in March 2014 among women residing across Japan. The primary purpose of the project was to estimate fecundity, i.e. the biological ability to produce an offspring, and its covariates by applying the current duration approach (Slama et al. 2006; 2012; Thoma et al. 2013). The choice of questions to be included in the survey questionnaire was based on previous literature (Slama et al. 2006; 2012; Thoma et al. 2013). The respondents were recruited from a group of research participants registered under the “Cue monitor” system with a Japanese market research company, Intage inc. N = 10,467 women whose ages ranged between 20 and 44 years old (according to the database) were asked to complete an online survey through email. In total, 3,214 completed the questionnaire (a 30.7% response rate).

The questionnaire included questions on basic demographic and socioeconomic characteristics, reproductive history (including sterilization and infertility treatment of the woman and her current partner), frequency of sexual intercourse, contraceptive use, and pregnancy intention. For each form of contraception, i.e. condom, oral contraceptive, emergency contraception (the morning after pill), withdrawal, calendar, basal body temperature, or other method, respondents were asked to select one of five answer choices, i.e. always use, sometimes use, stopped using, never used, or do not know. Long-acting methods, e.g. the IUD, implant, and injectable, were included in other methods, because they are not commonly used in Japan. Women were also asked to select one of the following answers on pregnancy intention at the time of the survey; currently want to become pregnant, want to become pregnant within one year from now, want to become pregnant after one year from now, do not want to become pregnant currently or in the future, or do not know.

Women’s age was calculated using their reported year and month of birth, which differed slightly from the registered age in the original Intage inc database. We used the calculated age for statistical analyses, which resulted in 18 respondents whose calculated ages were either below 20 or older than 44 years old being excluded (Supplementary Fig. 1). The distribution of partnership status and education level by age group was compared between the present sample and the national population using data from the 2010 Population Census (Ministry of Internal Affairs and Communications, 2015) and the National Survey on Fertility 2010 (National Institute of Population and Social Security Research, 2011).

Respondents who were not at risk of pregnancy, i.e. currently pregnant or sterilized, or gave no information on condom or oral contraceptive use were also excluded from the statistical analysis (Supplementary Fig. 1).

2. Statistical analysis

We characterized the study participants in terms of pregnancy intention, contraceptive behavior, frequency of sexual intercourse (1+ day per week; 1 to 3 days per month; 1 to 5 days per 6 months; less than 1 day per 6 months; do not know/do not want to answer), infertility treatment/consultation (ever, never, or do not know/do not want to answer), and basic sociodemographic data including education, age (20–24, 25–29, 30–34, 35–39, 40–44 years old), and number of children (0, 1, or 2+), past experience of induced abortion (none, any, do not know/do not want to answer). Educational background
was divided into three categories, i.e. high school or less, junior college or vocational school, and university or higher. The participants who were enrolled in school at the time of the survey were categorized according to the type of their current school.

Contraceptive use was divided into three categories, i.e. no contraceptive use, unreliable contraceptive use, or reliable contraceptive use. A woman was categorized as using no contraception if she answered that she had either stopped using or never used all six types of contraception, i.e. a condom, oral contraceptives, emergency contraception (the morning after pill), withdrawal, calendar, basal body temperature, and if she was not always using any “other method”. If a woman reported that she always used either a condom or oral contraceptive pill, then she was categorized as using reliable contraception. While estimated proportion of women experiencing and unintended pregnancy within the first year of perfect use is higher for condom (2%) compared to oral contraceptive (0.3%) (Trussell, 2004), in the present study if women were always using either of them they were defined to use reliable contraceptives. Those women who were not in either the reliable or no contraceptive groups were categorized as unreliable contraceptive users.

The five categories of pregnancy intention in the original questionnaire were subsequently reduced to three for statistical analysis. If a woman wanted to become pregnant at that time or within one year, she was categorized as wanting to become pregnant “soon”, whereas if a woman wanted to become pregnant after one year, she was categorized as wanting to become pregnant “in the future”. If a woman answered that she did not want to become pregnant or did not know, she was categorized as not wanting to become pregnant (“no” intention of becoming pregnant currently or in the future). Since a recent literature emphasized the role of births that are neither intended nor unintended (Raymo et al. 2014), we conducted a sensitivity analysis in which pregnancy intention was categorized into four, i.e. “soon”, “in the future”, “no”, and “do not know” for the logistic regression analyses described below.

To elucidate which subgroup of women were more likely to use unreliable/no contraception, logistic regression analyses were conducted while adjusting for pregnancy intention at the time of the survey. Odds ratios (OR) and 95% confidence intervals (CI) were calculated for unreliable/no contraceptive use vs. reliable contraceptive use for married and unmarried women separately using bivariable and multivariable models. For both married and unmarried women frequency of intercourse was categorized into four groups by merging two categories (“1 to 5 days per 6 months” and “less than 1 day per 6 months”) into one (“less than 1 day per month”) for the logistic regression analyses. In addition, for married women number of children was categorized as 0, 1, or 2+, while for unmarried women it was either none or any. In the multivariable model for the unmarried women infertility consultation was not included due to small sample size. The level of statistical significance was set at p<0.05.

Ethical approval for the study was obtained from the Ethics Committee of the Graduate School of Medicine, the University of Tokyo. Statistical analyses were conducted using R (version 3.0.2; R Project for Statistical Computing, Vienna, Austria).

### RESULTS

After exclusions the final number of women included in the analysis was 1,746 (1,361 married and 385 unmarried but with a male partner) (Supplementary Fig. 1).

The participants resided in all the 47 prefectures of Japan. Compared to the national population, the
present participants showed higher proportion married especially in younger age groups (Table 1) and slightly higher levels of education (Table 2). Sixty-four percent of married and 30% of unmarried women had no pregnancy intention either then or in the future, among whom 18% and 7% respectively were not using any contraception (Table 3). The proportion of reliable contraceptive users was low among both married (39%) and unmarried (47%) women with no pregnancy intention. The proportion of women who wanted to become pregnant at that time was similar in the two groups, i.e. 26% among married and 24% among unmarried women, among whom 38% and 4% respectively had previously had a consultation for infertility and/or treatment.

The types of contraception used differed between married and unmarried women, especially those with a future pregnancy intention. Thirty-five percent of married and 60% of unmarried women always used a condom, while consistent oral contraceptive use was 4% among married and
Table 3  Pregnancy intention and age, education, reproductive history and current contraceptive use among married (N=1,361) and unmarried (N=385) women in Japan.

| Education* | Married (N=1,361) | Unmarried (N=385) |
|------------|-------------------|-------------------|
|            | Pregnancy intention | Pregnancy intention |
|            | Soon (26%) | In future (10%) | None (64%) | Total (100%) | Soon (24%) | In future (46%) | None (30%) | Total (100%) |
| Total      | 357 (26%) | 139 (10%) | 865 (64%) | 1,361 (100%) | 91 (24%) | 177 (46%) | 117 (30%) | 385 (100%) |
| High school | 88 (25%) | 31 (22%) | 298 (34%) | 417 (31%) | 26 (29%) | 35 (20%) | 35 (30%) | 96 (25%) |
| Junior college / vocational school | 142 (40%) | 53 (38%) | 318 (37%) | 513 (38%) | 31 (34%) | 45 (25%) | 31 (26%) | 107 (28%) |
| University  | 127 (36%) | 55 (40%) | 249 (29%) | 431 (32%) | 34 (37%) | 97 (55%) | 51 (44%) | 182 (47%) |
| Age (y)     |                |                |                |              |                |                |              |              |
| 20-24       | 9 (3%) | 6 (4%) | 9 (1%) | 24 (2%) | 9 (10%) | 58 (33%) | 21 (18%) | 88 (23%) |
| 25-29       | 73 (20%) | 54 (39%) | 40 (5%) | 167 (12%) | 18 (20%) | 70 (40%) | 11 (9%) | 99 (26%) |
| 30-34       | 114 (32%) | 45 (32%) | 134 (15%) | 293 (22%) | 32 (35%) | 32 (18%) | 23 (20%) | 87 (23%) |
| 35-39       | 107 (30%) | 27 (19%) | 298 (34%) | 432 (32%) | 24 (26%) | 13 (7%) | 29 (25%) | 66 (17%) |
| 40-44       | 54 (15%) | 7 (5%) | 384 (44%) | 445 (33%) | 8 (9%) | 4 (2%) | 33 (28%) | 45 (12%) |
| Number of children |                     |                     |                     |              |                     |                     |              |              |
| 0          | 194 (54%) | 52 (37%) | 189 (22%) | 435 (32%) | 75 (82%) | 168 (95%) | 99 (85%) | 342 (89%) |
| 1          | 125 (35%) | 62 (45%) | 160 (18%) | 347 (25%) | 12 (13%) | 5 (3%) | 6 (5%) | 23 (6%) |
| 2-          | 38 (11%) | 25 (18%) | 516 (60%) | 579 (43%) | 4 (4%) | 4 (2%) | 12 (10%) | 20 (5%) |
| Induced abortion |                     |                     |                     |              |                     |                     |              |              |
| None       | 328 (92%) | 123 (88%) | 748 (86%) | 1199 (88%) | 74 (80%) | 172 (93%) | 142 (89%) | 339 (88%) |
| Any        | 26 (7%) | 15 (11%) | 110 (13%) | 151 (11%) | 13 (12%) | 4 (3%) | 13 (11%) | 44 (11%) |
| Do not know/ do not want to answer | 3 (1%) | 1 (1%) | 7 (1%) | 11 (1%) | 2 (2%) | 0 (0%) | 0 (0%) | 2 (1%) |
| Infertility consultation/ treatment |                     |                     |                     |              |                     |                     |              |              |
| Ever       | 134 (38%) | 12 (9%) | 120 (14%) | 266 (20%) | 4 (4%) | 5 (3%) | 3 (3%) | 12 (3%) |
| Never      | 211 (59%) | 120 (86%) | 723 (84%) | 1,054 (77%) | 82 (87%) | 167 (94%) | 108 (92%) | 357 (93%) |
| Do not know/ do not want to answer | 12 (3%) | 7 (5%) | 22 (3%) | 41 (3%) | 8 (9%) | 5 (3%) | 6 (5%) | 16 (4%) |
| Current contraceptive use |                     |                     |                     |              |                     |                     |              |              |
| None       | 123 (34%) | 18 (13%) | 153 (18%) | 294 (22%) | 8 (9%) | 7 (4%) | 8 (7%) | 23 (6%) |
| Unreliable | 199 (56%) | 67 (48%) | 373 (43%) | 649 (47%) | 44 (48%) | 48 (27%) | 54 (46%) | 146 (38%) |
| Reliable   | 35 (10%) | 54 (39%) | 339 (39%) | 428 (31%) | 39 (43%) | 122 (69%) | 55 (47%) | 216 (56%) |
| Frequency of sexual intercourse |                     |                     |                     |              |                     |                     |              |              |
| 1 day per week | 85 (24%) | 20 (14%) | 103 (12%) | 208 (15%) | 30 (33%) | 56 (32%) | 25 (21%) | 111 (29%) |
| 1 to 3 days per month | 134 (38%) | 45 (32%) | 244 (28%) | 423 (31%) | 30 (33%) | 70 (40%) | 41 (35%) | 141 (37%) |
| 1 to 5 days per 6 months | 45 (13%) | 21 (15%) | 141 (16%) | 207 (15%) | 11 (12%) | 25 (14%) | 18 (15%) | 54 (14%) |
| Less than 1 day per 6 months | 56 (16%) | 41 (29%) | 270 (31%) | 367 (27%) | 4 (4%) | 3 (2%) | 14 (12%) | 21 (5%) |
| Do not know/ do not want to answer | 37 (10%) | 12 (9%) | 107 (12%) | 156 (11%) | 16 (18%) | 23 (13%) | 19 (16%) | 58 (15%) |

* Highest education completed, or currently enrolled.
11% among unmarried women with a future pregnancy intention (Supplementary Table 1).

In the bivariable logistic regression analysis, future pregnancy intention was significantly associated with lower odds ratio of using unreliable or no contraception for both married (OR 0.17, 95% CI 0.10–0.28) and unmarried (OR 0.34, 95% CI 0.20–0.57) women (Table 4). On the other hand, having no pregnancy intention was associated with significantly reduced odds ratio of using reliable or no contraception for married, but not for unmarried women. In married women never having had an infertility consultation/treatment was associated with lower odds for using unreliable/no contraception (OR 0.46, 95% CI 0.30–0.69) (Table 4). For unmarried women lower level education and higher age were both significantly associated with a higher OR for using unreliable/no contraception.

In the multivariable logistic regression analysis, university-level education was significantly nega-

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**Table 4** Unreliable/no contraception (vs. reliable contraception) estimated by bivariable and multivariable logistic regression analysis for married (N=1,361) and partnered (N=385) Japanese women.

|                      | Married (N=1,361) |          |          | Unmarried (N=385) |          |          |
|----------------------|-------------------|----------|----------|-------------------|----------|----------|
|                      | Bivariable        |          |          | Multivariable     |          |          |
|                      | OR 95% CI         | OR 95% CI|          | OR 95% CI        | OR 95% CI|
| Pregnancy intention (Ref: Soon) |                      |          |          |                  |          |          |
| In future            | 0.17 0.10–0.28    | 0.21     | 0.13–0.35 | 0.34 0.20–0.57   | 0.47     | 0.26–0.84|
| None                 | 0.17 0.11–0.24    | 0.17     | 0.11–0.26 | 0.85 0.49–1.47   | 0.75     | 0.41–1.38|
| Education* (Ref: High school or less) |                      |          |          |                  |          |          |
| Junior college/vocational school | 0.93 0.70–1.23 | 0.77     | 0.57–1.03 | 0.65 0.37–1.13   | 0.71     | 0.39–1.29|
| University           | 0.91 0.68–1.22    | 0.72     | 0.52–0.98 | 0.34 0.20–0.56   | 0.49     | 0.28–0.87|
| Age (y) (Ref: 20–24) |                      |          |          |                  |          |          |
| 25–29                | 1.67 0.68–3.99    | 1.77     | 0.66–4.63 | 1.02 0.55–1.90   | 0.99     | 0.52–1.89|
| 30–34                | 1.56 0.65–3.62    | 1.75     | 0.67–4.50 | 1.74 0.94–3.25   | 1.15     | 0.59–2.26|
| 35–39                | 1.68 0.71–3.85    | 2.46     | 0.95–6.31 | 2.91 1.51–5.70   | 1.66     | 0.80–3.49|
| 40–44                | 1.45 0.61–3.31    | 2.45     | 0.94–6.31 | 5.27 2.45–11.9  | 3.04     | 1.29–7.45|
| Number of children (Ref: 0) |                      |          |          |                  |          |          |
| 1                    | 1.00 0.72–1.38    | 1.15     | 0.81–1.64 | 3.82 1.94–7.98   | 1.50     | 0.67–3.50|
| 2+                   | 0.51 0.39–0.67    | 0.85     | 0.62–1.17 | NA NA NA         | 1.62–6.25| 1.80     | 0.84–3.95|
| Induced abortion (Ref: None) |                      |          |          |                  |          |          |
| Any                  | 0.83 0.58–1.19    | 0.93     | 0.63–1.37 | 3.11 1.62–6.25   | 1.80     | 0.84–3.95|
| Infertility consultation/treatment (Ref: Ever) |                      |          |          |                  |          |          |
| Never                | 0.31 0.22–0.45    | 0.46     | 0.31–0.67 | 0.55 0.16–1.77   | NA NA    | NA NA    |
| Do not know/do not want to answer | 0.24 0.12–0.50 | 0.29     | 0.13–0.64 | 0.43 0.09–1.94   | NA NA    | NA NA    |
| Frequency of sexual intercourse (Ref: 1 day/week) |                      |          |          |                  |          |          |
| 1 to 3 days per month | 0.73 0.50–1.05    | 0.77     | 0.52–1.14 | 1.03 0.62–1.70   | 1.08     | 0.50–1.82|
| Less than 1 day per month | 0.88 0.62–1.25 | 1.07     | 0.72–1.58 | 1.09 0.60–1.96   | 0.95     | 0.50–1.82|
| Do not know/do not want to answer | 0.69 0.44–1.09 | 0.84     | 0.51–1.39 | 0.99 0.52–1.89   | 0.96     | 0.48–1.90|

*Highest education completed, or currently enrolled.
tively associated with unreliable/no contraception for both married and unmarried women (Table 4). Number of children was not significantly associated with unreliable/no contraceptive use for either married or unmarried women.

The results of the bivariable and multivariable logistic regression analysis remained similar when “do not know” pregnancy intention was separated from “none” category and put into the regression models (Supplementary Table 2).

**IV DISCUSSION**

The present study is the first to report detailed information on pregnancy intention and contraceptive use simultaneously among both married and unmarried women in Japan. The data showed that a significant proportion of women were using unreliable or no contraception, even without pregnancy intention. Among those who did not intend to become pregnant then or in the future, only 39% of married and 47% of unmarried women were using reliable contraception. We also found that pregnancy intention was not limited to married women. Pregnancy intention within one year was reported by 24% of unmarried women, which was comparable to the figure (26%) among married women. Unreliable or no contraceptive use was commonplace among the study population. Although only 6% of unmarried women stated that they were using no contraceptives, 38% of them reported using unreliable contraceptive methods. Among married women the proportion using unreliable contraception was as high as 47%. The high percentage of women using unreliable contraceptives in the present study can partly be attributed to inconsistent condom use. In Japan it is common to combine rhythm methods and condom use, i.e. condoms are used only during the presumed fertile period, and to use induced abortion in case of contraceptive failure (Sato, 2007). Based on US data it has been estimated that 15% of women experience an unintended pregnancy within the first year of typical (i.e. imperfect) male condom use (Trussell, 2004). While there is no such estimate based on Japanese data, it is probable that imperfect contraceptive use is closely related to the trends in unintended pregnancy and thus the risk of unintended pregnancy associated with such contraceptive use needs to be further investigated in future studies.

The observed low prevalence of reliable contraceptive use is closely linked to the low proportion of oral contraceptive users in the present sample. The proportion is lower compared to that in many of the developed and developing countries in the world; the proportion of partnered (including both married and unmarried) women who use oral contraceptives has been estimated as 17.7% for developed and 7.5% for developing regions (United Nations, 2013). Even with a low prevalence, we found that oral contraceptive use was more common among unmarried women in the present study; 10% of unmarried but only 2% of married women answered that they always used oral contraceptives. Overall, use of condom, rhythm, and withdrawal was more common among the present participants compared to that in other developed and developing regions, while use of oral contraceptive and IUD was less common (Supplementary Table 1) (United Nations, 2013). As for the analysis of factors relating to reliable contraceptive use, it may also be informative to analyze consistent condom and pill use separately, because the former is more dependent on male’s decision, while the latter can be done according to female’s decision. However, small sample size of the present study did not allow us to conduct such analysis and it should be done in future studies.

It is notable that despite the low prevalence of out–of–wedlock childbearing in Japan (Hertog and Iwasawa, 2011), 24% of unmarried women stated
that they wanted to become pregnant within one year. It suggests that even unmarried women have a high desire to give birth, if the economic and social circumstances are favorable and that fertility trends might not only be affected by married women's pregnancy intentions, but also by unmarried women's intentions. This finding may also suggest possibility that "unintended" pregnancy resulting in shotgun marriage is not totally unintended, rather women somehow "intend" to become pregnant and get married. Some of them may had already been engaged, while others may have expected pregnancy to happen to make partner decide to marry her. While there is no previous studies on pregnancy intention of unmarried Japanese women, the supposition should be tested in future studies while taking into account that many of out-of-wedlock pregnancies result in induced abortion.

For both married and unmarried women higher education was significantly associated with reliable contraceptive use, which is consistent with previous finding in the US (Upson et al. 2010; Wu et al. 2008). On the other hand, frequency of sexual intercourse was not significantly associated with contraceptive use in the present sample, while less frequent intercourse tends to be associated with the use of condom in a nationally representative US women (Frost and Darroch, 2004).

Among those women without pregnancy intention, fecundity, i.e. the biological ability to produce offspring, may have been associated with contraceptive use. Specifically, among unmarried women unreliable/no contraceptive use was significantly associated with older age. It can be hypothesized that younger unmarried women who use unreliable/no contraceptives are more likely to have become pregnant, which often results in either marriage with pre-marital pregnancy, induced abortion, and/or change in contraceptive behavior. Older women are less likely to have become pregnant and thus remain unmarried. Among married women past experience of infertility consultation/treatment was significantly associated with higher odds of unreliable/no contraceptive use. It can be speculated that those women who regard themselves as being unlikely to become pregnant may be less likely to use reliable contraceptives. However, the actual risk of unintended pregnancy among these presumably subfecund women could not be determined in the present study and needs to be examined in future studies. Additionally, risks of acquiring sexually transmitted diseases should also be taken into consideration when we examine the possible risks and benefits associated with various contraceptive behaviors.

This study had several limitations. Participants were not randomly selected from a nationally representative sample, but selected from registered individuals with a marketing research company. Nonetheless, the distribution of educational attainment and partnership status as well as the patterns of contraceptive use observed among the present participants were similar to those found in previous studies of nationally representative samples. Low response rate (30.7%) is not ideal, but still comparable to the response rates (20–40%) often reported in community-based mail surveys in Japan (Sakurai and Jacobson, 2010). Considering that we were able to obtain sensitive information through the web-based survey, we believe that it was the best strategy to obtain detailed information on pregnancy intention and contraceptive use of Japanese women. In future studies information on pregnancy intention of their partners could also be collected by including them in a survey. It is also possible that as this study used a cross-sectional design respondents' answers may have been affected by recall bias. Future research should employ a prospective design with a more representative sam-
Unreliable/no contraceptive use is common among both married and unmarried women in Japan even among those with no pregnancy intention, while this study suggests that lower-educated women are more likely to use unreliable/no contraceptives regardless of marital status. Further studies are needed to determine which subgroups of women are at increased risk of unintended pregnancy.

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Supplementary Fig. 1. Flow diagram of sampling selection and final number of participants included in the analysis. The Biodemography Project 2014.

Total number of women contacted N=10,467

Response rate 30.7%

Completed questionnaire survey N=3,214

Aged <20 or >44 years old N=18

Aged 20-44 years old N=3,196

Had a male partner N=2,414

No male partner N=782

Not currently pregnant N=2,276

Currently pregnant N=138

Woman or her partner sterilized N=84

No menstruation in the past 6 months N=198 (including N=3 primary amenorrhea women)

Had not been sterilized N=2,192

Had at least one menstruation in the past 6 months N=1,994

Information on condom use N=1,762

No information on condom use N=232

Information on oral contraceptive use N=1,746

No information on oral contraceptive use N=16

Married N=1,361

Non-married N=385
### Supplementary Table 1  Current contraceptive use by pregnancy intention among married and unmarried Japanese women.

|                 | Married (N=1,361) | Unmarried (N=385) |
|-----------------|------------------|-------------------|
|                 | Pregnancy intention | Total | Pregnancy intention | Total |
|                 | Soon | In future | None | Total | Soon | In future | None | Total |
| Total           | 357 (26%) | 139 (10%) | 865 (64%) | 1,361 (100%) | 91 (24%) | 177 (46%) | 117 (30%) | 385 (100%) |
| **Condom**      |       |           |       |          |       |           |       |          |
| Always using    | 31 (9%) | 48 (35%) | 330 (38%) | 409 (20%) | 35 (38%) | 107 (60%) | 42 (36%) | 184 (48%) |
| Sometimes using | 49 (14%) | 35 (25%) | 193 (22%) | 277 (20%) | 17 (19%) | 35 (20%) | 32 (27%) | 84 (22%) |
| Stopped using   | 226 (63%) | 42 (30%) | 232 (27%) | 500 (37%) | 27 (30%) | 27 (15%) | 25 (21%) | 79 (21%) |
| Never used      | 51 (14%) | 14 (10%) | 110 (13%) | 175 (13%) | 12 (13%) | 8 (5%) | 18 (15%) | 38 (10%) |
| Do not know/do not want to answer | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| **Oral contraceptive** |       |           |       |          |       |           |       |          |
| Always using    | 4 (1%) | 6 (4%) | 14 (2%) | 24 (2%) | 4 (4%) | 19 (11%) | 15 (13%) | 38 (10%) |
| Sometimes using | 2 (1%) | 1 (1%) | 2 (0%) | 5 (0%) | 1 (1%) | 1 (1%) | 2 (2%) | 4 (1%) |
| Stopped using   | 32 (9%) | 14 (10%) | 71 (8%) | 117 (9%) | 18 (20%) | 12 (7%) | 10 (9%) | 40 (10%) |
| Never used      | 319 (89%) | 118 (85%) | 778 (90%) | 1215 (89%) | 68 (75%) | 145 (82%) | 90 (77%) | 303 (79%) |
| Do not know/do not want to answer | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| **Emergency pill (morning pill)** |       |           |       |          |       |           |       |          |
| Always using    | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Sometimes using | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (1%) | 0 (0%) | 1 (1%) | 2 (1%) |
| Stopped using   | 5 (1%) | 5 (4%) | 12 (1%) | 22 (2%) | 2 (2%) | 10 (6%) | 8 (7%) | 20 (5%) |
| Never used      | 351 (98%) | 132 (95%) | 850 (98%) | 1333 (98%) | 87 (96%) | 166 (94%) | 105 (90%) | 358 (93%) |
| Do not know/do not want to answer | 1 (0%) | 2 (1%) | 3 (0%) | 6 (0%) | 1 (1%) | 1 (1%) | 3 (3%) | 5 (1%) |
| **Withdrawal**  |       |           |       |          |       |           |       |          |
| Always using    | 16 (4%) | 14 (10%) | 110 (13%) | 140 (10%) | 15 (16%) | 15 (8%) | 17 (15%) | 47 (12%) |
| Sometimes using | 34 (10%) | 29 (21%) | 132 (15%) | 195 (14%) | 15 (16%) | 25 (14%) | 29 (25%) | 69 (18%) |
| Stopped using   | 71 (20%) | 17 (12%) | 116 (13%) | 204 (15%) | 8 (9%) | 20 (11%) | 13 (11%) | 41 (11%) |
| Never used      | 202 (57%) | 69 (50%) | 411 (48%) | 682 (50%) | 47 (52%) | 105 (59%) | 52 (44%) | 204 (53%) |
| Do not know/do not want to answer | 34 (10%) | 10 (7%) | 96 (11%) | 140 (10%) | 6 (7%) | 12 (7%) | 6 (5%) | 24 (6%) |
### Supplementary Table 1  Continued

|                | Married \((N=1,361)\) |          |          | Total |         |          |          | Total |          |          |          | Total |
|----------------|------------------------|----------|----------|-------|----------|----------|----------|-------|----------|----------|----------|-------|
|                | Soon | In future | None  |       |         | Soon | In future | None  |       |         |         |         |       |
| Calendar       |      |          |       |       |         |       |          |       |       |         |         |         |       |
| Always using   | 53   | 16        | 62    | 131   | (15%)   | 13    | 27        | 12    | 52       | (14%)   |         |       |
| Sometimes using| 52   | 17        | 80    | 149   | (15%)   | 11    | 21        | 16    | 48       | (12%)   |         |       |
| Stopped using  | 56   | 16        | 143   | 215   | (17%)   | 7     | 6         | 6     | 19       | (5%)    |         |       |
| Never used     | 187  | 84        | 555   | 826   | (64%)   | 59    | 120       | 81    | 260      | (68%)   |         |       |
| Do not know/do not want to answer | 9    | 6        | 25    | 40    | (3%)    | 1     | 3         | 2     | 6        | (2%)    |         |       |
| Basal body temperature |        |          |       |       |         |       |          |       |         |         |         |       |
| Always using   | 78   | 11        | 35    | 119   | (9%)    | 9     | 13        | 8     | 30       | (8%)    |         |       |
| Sometimes using| 32   | 11        | 33    | 76    | (6%)    | 10    | 6         | 7     | 23       | (6%)    |         |       |
| Stopped using  | 92   | 35        | 333   | 460   | (34%)   | 20    | 26        | 18    | 64       | (17%)   |         |       |
| Never used     | 150  | 87        | 452   | 689   | (51%)   | 51    | 131       | 81    | 263      | (68%)   |         |       |
| Do not know/do not want to answer | 5    | 0        | 12    | 17    | (1%)    | 1     | 1         | 3     | 5        | (1%)    |         |       |
| Other          |      |          |       |       |         |       |          |       |         |         |         |       |
| Always using   | 6    | 1         | 18    | 25    | (2%)    | 0     | 1         | 2     | 3        | (1%)    |         |       |
| Sometimes using| 6    | 0         | 18    | 24    | (2%)    | 1     | 0         | 1     | 2        | (1%)    |         |       |
| Stopped using  | 8    | 1         | 22    | 31    | (2%)    | 3     | 1         | 1     | 5        | (1%)    |         |       |
| Never used     | 235  | 94        | 590   | 919   | (68%)   | 58    | 124       | 81    | 263      | (68%)   |         |       |
| Do not know/do not want to answer | 102  | 43        | 217   | 362   | (27%)   | 29    | 51        | 32    | 112      | (29%)   |         |       |
Supplementary Table 2  Unreliable/no contraception (vs. reliable contraception) estimated by bivariable and multivariable logistic regression analysis for married (N=1,361) and partnered (N= 385) Japanese women. Pregnancy intention was categorized into four groups instead of three as shown in Table 4.

|                      | Married (N=1,361) |          |          |          | Unmarried (N=385) |          |          |          |
|----------------------|-------------------|----------|----------|----------|-------------------|----------|----------|----------|
|                      | Bivariable        | Multivariable | Bivariable | Multivariable |
|                      | OR 95%CI          | OR 95%CI | OR 95%CI | OR 95%CI | OR 95%CI          | OR 95%CI | OR 95%CI | OR 95%CI | OR 95%CI |
| Pregnancy intention (Ref: Soon) |                   |          |          |          |                   |          |          |          |          |
| In future            | 0.17 0.10-0.28    | 0.21     | 0.13-0.35 | 0.34     | 0.20-0.57         | 0.47     | 0.26-0.83 |          |          |
| None                 | 0.15 0.10-0.22    | 0.14     | 0.09-0.22 | 0.82     | 0.46-1.46         | 0.66     | 0.34-1.27 |          |          |
| Do not know          | 0.50 0.27-0.95    | 0.47     | 0.25-0.91 | 0.95     | 0.39-2.37         | 1.12     | 0.44-2.90 |          |          |
| Education* (Ref: High school) |                   |          |          |          |                   |          |          |          |          |
| Junior college /vocational school | 0.93 0.70-1.23 | 0.76     | 0.56-1.02 | 0.65     | 0.37-1.13         | 0.69     | 0.37-1.26 |          |          |
| University           | 0.91 0.68-1.22    | 0.71     | 0.51-0.97 | 0.34     | 0.20-0.56         | 0.48     | 0.27-0.85 |          |          |
| Age (y) (Ref: 20-24) |                   |          |          |          |                   |          |          |          |          |
| 25-29                | 1.67 0.68-3.99    | 1.68     | 0.63-4.44 | 1.02     | 0.55-1.90         | 0.98     | 0.51-1.88 |          |          |
| 30-34                | 1.56 0.65-3.62    | 1.62     | 0.62-4.19 | 1.74     | 0.94-3.25         | 1.10     | 0.56-2.18 |          |          |
| 35-39                | 1.68 0.71-3.85    | 2.43     | 0.93-6.03 | 2.91     | 1.51-5.70         | 1.63     | 0.78-3.43 |          |          |
| 40-44                | 1.45 0.61-3.31    | 2.46     | 0.94-6.41 | 5.27     | 2.45-11.9         | 3.12     | 1.32-7.67 |          |          |
| Number of children (Ref: 0) |                   |          |          |          |                   |          |          |          |          |
| 1                    | 1.00 0.72-1.38    | 1.19     | 0.83-1.70 | 3.82     | 1.94-7.98         | 1.55     | 0.69-3.61 |          |          |
| 2+                   | 0.51 0.39-0.67    | 0.96     | 0.70-1.33 | NA       | NA                | NA       | NA       |          |          |
| Induced abortion (Ref: None) |                   |          |          |          |                   |          |          |          |          |
| Any                  | 0.83 0.58-1.19    | 0.97     | 0.66-1.43 | 3.11     | 1.62-6.25         | 1.80     | 0.84-3.97 |          |          |
| Infertility consultation/treatment (Ref: Ever) |                   |          |          |          |                   |          |          |          |          |
| Never                | 0.31 0.22-0.45    | 0.48     | 0.32-0.70 | 0.55     | 0.16-1.77         | NA       | NA       |          |          |
| Do not know/do not want to answer | 0.24 0.12-0.50 | 0.30     | 0.14-0.66 | 0.43     | 0.09-1.94         | NA       | NA       |          |          |
| Frequency of sexual intercourse (Ref: 1+ day /week) |                   |          |          |          |                   |          |          |          |          |
| 1 to 3 days per month | 0.73 0.50-1.05    | 0.75     | 0.50-1.12 | 1.03     | 0.62-1.70         | 1.09     | 0.63-1.89 |          |          |
| Less than 1 day per month | 0.88 0.62-1.25 | 1.04     | 0.70-1.54 | 1.09     | 0.60-1.96         | 0.94     | 0.49-1.79 |          |          |
| Do not know/do not want to answer | 0.69 0.44-1.09 | 0.82     | 0.50-1.37 | 0.99     | 0.52-1.89         | 0.96     | 0.48-1.91 |          |          |

* Highest education completed, or currently enrolled.
Pregnancy intention and contraceptive use among married and unmarried women in Japan

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和文抄録

目的: 本研究の目的は,日本の既婚および未婚女性における避妊使用の傾向を明らかにすること,および妊娠企図の影響を調整したうえで,避妊の使用と関連する要因を明らかにすることである.

方法: 2014年に実施した横断調査である,生物人口学プロジェクトにおいて,男性パートナーがいると回答した1746人の女性（うち既婚1361人,未婚385人；年齢20-44歳）の避妊使用と妊娠企図（調査時点に妊娠を希望；将来妊娠を希望；妊娠を望んでいない）について解析を実施した。

結果: 既婚女性の64％,未婚女性の30％は調査時点あるいは将来も妊娠を希望していなかった。しかしこのうちわずか各39％と47％の女性しか,確実な避妊法（コンドームあるいは経口避妊薬の継続的な使用）を実施していなかった。多変量ロジスティック回帰分析によると,既婚および未婚の女性の双方について,将来妊娠を希望していること（vs. 調査時点で妊娠を希望していること）および大学卒業以上の学歴（vs. 高校卒業あるいはそれ以下）は,確実な避妊法の実施と有意な正の関連を示した。既婚女性に限ってみると,妊娠を望んでいなかった女性は,調査時点で妊娠を希望していた女性と比較して確実な避妊法を実施する傾向が強かった。一方,未婚女性では同様の関連はみられず,年齢が高いほど確実な避妊法を実施する割合が小さくなる傾向がみられた。

結論: 調査時点で妊娠を希望していない場合でも,未婚女性,既婚女性とともに確実な避妊法を実施していない者が多かった。これらの女性がどの程度,望まない妊娠のリスクに晒されているのかについて,今後の調査研究が必要である。