ABSTRACT

Objectives Zika virus (ZIKV) can be sexually transmitted, and ZIKV infection during pregnancy can cause birth defects. Contraception is a medical countermeasure to reduce unintended pregnancy and ZIKV-associated birth defects. We estimated the prevalence of condom use and associated factors among women at risk for unintended pregnancy in Puerto Rico during the 2016 ZIKV outbreak.

Design Secondary analysis of a cross-sectional, population-based, cell-phone survey.

Setting and participants Women, 18–49 years, living in Puerto Rico during July–November 2016. We limited our analytical sample (n=1840) to women at risk for unintended pregnancy, defined as those who were sexually active with a man in the last 3 months and did not report menopause, hysterectomy, current pregnancy or desiring pregnancy.

Outcome measures We estimated the weighted prevalence of any condom use among women at risk for unintended pregnancy. We calculated crude and adjusted prevalence ratios (aPRs) to examine the association between condom use and ZIKV-related factors, stratified by use of more effective versus less effective or no contraception.

Results Overall, 32.7% (95% CI: 30.2% to 35.1%) of women reported any condom use in the last 3 months. Among women using more effective contraception, condom use was higher for women who received ZIKV counselling (aPR: 1.61, 95% CI: 1.15 to 2.25) and those worried about having a child with a ZIKV-associated birth defect (aPR: 1.47, 95% CI: 1.03 to 2.10). Among women using less effective or no contraception, condom use was associated with being worried (aPR: 1.20, 95% CI: 1.01 to 1.43) compared with those not worried about ZIKV infection or with a previous known infection.

Conclusions During the 2016 ZIKV outbreak, one in three women at risk for unintended pregnancy reported any condom use. Counselling to promote consistent and correct condom use may address concerns regarding ZIKV among women of reproductive age, which may differ by use of effective contraception.
and after carefully reviewing all available evidence in April 2016, the Centers for Disease Control and Prevention concluded that ZIKV infection during pregnancy caused neonatal microcephaly and other serious brain anomalies.1–3 Additionally, in Puerto Rico, it was estimated that 5900–10 300 pregnant women would be infected during the initial ZIKV outbreak, and as a result, 100–270 infants may be born with microcephaly in the absence of prevention measures.9

For women of reproductive age (WRA) not desiring pregnancy and living in an area with risk of Zika, contraception is a medical countermeasure to reduce unintended pregnancy and subsequent ZIKV-associated birth defects.1–3 Couples who are not trying to conceive can consider using condoms consistently and correctly during sex to protect against sexual transmission of ZIKV.6 7 A focus group analysis with women in Guatemala reported that most women did not realise that Zika could be sexually transmitted.8 While a previous study estimated the prevalence of condom use among pregnant women,9 less is known about condom use among WRA.

A previous analysis of the survey data used here reported most WRA using some form of contraception (82.8%) during the 2016 ZIKV outbreak.10 In this secondary analysis, we assessed condom use among WRA (18–49 years) living in Puerto Rico during the 2016 ZIKV outbreak and examined the association of condom use with ZIKV-related characteristics, including receiving healthcare provider counselling about ZIKV, worrying about getting infected with ZIKV or worrying about having a baby with a birth defect, stratified by contraceptive use (more effective vs less effective or no contraception).

METHODS
Design, setting and participants
Leveraging the Behavioral Risk Factor Surveillance System11 platform, the Puerto Rico Department of Health conducted a cross-sectional, population-based, cell-phone survey, among women aged 18–49 years living in Puerto Rico during July–November 2016.12 The survey was available in English and Spanish; approximately 99% of respondents completed the Spanish version. Marketing Systems Group, provided the study with randomly generated samples of cell phone numbers. Interviewers varied times and days of the week to include evenings and weekends and repeated calls up to six times if no one answered. Interviewers obtained verbal consent from respondents, and then used WINCATI, a computer-assisted telephone interview software, to administer the survey.11 As previously described in the primary study, the survey comprised 48 questions about demographics, contraception, sexual activity and ZIKV-prevention behaviours. In total, 16 311 individuals answered the phone, 3169 women were eligible, 110 refused and 3059 women participated in the survey (69% response rate).10 To produce estimates that were representative of the population, the data were weighted using raking methodology.12 The raking margins used were based on population estimates available by age and sex from the US Census Bureau’s American Community Survey in Puerto Rico for 2015.12 The data were raked to the population estimates for women aged 18–49 using seven age categories (18–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49) and five marital status categories (married, separated, divorced, widow, never married). The Centers for Disease Control and Prevention determined the survey to be a non-research, public health practice activity during an emergency response.13

Measures
For this secondary analysis, we defined women at risk for unintended pregnancy as those who were sexually active with a man in the last 3 months, and did not report menopause, having had a hysterectomy, current pregnancy or desiring pregnancy. Factors of interest were receiving healthcare provider counselling about ZIKV at any time, worrying about ZIKV infection (very worried/a little or somewhat worried/already had ZIKV/not worried) and worrying about having a child with a ZIKV-associated birth defect (very worried/a little or somewhat worried/not worried). Women were asked, ‘What are you or your spouse or partner using or doing to keep you from getting pregnant?’ Answer options were contraceptive implant, intrauterine device (IUD), shots/injections, birth control pills, contraceptive patch, contraceptive ring, male condoms, diaphragm, female condoms, not having sex at certain times (rhythm or natural family planning) and withdrawal. More effective contraception included sterilisation, implant, IUD, shot, pill, patch, ring while less effective contraception included male/female condom, diaphragm, rhythm method, withdrawal. Only the most effective method reported was recorded in the survey as the current method used to keep from getting pregnant. Women were also asked, ‘When you had sex during the last 3 months, how often did you and your partner use a condom?’. Condom use was measured as every, most, some or none of the time during sex up to six times if no one answered. Interviewers obtained verbal consent from respondents, and then used WINCATI, a computer-assisted telephone interview software, to administer the survey.11 As previously described in the primary study, the survey comprised 48 questions about demographics, contraception, sexual activity and ZIKV-prevention behaviours. In total, 16 311 individuals answered the phone, 3169 women were eligible, 110 refused and 3059 women participated in the survey (69% response rate).10 To produce estimates that were representative of the population, the data were weighted using raking methodology.12 The raking margins used were based on population estimates available by age and sex from the US Census Bureau’s American Community Survey in Puerto Rico for 2015.12 The data were raked to the population estimates for women aged 18–49 using seven age categories (18–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49) and five marital status categories (married, separated, divorced, widow, never married). The Centers for Disease Control and Prevention determined the survey to be a non-research, public health practice activity during an emergency response.13

Statistical analysis
We describe characteristics of women included in our analytical sample. We estimated the weighted prevalence of any condom use for women at risk for unintended pregnancy. Missing data were minimal (≤2.5% missing data), and weighted percentages were estimated excluding missing data. We calculated crude and
adjusted prevalence ratios (aPRs) to examine the association between any condom use and receiving ZIKV counselling, worrying about ZIKV infection (very/a little/somewhat worried vs self-report of already had ZIKV/not worried) and worrying about having a child with a ZIKV-associated birth defect (very/a little/somewhat worried vs not worried). Analyses were conducted in SAS V.9.4 using modified Poisson regression with robust error variance, stratified by use of more effective contraception versus less effective, or no contraception and adjusted for age, education and health insurance. Adjustment variables were determined to be potential confounders a priori based on previous research and the primary analysis.

**Patient and public involvement**
There was no patient or public involvement.

**RESULTS**
We excluded women who were not sexually active or missing information on sexual activity in the last 3 months (n=890), reported menopause or having had a hystere
tomy (n=80), current pregnancy (n=75) and desiring pregnancy (n=174) from our analytical sample (n=1840). Overall, 44.8% (95% CI: 42.4% to 47.3%) of women were 35–49 years, 42.1% (95% CI: 39.7% to 44.6%) had a college degree, 54.0% (95% CI: 51.5% to 56.5%) had Medicaid/public insurance and 44.8% (95% CI: 42.4% to 47.1%) were married, living with, or in a long-term relationship with a man (table 1).

Over half (59.9%, 95% CI: 57.5% to 62.4%) of women reported using a more effective contraceptive method. One-fourth (25.3%, 95% CI: 23.2% to 27.4%) of women reported talking to a healthcare provider about ZIKV. Most women were worried about ZIKV infection (28.4% (95% CI: 26.2% to 30.6%) very worried and 45.4% (95% CI: 42.9% to 47.8%) little/somewhat worried) and having a child with a ZIKV-associated birth defect (59.3% (95% CI: 50.8% to 55.7%) very worried and 9.1% (95% CI: 7.7% to 10.6%) little/somewhat worried). Overall, 32.7% (95% CI: 30.2% to 35.1%) of women reported any condom use. The most common reasons for not using condoms included being in a committed relationship (47.6%, 95% CI: 44.9% to 50.4%), using another contraceptive method (21.5%, 95% CI: 19.3% to 23.7%) and not liking condoms (11.4%, 95% CI: 9.6% to 13.2%).

Among women using more effective contraception, any condom use was higher among women who talked to a healthcare provider about ZIKV (19.2%; aPR: 1.61, 95% CI: 1.15 to 2.25) versus those who did not (12.7%; referent) (table 2).

In this same group, any condom use was higher in women who were worried (18.4%; aPR: 1.47, 95% CI: 1.03 to 2.10) versus not worried (10.3%; referent) about having a child with a birth defect. Among women using less effective or no contraception, any condom use was associated with being worried about ZIKV infection (62.4%; aPR: 1.20, 95% CI: 1.01 to 1.43) compared with those not worried about ZIKV infection or with a previously self-reported ZIKV infection (52.7%; referent).

**DISCUSSION**
One in three women at risk for unintended pregnancy reported any condom use. This finding is similar to another study conducted in Puerto Rico during the ZIKV outbreak that found 22% of pregnant women reported any condom use. This finding is also similar to a 2014 study (pre ZIKV) which noted the need for sexually transmitted infection (STI) prevention education throughout the lifespan in Puerto Rico; which found that only 22% of women ages 21–49 reported condom use during all sexual practices, and was highest (more than 30%) among the youngest women (ages 21–22) who reported vaginal intercourse in the last 3 months. During the ZIKV outbreak, condom use remained low despite the public health prevention strategy for women at risk for unintended pregnancy. This strategy was twofold: (1) promote condom use to prevent sexual transmission of ZIKV and (2) promote use of effective contraception to prevent unintended pregnancy. Because reasons for condom use differed among women using more effective contraception versus those using less effective or no contraception, distinct counselling approaches to promote condom use may be needed.

Among women using more effective contraception, condom use was associated with receipt of ZIKV counselling and concerns about having a child with a birth defect, while concerns of ZIKV infection were associated with condom use among women using less effective or no contraception. Women in the latter group may also benefit from information on effective contraception to prevent unintended pregnancy, if desired. However, women using more effective contraception may be more likely to have routine encounters with the healthcare system for method insertion or for a prescription, which may allow for opportunities for ZIKV prevention counselling especially raising awareness of ZIKV as sexually transmitted. For example, a study in Guatemala noted that women in focus groups were not aware that ZIKV could be sexually transmitted. Those using less effective or no contraception may not visit a healthcare provider and may require population-based efforts to reach them. Education campaigns like Deténi El Zika primarily targeted pregnant women and focused on healthy babies; similar campaigns targeting both pregnancy and STI concerns among WRA and men may also be needed.

This analysis is subject to the following limitations. First, the survey asked about sexual behaviours and experiences over the past 3 months; therefore, women’s self-reports may be subject to recall bias. Estimates of condom use may be biased if women overstated their frequency of condom use due to social desirability. The survey was administered only to women 18 years and older and did not include those younger than 18 years. Women also had to have a cell phone to participate in this survey, which
Table 1  Characteristics of women of reproductive age (18–49 years) at risk of unintended pregnancy,* 2016 contraceptive assessment for Puerto Rico

|                                | n (Unweighted) | N (Weighted) | % (Weighted) | (95% CI) |
|--------------------------------|----------------|--------------|--------------|----------|
| **Overall**                    | 1840           | 432 952      | 100          | (–)      |
| **Age group, years**           |                |              |              |          |
| 18–24                          | 303            | 90 941       | 21.0         | (18.9 to 23.2) |
| 25–34                          | 659            | 147 842      | 34.2         | (31.8 to 36.5) |
| 35–49                          | 878            | 194 169      | 44.8         | (42.4 to 47.3) |
| **Education completed†**       |                |              |              |          |
| Less than high school          | 112            | 26 078       | 6.0          | (4.9 to 7.2) |
| High school                    | 406            | 98 210       | 22.7         | (20.6 to 24.8) |
| Some college                   | 532            | 126 029      | 29.1         | (26.9 to 31.4) |
| College                        | 789            | 182 273      | 42.1         | (39.7 to 44.6) |
| **Health insurance‡**          |                |              |              |          |
| Private/through employer       | 788            | 178 189      | 41.5         | (39.1 to 43.9) |
| Medicaid or other public insurance | 957            | 231 728      | 54.0         | (51.5 to 56.5) |
| No insurance                   | 81             | 19 315       | 4.5          | (3.5 to 5.5) |
| **Relationship status§**       |                |              |              |          |
| Married/long-term relationship with a man | 1153           | 193 183      | 44.8         | (42.4 to 47.1) |
| Married/long-term relationship with a woman | 1            | 163          | 0.04         | (0 to 0.1) |
| Divorced/widowed/separated     | 193            | 62 967       | 14.6         | (12.6 to 16.6) |
| Never married/not in a long-term relationship | 489           | 175 263      | 40.6         | (38.1 to 43.2) |
| **Use of a more effective method of contraception¶** |                |              |              |          |
| Yes                            | 1188           | 259 023      | 59.9         | (57.5 to 62.4) |
| No                             | 649            | 173 249      | 40.1         | (37.6 to 42.5) |
| **Talked to a healthcare provider about ZIKV** |                |              |              |          |
| Yes                            | 495            | 109 564      | 25.3         | (23.2 to 27.4) |
| No                             | 1345           | 323 388      | 74.7         | (72.6 to 76.8) |
| **Worried about getting infected with ZIKV** |                |              |              |          |
| Very worried                   | 533            | 122 609      | 28.4         | (26.2 to 30.6) |
| A little/somewhat worried      | 832            | 195 852      | 45.4         | (42.9 to 47.8) |
| Already had Zika               | 354            | 86 546       | 20.0         | (18.0 to 22.1) |
| Not worried                    | 116            | 26 654       | 6.2          | (5.0 to 7.4) |
| **Worried about having a baby with a birth defect††** |                |              |              |          |
| Very worried                   | 938            | 226 935      | 53.3         | (50.8 to 55.7) |
| A little/somewhat worried      | 163            | 38 848       | 9.1          | (7.7 to 10.6) |
| Not worried                    | 713            | 160 365      | 37.6         | (35.2 to 40.0) |
| **Condom use in the past 3 months‡‡** |                |              |              |          |
| Yes                            | 488            | 140 619      | 32.7         | (30.2 to 35.1) |
| No                             | 1343           | 289 861      | 67.3         | (64.9 to 69.8) |

*Women who were not sexually active or missing information on sexual activity in the last 3 months (n=890), reported menopause or having had a hysterectomy (n=80), current pregnancy (n=75) and desiring pregnancy (n=174) were excluded.
†One missing response.
‡Seventeen missing responses.
§Five missing responses.
¶More effective method of contraception includes sterilisation, implant, intrauterine device, shot, pill, patch and ring.
**Five missing responses.
††Fifty-four missing responses.
‡‡Nine missing responses.
ZIKV, Zika virus.
may have biased the selection of participants. However, in 2016 Puerto Rico had a high rate of mobile subscriptions (99 per 100 people).16

Additionally, while consistent and correct condom use is recommended to prevent sexual transmission of ZIKV, we were limited by the small number (n=350, weighted n=102 304, weighted % 13.7%, 95% CI (11.4% to 15.9%)) of women who reported consistent condom use in this population, and instead, we report ‘any condom’ use. Furthermore, the question on contraceptive use in the survey asked only about current use and not use during the last 3 months. We were unable to differentiate whether women were using condoms as a primary or back-up method for preventing pregnancy versus for preventing sexual transmission of ZIKV, or for preventing other sexually transmitted diseases. The data are limited, and it is not clear whether sexual transmission is a salient consideration for women in the study. The lack of women reporting condom use may reflect low levels of awareness despite media or counselling, or those messages may have raised awareness but still had little effect on condom use behaviours. Women using effective contraception may have wanted to avoid having a baby with a birth defect and actively avoided ZIKV through a mosquito bite, but they may not have realised that sexual transmission from an infected partner posed a risk. Worry about ZIKV was associated with women who were using less effective or no contraception, using condoms, but it is unclear if some other confounding variables (like poverty or other structural measures) compounded or were independently associated with the likelihood of ZIKV.

The Zika Contraception Access Network (Z-CAN), was established in Puerto Rico during May 2016 through August 2017 to address a short-term emergency need to provide client-centred contraceptive counselling and same-day contraceptive services at no cost to those who chose to prevent pregnancy. Overall, more than 21 000 women received services through Z-CAN. While the first Z-CAN contraceptive services were offered on 4 May 2016, the overwhelming majority of initial Z-CAN visits occurred after the completion of this our survey in November 2016.17 During the evaluation of this programme, they found that ZIKV was not a motivating factor in contraception, but rather economic factors were the drivers of contraceptive behaviours.17 Finally, our findings may have limited generalisability considering the large burden of ZIKV cases in Puerto Rico during the 2016 ZIKV outbreak.

### Table 2 Association of ZIKV-related factors on condom use stratified by use of more effective contraception versus less or no effective contraception, 2016 contraceptive assessment for Puerto Rico

| Zika-related factors | Used condoms in the past 3 months (%*) | PR (95% CI) | Adjusted PR† (95% CI) |
|----------------------|---------------------------------------|------------|----------------------|
| **Women using more effective contraception‡ (n=1188§)** | | | |
| Overall | 14.5 | – | – |
| Talked to healthcare provider about ZIKV | 19.2 | 1.51 (1.08 to 2.11) | 1.61 (1.15 to 2.25) |
| Did not talk to healthcare provider about ZIKV | 12.7 | 1.00 | 1.00 |
| Worried about ZIKV infection¶ | 14.6 | 1.01 (0.69 to 1.48) | 0.93 (0.64 to 1.37) |
| Not worried about/already had ZIKV infection | 14.4 | 1.00 | 1.00 |
| Worried about having a child with a birth defect | 18.4 | 1.79 (1.26 to 2.55) | 1.47 (1.03 to 2.10) |
| Not worried about having a child with a birth defect | 10.3 | 1.00 | 1.00 |
| **Women using less effective or no contraception**** (n=649§)** | | | |
| Overall | 59.8 | – | – |
| Talked to healthcare provider | 60.4 | 1.01 (0.87 to 1.18) | 1.03 (0.88 to 1.20) |
| Did not talk to healthcare provider | 59.7 | 1.00 | 1.00 |
| Worried about ZIKV infection¶ | 62.4 | 1.18 (1.00 to 1.41) | 1.20 (1.01 to 1.43) |
| Not worried about/already had ZIKV infection | 52.7 | 1.00 | 1.00 |
| Worried about having a child with a birth defect†† | 60.2 | 1.02 (0.85 to 1.21) | 0.93 (0.78 to 1.11) |
| Not worried about having a child with a birth defect | 59.3 | 1.00 | 1.00 |

*Weighted percentages.
†Adjusted for age group, education completed and health insurance.
‡More effective methods of contraception includes sterilisation, implant, intrauterine device, shot, pill, patch and ring.
§Unweighted n.
¶Worried about ZIKV infection includes those a little/somewhat worried and very worried.
**Less effective methods of contraception includes diaphragm, rhythm method and withdrawal.
††Worried about having a child with a birth defect includes those a little/somewhat worried and very worried.

PR, prevalence ratios; ZIKV, Zika virus.
CONCLUSIONS
One in three women at risk for unintended pregnancy reported any condom use during the 2016 ZIKV outbreak in Puerto Rico. Counselling to promote consistent and correct condom use may address concerns regarding ZIKV among WRA, which may differ by use of effective contraception. Strategies to educate women and their partners about preventing sexual transmission of ZIKV and reducing risk of unintended pregnancy may need to consider both healthcare-based and population-based approaches.

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Competing interests None declared.

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Patient consent for publication Not applicable.

Ethics approval The Centers for Disease Control and Prevention determined the survey to be a non-research, public health practice activity during an emergency response.

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