Journal of Adolescent and Family Health

Volume 9 | Issue 1 Article 1

January 2018

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Cover Page Footnote

Funding: This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due to Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. No direct support was received from grant P01-HD31921 for this analysis. Conflicts of interest: No financial conflicts of interest involving any of the co-authors.

Adolescent - Perceived Maternal Relationship during Adolescence and Pap Smears during Young Adulthood

Cervical cancer death rates have decreased dramatically since the introduction of pap smears and HPV vaccines (American Cancer Society, 2015). In 2010, 11,818 new cases of cervical cancer were diagnosed and 3,939 deaths were reported in the U.S. (U.S. Cancer Statistics Working Group, 2013). Although cervical cancer incidence and mortality rates among women are much lower than lung and bronchus (13% new cases, 26% deaths) and breast cancers (29% new cases, 15% deaths), continued public health efforts are needed to reduce health disparities based on race and ethnicity where convergent incidence and mortality rates have not yet been observed (American Cancer Society, 2015). From 2007-2011, the age-adjusted incidence rate of cervical cancer per 100,000 persons was highest among Hispanics (10.5), non-Hispanic Blacks (10.2) and American Indian/Alaskan Natives (9.5) compared to non-Hispanic Whites (7.2) and Asian/Pacific Islanders (6.4) (American Cancer Society, 2015); mortality rates were twice as high among non-Hispanic Blacks (4.2) compared to non-Hispanic Whites (2.0). Prevention and early detection through the use of pap smears can help address these disparities.

Prevention and Early Detection of Cervical Cancer using Pap Smears

Guidelines for the prevention and early detection of cervical cancer have changed dramatically over the past 15 years with new clinical research and the advent of the HPV vaccine. In 2001, the U.S. Preventive Services Task Force recommended regular pap smears for all sexually active women beginning at the age of first intercourse. In addition, "adolescents whose sexual history is thought to be unreliable should be presumed to be sexually active at age 18" should receive pap smears every 12 months (U.S. Preventive Services Task Force, 1996). The American Cancer Society, National Cancer Institute, American Academy of

Family Physicians, the American Congress of Obstetricians and Gynecologists, American Academy of Pediatrics and others recommended that adolescents who have been sexually active and young women (ages 18 and older) have annual pap smears (Mettlin & Dodd, 1991). The most recent U.S. Preventive Services Task Force guidelines (2012) stipulate: women should wait until they are 21 years old before obtaining their first pap smear regardless of prior sexual history; and women ages 21-65 should receive a pap smear every 3 to 5 years for early detection of cervical cancer (Moyer, 2012).

Racial and ethnic disparities in receiving pap smears. Since 2000, pap smear estimates have decreased across all racial and ethnic groups. The most recent estimates found the largest decrease was observed among non-Hispanic Whites (12.6%) followed by non-Hispanic Blacks (9.8%), American Indian/Alaskan Natives (6.5%), Hispanics (6.5%) and Asians (1.1%) (National Center for Health Statistics, 2016). Although it is unclear whether the decrease in screening is due to changes in screening guidelines or the advent of HPV vaccines, pap smears can lead to early detection of and decreased mortality from cervical cancer.

Barriers to Receiving Pap Smears

Several studies have evaluated barriers to receiving pap smears. Miranda-Diaz, Betancourt, Ruiz-Candelaria and Hunter-Mellado (2015) conducted surveys with Hispanic patients and found that the most common barriers to receiving a pap smear were time (56.3%), feelings of discomfort (18.8%) and thoughts that the test was unnecessary (9.4%). Additional barriers identified were lack of physician recommendation (6.3%), fear (6.3%) and lack of knowledge about the procedure (3.1%) (Betancourt et al., 2015). Other studies found that fatalism, religion, modesty, perceptions of pain, limited access and lack of knowledge of its purpose may impede women from receiving a pap smear (Kasting, Wilson, Zollinger, Dixon,

Stupiansky & Zimet, 2017; Lee, Yang, Lee, & Ghebre, 2015; Hoyo, Yarnall, Skinner, Moorman, Sellers, & Reid, 2005). Focus groups found that education, free tests and support from physicians and friends can facilitate receiving pap smears (Byrd, Chavez, & Wilson, 2007).

Mother-Daughter Relationships as a Facilitator for Pap Smears

In addition to the role that support from physicians and friends can provide, previous research has shown that the support a woman receives from her mother facilitates receiving preventive health services (Villafuerte, Gomez, Betancourt, & Cervantes, 2007). Studies have found that factors that contribute to a quality relationship between mothers and daughters facilitated daughters' receipt of cancer screenings and HPV vaccines (Chao, Slezak, Coleman, & Jacobsen, 2009; Sinicrope et al., 2008; Sinicrope et al., 2009; Spencer Nee Pilkington, Brabin, Verma, & Roberts, 2013). Sinicrope et al. found that daughters whose mothers talked to them about breast cancer screening were more likely to get mammograms (Sinicrope et al., 2008). Madhivanan and colleagues conducted focus groups with Hispanic women and found that participants usually consulted their mothers or other woman relatives when making decisions to obtain cervical cancer screenings (Madhivanan, Valderrama, Krupp, & Ibanez, 2016). Chao and colleagues examined electronic medical records of mothers and daughters to determine whether daughters were more likely to obtain a HPV vaccine if their mother had a history of receiving a pap smear. Results indicated that daughters were more likely to obtain a HPV vaccine if their mother had a history of pap smears regardless of racial and socioeconomic differences (Chao et al., 2009). Kim and colleagues evaluated mothers' awareness and health beliefs about preventing cervical cancer in their daughters in Korea (Kim & Kang, 2014). They found that 23.7% of mothers had already talked to their daughter about pap smears and a majority (69.2%) intended to recommend receiving a pap smear to their daughters. A majority of studies conducted to date

have examined the mother-daughter relationship in relation to cancer screening behaviors using convenience samples, or evaluated the mother-daughter relationship from the mother's perspective (Chao et al., 2009; Sinicrope et al., 2009). As a result, it is unclear whether daughters' perceived relationship with their mothers during adolescence is associated with future receipt of pap smears in young adulthood using data from a nationally representative sample.

National studies evaluating mother-daughter relationships and health. Researchers have used the National Longitudinal Study of Adolescent Health (Add Heath) to study maternal support and adolescent delinquency (Deutsch, Crockett, Wolff, & Russell, 2012), risky sexual behaviors (Trejos-Castillo & Vazsonyi, 2009), deliberate decision making among adolescents (Wolff & Crockett, 2011) and cardiovascular disease risk in adulthood (Doom, Gunnar, & Clark, 2016). McRee and colleagues used Add Health data to evaluate differences in receiving a pap smear among young adult women based on disability status (McRee, Haydon, & Halpern, 2010). However, to our knowledge, no studies have examined the association between maternal relationship in adolescence and receiving a pap smear during young adulthood.

Purpose

To address this gap, the purpose of this study is two-fold: 1) identify demographic, socioeconomic, and health care related disparities in the prevalence of receiving pap smears and 2) evaluate whether the maternal relationship in adolescence is associated with receiving a pap smear during the previous 12 months in young adulthood. The three research questions include:

1. What demographic (age, race/ethnicity, immigrant and marital status), socioeconomic (education, employment, household and personal income) and health care related (health insurance and access to care) disparities exist among young adult women who did and did not receive a pap smear?

2. What differences exist in self-perceived maternal relationship quality among young adult women who did and did not receive a pap smear?
3. What is the association between self-perceived maternal relationship quality and receiving a pap smear before and after controlling for demographic (age and race/ethnicity) and socioeconomic variables (education)?

Method

Survey and Participants

The National Longitudinal Study of Adolescent Health (Add Health) includes four waves of longitudinal data to explore influences of adolescent health and health risk behaviors (Harris, 2013). At wave I (1994-1995), over 90,000 enrolled students were sampled from 80 U.S. high schools and 52 U.S. middle schools using a two-stage cluster sampling design (Harris, 2013). A stratified sample of approximately 200 students was selected from each school for in-home interviews. Participant-level survey data were collected in wave I during in-home interviews. At wave II, adolescents in grades 7-11 from wave I (n=14,738) were followed up one-year later (1995-1996) to longitudinally assess health risk behaviors and survey items addressing family and school context, peer and spatial networks and genetic pairs. At wave III (2001-2002), participants from the national representative cohort at wave I (n=15,170) were followed up to evaluate health outcomes, such as pap smears among women, in the transition to adulthood. At wave IV (2008-2009), wave I participants were followed up to further explore health during the transition into young adulthood using objective physical measurements and biospecimens (n=15,701). Wave IV participants were excluded from this analysis because neither maternal relationship nor pap smear data were collected.

Secondary data for this study were obtained from the restricted use sample of Add Health waves I (1994-1995) and III (2001-2002). Participant-level survey data were collected using face-to-face interviews at participants' homes during waves I (n=20,745) and III (n=15,170). Details of the Add Health, its sampling design and methods are available elsewhere (Harris, 2013). The longitudinal sample for this study (n=8,030) included adolescent and adult women who completed: 1) in-home interviews at waves I and III; and 2) survey questions assessing receipt of health services in wave III. After removing missing data, 7,224 women remained in the dataset. See figure 1 for a flow diagram of sample participants.

Ethics

The University of Texas Health Science Center at Houston Committee for the Protection of Human Subjects deemed all analyses of this de-identified dataset as exempt from human subjects review.

Independent Variables: Adolescent-Perceived Maternal Relationship Quality

The independent variable of interest in this study was adolescent-perceived maternal relationship quality. A composite measure was created using five questions from the adolescent portion of the in-home interview during wave I, which has been shown to be a valid measurement based on previous research (Deutsch et al., 2012; Trejos-Castillo & Vazsonyi, 2009). The maternal relationship scale combined the adolescent's perception of the mother's: 1) closeness to her mother; 2) how much she thinks her mother cares about her; 3) warmth and lovingness of the mother; 4) communication with her mother and 5) overall satisfaction with her mother-daughter relationship. Ratings of closeness and caring were reported on a 5-point Likert scale from 1= "not at all" to 5= "very much." Measures evaluating warmth, communication and overall relationship satisfaction were reported using a 5-point Likert scale from 1= "strongly

agree" to 5= "strongly disagree." For consistency in interpretation, warmth, communication and relationship satisfaction measures were reverse coded and averaged with the closeness and caring items to develop an adolescent-perceived maternal relationship composite scale based on previous research (Deutsch et al., 2012; Trejos-Castillo & Vazsonyi, 2009). The internal consistency for this scale was very good (α=0.85). Previous studies found similar results disaggregated by race and ethnicity (α=0.84 for European Americans; α=0.83 for African Americans) (Deutsch et al., 2012) and immigrant status (α=0.78 for 1st generation; α=0.85 for 2nd generation) (Trejos-Castillo & Vazsonyi, 2009). Adolescent-perceived maternal relationship items were evaluated individually as well as by the composite measure. Participants who did not know their mothers were excluded from the analysis.

Dependent Variable: Receiving a Pap Smear

The dependent variable was receiving a pap spear in the 12 months prior to the wave III interview. Women (ages 18-28) were asked, "When was the last time you had a gynecological exam?" Participants who reported having a gynecological exam were asked the follow-up question, "Did you have a pap smear at that time?" Using these items, a dichotomous variable was created to differentiate between women who reported that they were compliant with cervical cancer screening guidelines by having a pap smear during their gynecological exam during the past 12 months based on the recommended screening interval
(U.S. Preventive Services Task Force, 1996). Women who did not have a gynecological exam at least two years ago or longer were coded as not compliant by not having had a pap smear in the past 12 months. Previous studies have found self-reports of receiving a pap smear to be a valid measure of screening compared to medical records (Caplan et al., 2003; Giorgi Rossi et al., 2006).

Covariates

Covariates included demographic (age, race/ethnicity, nativity status and marital status) and socioeconomic characteristics (highest level of education obtained, current employment, annual household income and annual personal income), health insurance coverage and usual source of care variables collected at wave III. These measures were included because they have an established relationship with receiving a pap smear (National Center for Health Statistics, 2016) and maternal relationship (Deutsch et al., 2012; Doom et al., 2016; Trejos-Castillo & Vazsonyi, 2009).

Statistical Analysis

First, to evaluate demographic, socioeconomic and health care related disparities among women who did and did not receive a pap smear in the past 12 months, the weighted Chi square test with robust standard errors (α=0.05) was used. Second, to describe variations in self-perceived maternal relationship quality among young adult women who did and did not receive a pap smear in the past 12 months, weighted means, medians, standard deviations and ranges were used. Third, to determine the association between self-perceived maternal relationship quality (independent variable) and receiving a pap smear (dependent variable) before and after controlling for demographic (age and race/ethnicity) and socioeconomic variables (education), bivariate and multivariable logistic regression procedures were used. Before the adjusted logistic regression model was fit, all demographic, socioeconomic and health care related variables were evaluated for inclusion in the final model ($p < .10$). Collinearity existed between race/ethnicity and place of birth; therefore, place of birth was excluded from the model since a majority of young adults were born in the U.S. Age, race/ethnicity, and educational attainment were included

in the final, multivariate logistic regression models. Stata 13.0 software was used to account for the sophisticated sampling design and inverse probability weighting.

Results

Descriptive Characteristics

Selected characteristics of young adult women who did and did not report receiving a pap smear in the last 12 months are reported in Table 1. A majority of participants (74.96%) reported having a pap smear in the past 12 months. Significant differences in receiving a pap smear by age, race/ethnicity, nativity status, education, annual personal income and health insurance coverage were observed. Specifically, receiving a pap smear was less common among Hispanic, non-Hispanic American Indians/Alaskan Natives, and non-Hispanic Asians compared to non-Hispanic White and non-Hispanic Black women ($p < .05$). Few women born outside of the U.S. (5.87%) reported having a pap smear in the last 12 months than U.S. born women (94.13%; $p = .022$). Slightly more than one fourth (27.73%) of women who reported that they did not have health insurance coverage reported a pap smear in the last 12 months (72.69%; $p < .001$).

Bivariate Results: Maternal Relationship and Pap Smears

Results from bivariate analyses are reported in Table 2. Results are reported for the adolescent perception composite scale and each individual item. The mean adolescent-perceived maternal relationship score was significantly higher among women who reported a pap smear in the previous 12 months (4.37 versus 4.30; $p = .021$).

Bivariate and Multivariable Regression Results

Results from regression analyses are provided in Table 3. In crude analyses, every one unit increase in maternal relationship quality during adolescence was associated with 14% greater odds of receiving a pap smear in the last 12 months (OR = 1.14; 95% CI = 1.03-1.28).

Similar effects were observed in multivariable analysis; each one unit increase in maternal relationship quality during adolescence was associated with an 11% increase in the odds of receiving a pap smear in the last 12 months (OR = 1.11; 95% CI = 1.00-1.24).

Notably, race, ethnicity and educational attainment were associated with receiving a pap smear. Hispanic (OR = 0.77; 95% CI = 0.60-0.99), non-Hispanic American Indian and Alaskan Natives (OR = 0.59; 95% CI = 0.36-0.84), and non-Hispanic Asians (OR = 0.55; 95% CI = 0.36-0.84) were less likely to report a pap smear in the last 12 months compared to non-Hispanic Whites. Conversely, non-Hispanic Blacks (OR = 1.51; 95% CI = 1.15-1.98) were more likely to report a pap smear in the last 12 months compared to non-Hispanic Whites. Women whose highest level of education was graduation from high school (OR = 0.80; 95% CI = 0.66, 0.97) were 20% less likely to report having a pap smear in the last 12 months compared to women with some college or higher.

Discussion

The purpose of this study was to determine demographic, socioeconomic and health care related disparities in receiving pap smears and evaluate whether the adolescent-perceived maternal relationship was associated with receiving a pap smear during young adulthood. Overall, we found significant differences in reports of receiving pap smears by demographic, socioeconomic and health care related characteristics. We found an association between the adolescent-perceived maternal relationship quality and receiving a pap smear before and after controlling for confounders.

Our first main finding was that receiving a pap smear differed by age, race and ethnicity, nativity status, education, personal income and health insurance. Results from multivariable regression models indicated that receipt of pap smears was lower among women whose highest

level of education is high school and among Hispanics, non-Hispanic American Indian/Alaskan Natives and non-Hispanic Asians. Our findings are similar to other studies evaluating receipt of pap smears among young adult women using national datasets. For instance, Vinekar and colleagues (2015) evaluated pap smears, pelvic exams and contraceptive practices among adolescents and young women using data from the National Survey of Family Growth. Similar to our results, they found differences in receiving a pap smear by race/ethnicity, age and health insurance status. Furthermore, pap smears were lowest among Hispanics and the non-Hispanic other race group compared to non-Hispanic whites (Vinekar et al., 2015). Our findings differ from other national studies by evaluating women as part of a longitudinal population-based study evaluating health in adolescence across the life span into young adulthood. Our independent variable (maternal relationship) was measured by adolescents at wave I (mean age = 14.95) and dependent variable (receiving a pap smear) was measured by the same participants as they transitioned into young adulthood at wave III (mean age = 21.31). To our knowledge, only one study evaluated pap smears using Add Health data (McRee et al., 2010). The study by McRee and colleagues (2010) evaluated disability status and pap smears using wave III data only. Furthermore, the only study that evaluated maternal relationship at wave I and health outcomes at wave III evaluated cardiovascular disease risk (Doom et al., 2016).

Our second main finding was that adolescent-perceived maternal relationship quality was associated with an increase in pap smears during young adulthood. Our results were significant in both bivariate and multivariate analyses. In bivariate analyses, women whose composite scores equaled five on the adolescent perceived quality of the maternal relationship scale had a 56% increase in their odds of receiving a pap smear in in the last 12 months compared to those who scored one. In multivariate analyses, results remained significant after adjusting for age,

race/ethnicity and education. Women whose composite scores equaled five on the adolescent-perceived maternal relationship quality scale had a 44% increase in their odds of receiving a pap smear in the last 12 months compared to those who scored one. Our results extend previous research studies that have evaluated maternal intentions and influences towards recommending cervical cancer prevention to their daughters by evaluating pap smears from the adolescent perspective (H. W. Kim, 2016; J. S. Kim & Kang, 2014; Madhivanan et al., 2016).

Strengths and Limitations

Our study has several strengths and limitations. Among the strengths of the study is the use of restricted data from a nationally representative sample. The Add Health study used a probability-based cluster sampling design which allows for results to be weighted and extrapolated to the U.S. population. National surveys, including the Add Health, collect a wealth of information on demographic, socioeconomic and health related topics which allows for the assessment of multiple confounders. In summary, use of a nationally representative sample enhances the internal and external validity of the results generated from this study. Among the limitations was the use of self-reported data for all variables, and perceptions of the maternal relationship quality were analyzed only from the adolescent perspective. A study by Doom and colleagues (2016) evaluated the association between maternal relationship and cardiovascular disease risk using Add Health data with both parent and adolescent perceptions in the maternal relationship scale. Although the study by Doom and colleagues benefited from two measures of perception, we did not include the parent questions due to a smaller sample size of respondents completing the parent questionnaire at wave I. In fact, inclusion of the parent measures lowered our internal consistency for the mother perception composite scale ($\alpha = 0.70$). Future waves should continue to collect data on pap smears and other preventive health measures to determine

continued prevalence and appropriate receipt of cancer screenings based on screening guidelines. With such a high prevalence among this group, it would be interesting to see if women continue to get a pap smear every year or follow the new recommended guidelines of every three to five years (Moyer, 2012).

Future Directions

In practice, interventions should be designed to promote quality relationships and shared knowledge between adolescents and their mothers thereby encouraging communication about appropriate receipt of cancer screenings and preventive services. Obulaney, Gilliland and Cassells (2016) developed and evaluated an intervention with the goal of improving knowledge among mothers and daughters about cervical cancer. The authors used current guidance from the American Congress of Obstetricians and Gynecologists, the Centers for Disease Control and Prevention and the Medical Institute for Sexual Health to develop 20 to 25 minute educational sessions for mothers and daughters to attend together. Improvements in cervical cancer prevention knowledge were found after the education sessions (Obulaney et al., 2016). There is a growing body of evidence focusing on the reciprocal role that mothers and daughters can play on improving each other's health. Studies with mother-daughter dyads have found that a majority of mothers were open to receiving health advice from their adolescent daughters (Mosavel, Simon & Stade, 2006; Mosavel & Ports, 2015). Future studies on the mother-daughter relationship should aim to improve cervical cancer screening based on both upward and downward communication between mothers and daughters and collect qualitative data to better understand the role that each other can play in influencing preventive health behaviors.

Conclusion

In conclusion, our main findings suggest that women who have higher quality relationships with their mothers during adolescence are more likely to adhere to cervical cancer screening guidelines. This study makes an important contribution to the literature by evaluating maternal relationship quality in adolescence as an influence on one of the first decisions women make towards receipt of preventive services in young adulthood.

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Table 1

*Selected characteristics and receiving a pap smear, n=7,224**

	No Pap smear *n (%)*	Pap smear *n (%)*	*p*-value
Demographics			
Age *mean(sd)*	21.54 (1.59)	21.38 (1.60)	0.031
Race/Ethnicity			0.000
Hispanic	343 (13.50)	746 (10.28)	
Non-Hispanic White	939 (66.06)	2837 (66.47)	
Non-Hispanic Black/African American	330 (11.70)	1379 (17.90)	
Non-Hispanic AI/AN	61 (4.04)	142 (2.48)	
Non-Hispanic Asian	136 (4.69)	296 (2.87)	
Born in the US *(%no)*	175 (8.60)	324 (5.87)	0.022
Marital status *(%yes)*	409 (93.75)	1154 (90.56)	0.152
Socioeconomics			
Education			0.019
Less than HS diploma	238 (16.25)	620 (13.13)	
HS graduate	604 (34.56)	1707 (31.07)	
Some college or greater	971 (49.19)	3083 (55.80)	
Currently Employed *(%yes)*	1289 (69.75)	3941 (72.35)	0.201
Annual Household Income			0.209
Less than $20,000	43 (24.14)	85 (14.99)	
$20,000-$39,000	42 (18.97)	84 (14.50)	
$40,000-$49,000	24 (12.38)	78 (16.86)	
$50,000-$74,000	37 (14.88)	111 (22.74)	
$75,000 or higher	46 (29.64)	139 (30.91)	
Annual Personal Income			0.014
Less than $10,000	131 (56.22)	383 (66.14)	
$10,000-$19,000	83 (38.84)	168 (24.79)	
$20,000 or greater	19 (4.95)	80 (9.06)	
Health Insurance and Access to Care			
Health insurance *(% not covered)*	510 (42.90)	931 (27.31)	0.000
Private clinic as usual source of care *(%yes)*	806 (48.16)	2595 (50.81)	0.251

Note. *Data collected at wave III.

Table 2

Quality of adolescent perceived maternal relationship and receiving a pap smear in the past 12 months, n=7,224

*Maternal Relationship**	No pap smear[+] *Mean (SD)*	Pap smear[+] *Mean (SD)*	*p*-value
Adolescent perception composite scale	4.30 (0.72)	4.37 (0.68)	0.021
Feel close to mother	4.39 (0.90)	4.49 (0.81)	0.015
Think mom cares about you	4.81 (0.56)	4.84 (0.50)	0.092
Mom is warm and loving toward you	4.35 (0.81)	4.28 (0.88)	0.065
Satisfied communication with mom	3.86 (1.10)	3.95 (1.06)	0.076
Satisfied with relationship with mom	4.16 (0.97)	4.24 (0.94)	0.060

Note. *Data collected at wave I (mean age 14.95).

[+]Data collected at wave III (mean age 21.31).

Table 3

Bivariate and adjusted odds ratios (95% confidence intervals) for receiving a pap smear based on adolescent perceived maternal relationship, n=7,224

	Bivariate Model	Adjusted Model
	OR (95% CI)	OR (95% CI)
Adolescent Perceived Maternal Relationship*	1.14 (1.03, 1.28)	1.11 (1.00, 1.24)
Age[+]		0.94 (0.89, 1.00)
Race/Ethnicity[+]		
Non-Hispanic White		1.00
Hispanic		0.77 (0.60, 0.99)
Non-Hispanic Black		1.51 (1.15, 1.98)
Non-Hispanic AI/AN		0.59 (0.36, 0.84)
Non-Hispanic Asian		0.55 (0.36, 0.84)
Education[+]		
Some college or higher		1.00
HS graduate		0.80 (0.66, 0.97)
Less than HS		0.76 (0.58, 1.01)

Note. *Data collected at wave I (mean age 14.95).

[+]Data collected at wave III (mean age 21.31).

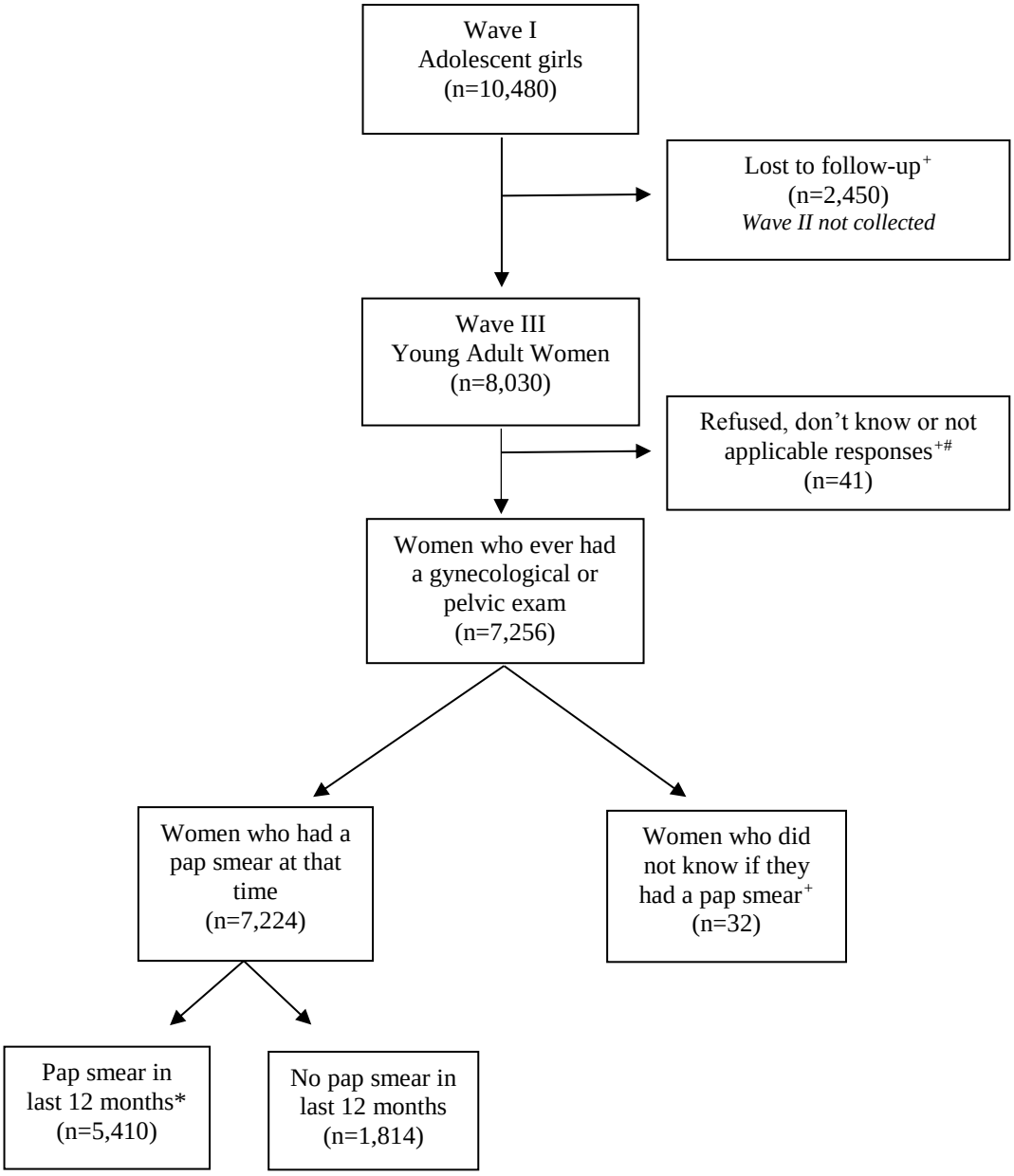

Figure 1. Sample selection flowchart, n=7,224

*Pap smear in the last 12 months is compliant based on 2001 recommended guidelines (US Preventive Services Task Force, 1996).

+Responses not included in analysis.

#Women who did not know their mothers were considered not applicable.