RESEARCH

Like a virgin (mother): analysis of data from a longitudinal, US population representative sample survey

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Abstract

Objective To estimate the incidence of self report of pregnancy without sexual intercourse (virgin pregnancy) and factors related to such reporting, in a population representative group of US adolescents and young adults.

Design Longitudinal, population representative sample survey.

Setting Nationally representative, multiethnic National Longitudinal Study of Adolescent Health, United States.

Participants 7870 women enrolled at wave I (1995) and completing the most recent wave of data collection (wave IV; 2008-09).

Main outcome measures Self reports of pregnancy and birth without sexual intercourse.

Results 45 women (0.5%) reported at least one virgin pregnancy unrelated to the use of assisted reproductive technology. Although it was rare for dates of sexual initiation and pregnancy consistent with virgin pregnancy to be reported, it was more common among women who signed chastity pledges or whose parents indicated lower levels of communication with their children about sex and birth control.

Conclusions Around 0.5% of women consistently affirmed their status as virgins and did not use assisted reproductive technology, yet reported virgin births. Even with numerous enhancements and safeguards to optimize reporting accuracy, researchers may still face challenges in the collection and analysis of self reported data on potentially sensitive topics.

Introduction

During Advent, many recount the birth of Jesus to the Virgin Mary.[1] Virgin births in non-humans are generally by asexual reproduction, where growth and development of the embryo occurs without fertilization, termed parthenogenesis (from the Greek parthenos for virgin and genesis for birth). Occurrences of parthenogenesis in vertebrates, including pit vipers, boa constrictors, sharks, and Komodo dragons,[2] have attracted much attention. Parthenogenesis also appears in popular culture, including the Spielberg blockbuster *Jurassic Park*[3] and the 2008 *Dr Who* episode "Partners in Crime."[4] Births without a human father are seen as distinct from asexual reproduction, and involve a non-mortal father—for example, the gospel of Matthew reports that Mary's was found to be "with child" from the Holy Spirit, and numerous Greek demigods, such as Perseus, were reportedly born of mortal women[5] (or in the case of Dionysus, his immortal father, Zeus[6]).

Some supporters of the doctrine of the perpetual virginity (aeiparthenos) of Mary (who include not only Roman Catholics but also reformers such as Martin Luther) believe that Mary dedicated herself and her virginity to God, and that her husband Joseph was guardian of that virginity—perhaps a precursor of present day pledges of chastity. Chastity pledges may be signed by those who plan to remain chaste until marriage and by non-virgins who pledge to abstain from further intercourse until marriage; the latter are often called "born again" virgins[7]; this concept of the reconstitution of virginity has also appeared in pop culture, notably in the play *Camino Real*.[8]

Using data from the US nationally representative, multiethnic National Longitudinal Study of Adolescent Health (Add Health), spanning the 14 year lifecycle period between adolescence and adulthood, we examined the incidence of virgin pregnancy and birth based on self report of pregnancy and sexual debut,

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hypothesizing that individual and contextual factors may influence reporting.

Methods

Data source

Add Health began in 1994-95 as a representative sample of the US school aged population (grades 7-12, typically ages 12-18). A stratified sample of 132 schools was selected with probability of selection proportional to size. Add Health includes in-home, in-school, parent, and school administrator interviews, providing a wealth of sociodemographic, contextual, behavioral, and biological data.[9] The in-home survey included 20 745 youth in wave I (1994-95; mean age 15.7 years). All eligible school aged respondents were followed (including dropouts) in wave II (1996; mean age 16.2 years, response rate 88.6%); all eligible wave I respondents were followed in waves III (2001; mean age 22.0 years, response rate 77.4%) and wave IV (2007; mean age 28.5 years, response rate 80.3%). State of the art technology (audio computer assisted self interview and computer assisted self interview) was used to enhance the candor of the respondents. We used sampling weights to account for the study design and dropout rate so that the results are generalizable to the US population.

Inclusion criteria

We included women enrolled in the main study who completed interviews at waves I and IV (n=7870, figure⇓).

Dependent variable measurement and definition

At every wave, participants reported their history of vaginal intercourse (defined as a male inserting his penis in a woman's vagina) and women reported their pregnancy history. We used these longitudinal data to classify women by their virginity status at the time of reported pregnancy. We defined virginity as consistent reporting of no history of vaginal intercourse. Women were classified as having virgin pregnancies if they reported a pregnancy before sexual debut. We classified the other women as non-virgins.

Independent variable measurement and definition

Unless indicated otherwise, all independent variables are from baseline (wave I).

Respondent reported variables included age, importance of religion, and presence of a chastity pledge. Respondents indicated how much they agreed with the following statements about contraception: you are quite knowledgeable about how to use a condom correctly; you are quite knowledgeable about the rhythm method of birth control and when it is a "safe" time during the month for a woman to have sex and not get pregnant; and you are quite knowledgeable about the withdrawal method of birth control.

Parents of respondents reported how much they had talked with their child about sex or birth control and indicated their level of agreement with the following statements: parent feels (s)he does not know enough to discuss sex/birth control with child; parent would find it difficult to discuss sex/birth control with child; parent feels child would be embarrassed by discussion of sex/birth control with parent.

School administrators reported whether sex education was offered in the respondent's school.

At waves I and IV, interviewers reported the quality of the interview, including number of interruptions, boredom of the respondent, and whether the respondent needed help with the questionnaire.

Statistical analysis

All analyses were conducted in Stata 12 and in Stat Xact (Cytel Studio 10.0, Cytel Software, Cambridge, MA). Using sampling weights to adjust for non-response and the study design, we computed the percentage of women in each group. We tested differences using Fisher's exact test for categorical variables and analysis of variance or Kruskal-Wallis tests for continuous variables. All differences presented are bivariate, without adjustment for potential confounders. We chose a significance level of 0.05 for groupwise tests; if significance was found, we used a step-down testing strategy to determine which individual differences were significant, to help preserve the type I error rate.[10]

Results

Of 7870 eligible women, 5340 reported a pregnancy, of whom 45 (0.8% of pregnant women) reported a virgin pregnancy (table 1⇓). Perceived importance of religion was associated with virginity but not with virgin pregnancy. The prevalence of abstinence pledges was 15.5%. The virgins who reported pregnancies were more likely to have pledged chastity (30.5%) than the non-virgins who reported pregnancies (15.0%, P=0.01) or the other virgins (21.2%, P=0.007).

The virgins who reported pregnancy were more likely to endorse knowledge of condom use (67.8% agree/strongly agree) or the withdrawal method (53.6% agree/strongly agree) than the other virgins (30.2%, P=0.007 and 45.3%, P=0.02, respectively) but were less likely to know how to use condoms than the non-virgins who reported pregnancy (79.6%, P=0.002).

Parental attitudes and guidance were informative (table 2⇓), with the parents of virgins who reported pregnancy more likely to indicate inadequate knowledge to discuss sex/birth control (27.7% agree/strongly agree) than the parents of the other virgins (1.7%, P<0.001) or of the non-virgins with or without pregnancies (5.2% and 3.9%, P<0.001). The parents of virgins who reported pregnancy were more likely to strongly agree it was difficult to discuss sex/birth control with the child (12.2%) than the parents of the virgins not reporting pregnancies (<0.1%, P<0.001) or of the non-virgins (1.4%, P=0.02). The parents of the virgins were more likely to strongly agree that their child would be embarrassed by these discussions (11.5%) than the parents of the non-virgins with or without pregnancies (2.3%, P=0.002 and 2.5%, P=0.004). The frequency of discussions about sex was related to pregnancy but not to virginity.

Differences in the quality of the interviews were apparent (table 3⇓) but related to pregnancy rather than to virginity, with the exception of needing help with the questionnaire, which was more common among the virgins (30.2%) than the non-virgins (10.8%, P=0.007).

While more virgins gave birth to boys (59.8%) or may have learnt they were pregnant during Advent, these trends did not reach statistical significance (table 4⇓). Virgins were younger on average at the time of the birth (median age 19.3 years) than non-virgins (21.7 years, P<0.001).

Discussion

We examined the incidence of self reports consistent with virgin pregnancy in the US nationally representative, multiethnic

National Longitudinal Study of Adolescent Health (Add Health). Reporting dates of pregnancy and sexual initiation consistent with virgin pregnancy was associated with cultural mores highly valuing virginity, specifically signing chastity pledges, and with parental endorsement of items indicative of lower levels of communication about sex and birth control.

Limitations and strengths of this study

While most pregnancies occurred in adulthood, some participants may have misunderstood the definition of sexual intercourse. In a study of Canadian college students, 90% considered penile vaginal intercourse with orgasm as "having sex."[11] Questions in Add Health regarding sex were clear, limiting the risk of misinterpretation.

Errors in data entry are possible. However, among "virgin pregnancies," the median sexual debut reported was 2 (interquartile range 1-6) years after the pregnancy, and numerous women reported virginity at multiple subsequent waves. While Add Health collected information about use of assisted reproductive technologies, all the virgins who reported pregnancies stated that they did not conceive by such methods.

One study[12] examined demographic and health survey data from Africa and noted that data problems arose from both recall errors and misinterpretation of sexual debut as the age at onset of intercourse with husbands. Because Add Health obtains data on sexual history before data on pregnancy, this type of misinterpretation is unlikely, though recall bias is possible. We note that the African study incorrectly refers to virgin births as immaculate conceptions. The doctrine of the immaculate conception of Mary, often confused with virgin birth, is that though Mary was conceived in the normal way, she was without the stain of original sin.

A third group of women (n=244) not included in analysis, "born again virgins," reported a history of sexual intercourse early in the study but later provided a conflicting report indicating virginity. Reports of pregnancy among born again virgins were associated with greater knowledge of contraception methods with higher failure rates (withdrawal and rhythm methods) and lower interview quality (data not shown), and reports from this group may be subject to greater misclassification error.

Numerous important factors can be only feasibly or affordably measured in large samples using self report in surveys, including sexual history, illicit drug use, domestic violence, maltreatment as a child, and diet. Unfortunately this means there is no ideal against which to judge accuracy of self report. Self reported sexual behavior is often "validated" through consistency analyses, wherein respondents' answers to the same questions at multiple time points are compared. Analyses of age at first vaginal sex suggest that 80-90% of respondents report a consistent age, with repeated measures crossing months[13 14] or even years.[15]

Even assuming all the self reports of virgin pregnancies in Add Health are due to error, the misclassification rate is low. In a randomized experiment, researchers[16] found that respondents who used audio computer assisted self interview were 1.46 times more likely to acknowledge that they had oral sex than respondents who used computer assisted personal interview and reported their behavior directly to an interviewer. The difference was even larger for an illegal behavior: respondents who used audio computer assisted self interview were 2.84 times more likely to acknowledge that they had used cocaine than respondents who used computer assisted personal interview. The use of audio computer assisted self interview in wave I and computer assisted self interview in waves III and IV of Add Health almost surely enhanced the candor of respondents when answering potentially sensitive questions.

Conclusion

All self reported measures of potentially sensitive items are subject to some degree of respondent bias, especially in studies that, unlike Add Health, do not use confidential reporting. In a US nationally representative cohort, we found that 0.8% of pregnancies were reported by virgins and not related to use of assisted reproductive technology, and these women were more likely than other virgins to have signed chastity pledges, to endorse knowledge of birth control, and to have parents who endorsed items indicative of lower levels of communication about sex and birth control.

1   Matthew 1:18-25, Luke 1:26-38. Holy Bible (authorized (King James) version). Robert Barker, Printer to the King's Most Excellent Majestie, 1611.

What is already known on this topic

Among humans the incidence of self reported dates of sexual debut and pregnancy consistent with virgin pregnancy is unknown

What this study adds

In a large survey representative of the US population, around 0.5% of women consistently affirmed their status as virgins and did not use assisted reproductive technology, yet reported virgin births

The study used carefully designed questions and state of the art self interview technology known to enhance the candor of respondents

2   Niesel D, Herzog N. Virgin births on the rise. Galveston County Daily News. 2013. www.utmb.edu/newsroom/article8559.aspx

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4   Partners in crime. *Dr Who* BBC 1, 5 April 2008.

5   Homer, Iliad, 14.319 ff (trans Lattimore).

6   Euripides, Bacchae, 520ff.

7   Born-again virgin. http://en.wikipedia.org/wiki/Born-again_virgin

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Tables

Table 1| Characteristics of women according to status of their virginity, from National Longitudinal Study of Adolescent Health. Values are numbers (percentages) unless stated otherwise

Characteristics	Virgins		Non-virgins	
	No pregnancy	Pregnancy	No pregnancy	Pregnancy
Women	146 (2.5)	45 (0.5)	2319 (30.7)	5116 (63.8)
Mean (SE) age at wave I	14.9 (0.5)	14.4 (0.4)	14.4 (0.1)	14.8 (0.1)
Importance of religion at wave I***:				
Very important	91 (49.0)	24 (53.3)	1017 (43.4)	2330 (42.7)
Somewhat important	30 (19.5)	11 (22.7)	800 (33.5)	1750 (35.5)
Somewhat unimportant	5 (2.6)	— (7.9)	163 (7.7)	257 (5.4)
Very unimportant	3 (8.4)	— (<0.1)	69 (3.0)	114 (2.4)
Refused/don't know	17 (20.5)	7 (16.2)	270 (12.4)	665 (14.0)
Sex education offered in school:				
No	25 (11.6)	8 (21.4)	321 (12.6)	806 (16.2)
Yes	114 (84.6)	35 (73.9)	1869 (79.8)	4089 (78.0)
Missing	7 (3.8)	2 (4.6)	129 (7.6)	221 (5.8)
Took pledge to remain virgin until married, wave I***:				
No	100 (72.4)	31 (66.4)	1888 (82.5)	4256 (83.7)
Yes	40 (21.2)	12 (30.5)	410 (16.4)	801 (15.0)
Missing/refused	6 (6.4)	2 (3.1)	21 (1.1)	59 (1.3)
Respondent beliefs				
Knows how to use a condom correctly, wave I***:				
Strongly agree	22 (14.3)	10 (16.1)	686 (29.1)	2103 (41.3)
Agree	43 (15.9)	19 (51.7)	902 (37.6)	1996 (38.3)
Neither agree nor disagree	26 (15.1)	5 (8.2)	313 (12.7)	426 (8.5)
Disagree	22 (18.2)	5 (16.0)	228 (9.8)	321 (5.9)
Strongly disagree	13 (5.7)	3 (0.6)	113 (5.1)	145 (2.9)
Don't know/refused	20 (30.8)	3 (7.3)	77 (5.8)	125 (3.1)
Knows how to use rhythm method of contraception, wave I***:				
Strongly agree	13 (6.5)	6 (14.4)	329 (13.9)	1007 (19.0)
Agree	38 (13.6)	16 (39.6)	760 (31.3)	1927 (37.3)
Neither agree nor disagree	34 (19.2)	7 (16.5)	478 (20.0)	938 (19.3)
Disagree	27 (17.7)	10 (19.6)	478 (20.6)	788 (15.1)
Strongly disagree	14 (7.2)	3 (2.5)	163 (6.6)	276 (5.1)
Don't know/refused	20 (35.7)	3 (7.3)	111 (7.4)	180 (4.2)
Knows how to use withdrawal method of contraception, wave I***:				
Strongly agree	14 (8.6)	7 (12.3)	356 (15.1)	1077 (20.5)
Agree	29 (12.7)	19 (43.1)	869 (35.3)	2271 (44.1)
Neither agree nor disagree	41 (23.3)	9 (22.8)	468 (20.2)	843 (16.8)
Disagree	29 (14.1)	5 (8.6)	377 (16.1)	583 (11.1)
Strongly disagree	11 (6.1)	— (6.0)	125 (5.3)	158 (3.2)
Don't know/refused	22 (35.3)	— (7.3)	124 (8.1)	184 (4.3)

Percentages calculated using survey weights to allow population representative inference. Dash indicates cell size was too small to be displayed. Data from 244 "born again virgins" who reported sex in an early wave but later recanted are not shown.

***P<0.001 using analysis of variance for continuous variables and Fisher's exact test for categorical variables.

Table 2| Parental attitudes and guidance according to respondent's virginity status and gravidity, from National Longitudinal Study of Adolescent Health, wave I. Values are numbers (percentages)

Variables	Virgins		Non-virgins	
	No pregnancy	Pregnancy	No pregnancy	Pregnancy
Women	146 (2.5)	45 (0.5)	2319 (30.7)	5116 (63.8)
Parent feels (s)he does not know enough to discuss sex/birth control with child***:				
Strongly agree	3 (0.5)	4 (11.9)	35 (1.1)	104 (2.1)
Agree	4 (1.2)	5 (11.3)	79 (2.8)	195 (3.1)
Neither agree nor disagree	6 (5.6)	5 (9.7)	78 (3.3)	197 (3.7)
Disagree	41 (43.4)	14 (23.8)	721 (32.0)	1605 (31.5)
Strongly disagree	76 (43.2)	10 (26.9)	1136 (51.7)	2239 (46.0)
Don't know/refused/missing	16 (6.0)	7(16.4)	270 (9.1)	776 (13.6)
Parent would find it difficult to discuss sex/birth control with child*:				
Strongly agree	— (<0.1)	5 (12.2)	27 (1.0)	73 (1.4)
Agree	8 (9.1)	— (5.5)	129 (7.2)	246 (4.2)
Neither agree nor disagree	— (4.0)	— (4.8)	91 (4.2)	172 (3.1)
Disagree	58 (42.0)	16 (25.8)	870 (37.8)	1859 (37.1)
Strongly disagree	60 (38.3)	12 (35.3)	934 (40.9)	1985 (40.6)
Don't know/refused/missing	17 (6.5)	7 (16.4)	268 (9.0)	781 (13.7)
Parent feels child would be embarrassed if parent discussed sex/birth control with them***:				
Strongly agree	3 (2.4)	5 (11.5)	53 (2.5)	120 (2.3)
Agree	19 (27.8)	3 (5.8)	334 (14.7)	566 (11.1)
Neither agree nor disagree	8 (6.1)	3 (10.7)	200 (9.6)	322 (6.7)
Disagree	54 (32.3)	16 (28.2)	809 (34.9)	1703 (33.0)
Strongly disagree	45 (25.1)	11 (27.5)	656 (29.3)	1622 (33.1)
Don't know/refused/missing	17 (6.3)	7 (16.4)	267 (9.0)	783 (13.7)
How much has the parent talked with the child about sex?***:				
Not at all	11 (11.2)	5 (15.5)	134 (6.6)	248 (4.9)
Somewhat	36 (23.1)	7 (15.0)	512 (24.4)	752 (14.5)
A moderate amount	50 (33.0)	12 (16.3)	775 (32.9)	1366 (27.7)
A great deal	32 (26.5)	14 (36.7)	613 (26.3)	1933 (38.3)
Don't know/refused/missing	17 (6.1)	7 (16.4)	285 (9.8)	817 (14.5)

Percentages calculated using survey weights to allow population representative inference. Dash indicates cell size was too small to be displayed. Data from 244 "born again virgins" who reported sex in an early wave but later recanted are not shown.

*P<0.05.

***P<0.001 using ANOVA for continuous variables and Fisher's exact test for categorical variables.

Table 3| Interview quality at waves I and IV according to virginity status, from National Longitudinal Study of Adolescent Health. Values are numbers (percentages) unless stated otherwise

Variables	Virgins		Non-virgins	
	No pregnancy	Pregnancy	No pregnancy	Pregnancy
Women	146 (2.5)	45 (0.5)	2319 (30.7)	5116 (63.8)
Mean No of interruptions during interview, wave I**	0.7	1.0	0.9	1.1
Mean number of interruptions during interview, wave IV***	1.2	1.8	1.2	1.6
Respondent appeared bored, wave I:				
No	135 (92.5)	39 (89.3)	2132 (90.5)	4676 (90.7)
Yes	11 (7.5)	6 (10.7)	183 (9.3)	436 (9.3)
Don't know/refused/missing	0 (0)	0 (0)	4 (0.1)	4 (0.1)
Respondent appeared bored, wave IV*:				
No	139 (94.3)	40 (94.2)	2232 (96.8)	4859 (94.8)
Yes	6 (5.7)	5 (5.8)	83 (3.1)	252 (5.1)
Don't know/refused/missing	1 (<0.1)	0 (0)	4 (<0.1)	5 (0.1)
Respondent needed help with questionnaire, wave IV***:				
No help	124 (68.3)	33 (76.2)	2201 (93.6)	4477 (86.9)
Help with questions	21 (31.7)	12 (23.8)	114 (6.3)	634 (13.0)
Missing	1 (<0.1)	0 (0)	4 (<0.1)	5 (0.1)

Percentages calculated using survey weights to allow population representative inference.

*P<0.05.

**P<0.01.

***P<0.001 using ANOVA for continuous variables and Fisher's exact test for categorical variables.

Table 4| Characteristics of first live births according to virginity status, from National Longitudinal Study of Adolescent Health. Data are numbers (percentages) unless stated otherwise

Characteristics	Virgins	Non-virgins
No of women with live birth	36	4182
Baby's sex:		
Boy	20 (59.8)	2114 (52.2)
Girl	16 (40.2)	2063 (47.6)
Refused/don't know	0 (0)	5 (0.2)
Season of birth*:		
Spring	4 (8.2)	1035 (24.8)
Summer	15 (48.2)	1081 (24.8)
Fall	8 (12.8)	1035 (24.4)
Winter	9 (30.8)	1031 (26.0)
Median (interquartile range) baby's birth year	1998 (1997-2000)	2001 (1998-2004)
Median (interquartile range) woman's age at first birth (years)***	19.3 (17.4-20.6)	21.7 (19.2-24.8)

Percentages calculated using survey weights to allow population representative inference.

*Spring (March-May), summer (June-August), fall (September-November), winter (December-February).

***P<0.001 using Kruskal-Wallis test of medians for continuous variables and Fisher's exact test for categorical variables.

Figure
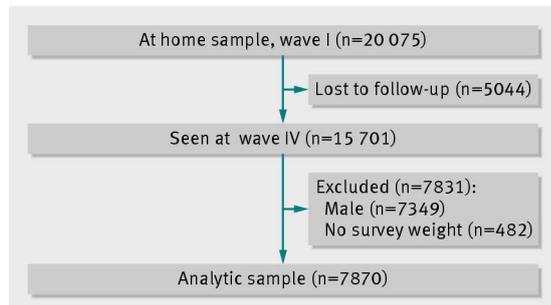
Study population and sample attrition. Women without a survey weight were added to enrich the sample for specific hypotheses (for example, twin or sibling studies) and are not considered part of the core representative sample or women over-sampled by design