

Sociodemographic Factors Associated With HPV Awareness/Knowledge and Cervical Cancer Screening Behaviors Among Caregivers in the US

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Abstract

Background. Family caregivers may be at a higher risk for several chronic diseases including cancer. Cervical cancer is one of the most prevalent cancers among U.S. women. Despite family caregivers' vulnerability, the status of their HPV awareness, knowledge, and preventive health behaviors, including cervical cancer screening, have been understudied. Thus, this study aimed to examine the sociodemographic factors associated with HPV awareness and knowledge, and adherence to the cervical cancer screening guidelines among caregivers in the U.S.

Methods. Nationally representative cross-sectional survey data were obtained from the Health Information National Trends Survey (HINTS 5, 2017-2020). Only female caregivers, aged 21-65, were included (N= 834). Weighted multivariate logistic regression was performed to identify factors associated with HPV awareness, knowledge, and adherence to the United States Preventive Service Task Force cervical cancer screening guidelines (by age, race/ethnicity, education, household income, marital status, employment status, and health insurance type).

Results. Caregivers who were older (aged 51-65 vs. 21-50), were less educated (high school graduate or less vs. some college or more) showed lower adherence to the cervical cancer screening guidelines (every 3 years) than their counterparts. Caregivers who were older and less educated showed lower HPV awareness (Heard of HPV).

Conclusions. There are caregiving populations whose HPV awareness, knowledge and cervical cancer screening adherence are low. To improve their awareness and knowledge of HPV and support their cervical cancer screening behaviors, we need to consider interventions that target those specific populations.

Introduction

Approximately 53 million individuals were family caregivers in the U.S. in 2020.(1) More than one in five people (21%) provided unpaid healthcare or functional needs for their family members. (1) This is a 9.5 million increase from 2018 (43.5 million), and the family caregiving population is projected to continue to increase.(1) Caregivers are often described as hidden patients because caregiving is burdensome as it requires physical, emotional, financial sacrifices and is usually a long-term commitment, spanning from several years to over a decade.(2) About a quarter of caregivers (26%) report spending over 20 hours per week providing care.(3) Consequentially, this population is vulnerable to an unhealthy lifestyle and are at high risk for chronic diseases.(4–7) Prolonged caregiving causes cumulated stress, including neurohormonal changes and inflammatory responses in the body, weight loss, and sleep deprivation.(8, 9) According to the caregiver data from the Behavioral Risk Factor Surveillance System (BRFSS), in 2015-17, 14.5% of caregivers experienced an unhealthy mental status for 14 and more days in the past month,(10) 17.6% had an unhealthy physical status for 14 days or more in the past month, and 36.7% reported insufficient sleep (less than 7 hours of sleep).(10) Moreover, 40.7% of caregivers reported multiple chronic medical conditions, including coronary heart disease, stroke, asthma, chronic obstructive pulmonary disease (COPD), arthritis, depressive disorder, kidney disease, diabetes, and cancer.(10)

The majority of caregivers are female (61%),(3) and the average age of female caregivers is 50.1 years.(1) Cervical cancer is one of the most prevalent cancers among women in the U.S. and the average age at diagnosis is 50.(11) It is also one of the most common causes of cancer death among U.S. women.(11) For most types of cervical cancer, Human Papilloma Virus (HPV) infection is the primary cause, specifically HPV 16 and 18.(12) Approximately 80 million people in the U.S. are currently infected with HPV.(13) While the majority of HPV infections disappear naturally within 1 to 2 years; (12) persistent high-risk HPV can cause cancers of the cervix, penis and anus.(12) Papanicolaou cytology (Pap smear) detects changes in cells caused by HPV and allows at-risk women to receive treatment before it becomes invasive carcinoma.(14) As early detection can reduce cervical cancer incidence and mortality significantly, active cervical cancer screening is strongly recommended as an effective prevention strategy. The U.S. Preventive Services Task Force (USPSTF) recommends cervical cytology every 3 years for women aged 21 to 29 years old, and for women aged 30-65 years old, either cervical cytology every 3 years, high-risk Human Papilloma Virus (hrHPV) testing every 5 years, or hrHPV testing in combination with cytology (co-testing) every 5 years.(15) In 2018, 12,733 new cervical cancer cases and 4,138 cervical cancer death were reported despite effective prevention and treatment options.(16, 17)

Despite the threat of cervical cancer, knowledge regarding the cause of cervical cancer and the linkage to HPV infection has been low to moderate among Americans.(18–20) Furthermore, HPV knowledge level differs by sociodemographic characteristics (e.g., race/ethnicity, age, income, educational attainment, insurance status, rurality of residence).(20–27) HPV knowledge level was lower in racial/ethnic minorities, including Hmong American immigrants, Korean American immigrants, and Hispanics, older populations, and rural residents. (20–27)

Adherence to the cervical cancer screening guidelines (e.g., pap smear within the past 3 years) has been moderate to high.(28, 29) Previous analysis of HINTS data (2013-14) revealed that 81.3% of 21-65 years of women reported that they had a Pap smear in the past 3 years.(30) However, stark disparities by sociodemographic factors were observed in cervical cancer screening behavior.(2, 3, 35, 4, 8, 9, 28, 31–34) Similar to the HPV knowledge level, the Pap smear test was less utilized in women who were older and racial/ethnic minorities (African American, Asians, Hispanics).(3, 34, 35) Also, low Socioeconomic Status (SES), including low income, low educational attainment, no health insurance, absence of a usual source of healthcare, was significantly associated with low adherence to obtaining cervical cancer screening.(2, 4, 8, 9, 31–33)

Reportedly, HPV knowledge level is an essential indicator in cervical cancer screening utilization as these two are positively associated with each other.(36, 37) Multiple studies have reported this association based on their empirical research or nationally representative survey data analysis.(36, 37) This relationship is also supported by the Theory of Reasoned Action, a theory explaining how intention and health behaviors are related.(5, 6)

While multiple studies have shown disparities in HPV knowledge and cervical cancer screening behavior in women in the U.S., studies focused on family caregivers' negative health behaviors due to the caregiving burden and the receipt of preventive clinical services, including cancer screening, are still scant with inconsistent results.(38–47) Some studies presented caregivers' adherence to the Pap smear test being low because of caregiving.(38–41) Other studies reported no association between caregiving status and Pap smear utilization.(39, 42, 43) Studies have also suggested that the caregivers are more aware of the preventive health services and hence actively participating in cancer screening.(44–47)

Despite the limited findings, there has been a longstanding concern that caregivers are less likely to perform cancer screenings because the burden of caregiving may hinder them from obtaining care for themselves and their health status is already vulnerable.(4–7, 38–41) In addition, the burden of caregiving and the association of chronic medical conditions also differed by sociodemographic characteristics. Family caregivers who are women, racial/ethnic minorities, rural residents, and with low income experienced heavier caregiving burdens,(7, 48–52) and also presented with worse health conditions.(50, 53–55) While we can reasonably assume that subgroups of caregivers are disproportionately low in cervical cancer screening and HPV knowledge, little is known in this area. Given the caregivers' crucial role in patients' disease management, treatment compliance, resilience, and mental and spiritual support, and family functioning, and the persisting nature of caregiving, this population needs additional support on the importance of obtaining and adhering to cervical cancer screening recommendations. Therefore, this study aimed to identify sociodemographic factors associated with disparities in HPV knowledge and cervical cancer screening behaviors among caregivers in the U.S. This information will contribute to the development of a targeted intervention to interpose existing inequities in this area.

Methods

Data source

This study used publicly available cross-sectional data, Health Information National Trends Survey (HINTS).(56) HINTS is a self-administered nationally representative survey data collected by the National Cancer Institute. The present study used HINTS 5 Cycle 1,2,3,4 in 2017-2020. HINTS 5 is a random digit-dialed telephone survey and a mailed questionnaire survey in non-institutionalized civilians aged 18 and older in the US. HINTS 5 included data of caregiver population, their health-related behavior, perception, and knowledge of the disease. Geographic addresses were stratified by either area with a high concentration of minority population or low concentration of minority population in HINTS 5 Cycle 2,3,4. HINTS 5 Cycle 1 included one more stratification in geographic address, counties of Central Appalachia. The present study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline.(57)

The total number of respondents used in this study was 16,092 (3,285 in Cycle 1, 3,504 in Cycle 2, 5,438 in Cycle 3, 3,865 in Cycle 4). Each response rate was 32.4%, 32.39%, 30.3%, 36.7%, respectively. The response rate was estimated based on Response Rate 2 formula (RR2) from the American Association of Public Opinion Research.(58) In our analysis, we only included female caregivers aged 21-65 (n= 834) because that is the population recommended to obtain a regular cervical cancer screening every 3 years by the USPSTF.

Caregiver status

Caregiving status was identified by one question; "Are you currently caring for or making health care decisions for someone with a medical, behavioral, disability, or other conditions?" Those who affirmatively responded 'yes' were defined as caregivers.

Outcome variables

HPV Awareness (Heard of HPV) and HPV Knowledge (HPV can cause cervical cancer)

To investigate caregivers' awareness of Human Papillomavirus (HPV), the following survey questions were used; "Have you ever heard of HPV? HPV stands for Human Papilloma Virus. It is not HCV, HIV, or Herpes." Those who answered "yes" were considered to have HPV awareness. Respondents who answered "yes" to the question, "Do you think HPV can cause cervical cancer?" were regarded as having knowledge of the causal effect of HPV on cervical cancer in this study.

Cervical cancer screening adherence to the screening guidelines (Had a pap test within 3 years)

To distinguish the caregivers who are complaint with the USPSTF cervical cancer screening guidelines, the question, "How long ago did you have your most recent Pap test to check for cervical cancer?" was used. Those who answered, "I have never had a Pap test" were recoded to "Never." Caregivers with all other answers were divided into "within guidelines" if they had a pap test within the past 3 years or "outside guidelines" if they had a pap test more than 3 years ago.

Covariates

Conceptual framework of social determinants of health from the Healthy People 2030 was applied for the choices of sociodemographic predictors in this study(59): Age (21–50, 51–65), birth gender, race/ethnicity (White, Hispanic, African American/Black, Others including Asian, Native Hawaiian/Pacific Islander, American Indian/Alaska Native, Multiple races), household income (less than \$20,000, \$20,000 to less than \$35,000, \$35,000 to less than \$50,000, \$50,000 or more), educational attainment (high school graduate or less, some college or more), marital status (married or living with a romantic partner as a married vs. not married including divorced, widowed, separated, single/never been married), employment status (employed vs. unemployed including homemaker, student, retired, disabled), health insurance type (insured by employment or private insurance, Tricare/VA/Indian Health Services, Medicare, Medicaid.)

Statistical Analysis

The weighted percent of each outcome was estimated for each demographic characteristic. To examine the association between characteristics and the three outcomes of interest (1) HPV awareness, 2) HPV knowledge, 3) adherence to the cervical cancer screening guidelines weighted multivariate logistic regression was performed to present odds ratios and 95% confidence intervals (Table 3). The statistical significance was determined at p-value is less than 0.05 and alpha is 0.05. All estimates accounted for the sampling strategy using replicate weights and survey procedures in SAS (SAS Studio, version 9.4, Cary, NC).

Results

Among female caregivers aged 21-65, 39% were aged 51-65, 64% were non-Hispanic White, 46% reported less than \$50,000 annual household income, 25% were high school graduate or less education, 60% were employed, 64% were married, 67% were insured by the employment-based or private plan while 33% was insured by the government provided insurance (Medicare, Medicaid, Tricare, VA, Indian Health Services), and approximately 98% was urban (metropolitan, micropolitan, and small town) residents. (Table 1).

HPV Awareness (Heard of HPV) and HPV knowledge (HPV can cause cervical cancer)

Approximately 79% of female caregivers (aged 21-65) heard of HPV and the majority of participants thought that HPV can cause cervical cancer (98%) (Table 2). However, disparities in HPV awareness were found by sociodemographic characteristics (Table 3). Younger female caregivers (21–50) were over 2 times more likely to have heard of HPV compared to older caregivers (51–65) (OR=2.67, 95% CI=1.61, 4.41). Female caregivers whose educational attainment was high school graduate or less were one third times likely to have heard of HPV than individuals with some college or more (OR=3.10, 95% CI=1.16, 5.79 in some college or more group).

Adherence to the Cervical Cancer Screening Guidelines (Had a pap test within 3 years)

Overall, 83% of female caregivers had a pap test in the past 3 years (Table 2). Sociodemographic disparities were also found (Table 3). Younger caregivers (21–50) were more likely to follow the cervical cancer screening guidelines than older caregivers (51–65) (OR=3.47, 95% CI=2.01, 5.98). Other ethnic groups, including Asian, Native Hawaiian/Pacific Islander, American Indian/Alaska Native, Multiple races were more likely to adhere to the cervical cancer screening guidelines than Hispanic female caregivers (OR=4.63, 95%=1.05, 20.38). Caregivers with some college or more education were nearly 2 times likely to adhere to the cervical cancer screening guidelines than those with high school graduate or less education (OR=2.08, 95% CI=1.16, 3.74).

Discussion

This study assessed sociodemographic factors associated with HPV awareness (heard of HPV), HPV knowledge (HPV can cause cervical cancer), and adherence to the cervical cancer screening guidelines (had a pap test within 3 years) among female caregivers in the U.S. from 2017-2020. In general, the older age group, Hispanics, those with low education, were less likely to have awareness and knowledge of HPV and adhere to guidelines.

Our results were similar to Blake et al.(60) who reported lower levels of HPV awareness among women who were older, less educated, had lower-income, had no health insurance, and were of a racial/ethnic minority (Hispanics). One plausible explanation could be that HPV awareness and HPV vaccination campaigns target younger age groups. Healthcare professionals also focus more on younger age groups to promote HPV vaccine uptake and HPV awareness. Thus, older generations, aged 51-65, are less likely to be exposed to these HPV campaigns and educational efforts.

Previous literature reported differences in HPV knowledge level by race/ethnicity, specifically lower knowledge among U.S. racial/ethnic minorities including Hmong American immigrants, Korean American immigrants, and Hispanic women.(23, 24, 26, 27, 61) Although other ethnic groups, including Asian female caregivers, were less likely to know about HPV than non-Hispanic Whites, African American/Blacks, and Hispanics in this study, it was not significant. Prior studies that examined HPV knowledge among the general population revealed that age,(21, 23) as well as socioeconomic status (income and educational attainment, rurality of residence)(20–22, 24) was also associated. However, socioeconomic factors, including household income, educational status, were not associated with HPV knowledge in this population. Presumably, individuals with higher education and higher income are more likely to have higher health literacy and greater access to health resources which can possibly increase their knowledge and awareness of HPV. However, this hypothetical relationship was not observed in this study. One explanation could be that only participants who answered that they have had heard of HPV, were asked subsequently, “Do you think HPV can cause cervical cancer?”. In other words, people who are already aware of HPV are more likely to know the causation of cervical cancer which may make it more challenging to associate additional socioeconomic disparities in HPV knowledge among this population. Additionally, this made the sample size of those with HPV knowledge even smaller, which may have resulted in non-significant differences in some of the socioeconomic factors. This can be the limitation of HINTS 5 data to precisely analyze variables related to HPV knowledge. Further comprehensive analysis to examine the association of socioeconomic characteristics and HPV knowledge among female caregivers with a larger sample will be necessary.

Prior studies reported that older age,(62–64) low income,(2, 8) low educational attainment,(2, 4, 8, 33) lack of health insurance,(2, 8, 33) marital status,(2, 4, 33) was associated with low cervical cancer screening rates (within 3 years) among US women. Johnson et al(63) reported younger age groups had higher odds of having a pap test within 5 years than older age groups in general US women. Similar associations were observed in the present study. Although most (93% or higher) female caregivers reported ever having a Pap smear in the past, many subgroups did not adhere to the cervical cancer screening guidelines of every 3 years. Healthy People 2030 aimed to reach 84.3% of adherence to the cervical cancer screening guidelines among U.S. women.(65) In our analysis, the younger age group (aged 21-50) showed satisfied status to reaching the goal (91%) while the older age group (aged 51-65) was far behind the target (75%).

Considering the average diagnosed age of cervical cancer in the U.S. is 50, the older age group is the one who needs our attention to improve and maintain their adherence to the USPSTF guidelines. Education was significantly associated with the adherence to the cervical cancer screening guidelines in both general women and caregivers. Women with low educational attainment (high school graduate or less education) showed lower odds of cervical cancer screening behaviors than those with higher educational attainment (4-year college and more education) in general women (63), and this trend was the same in the caregiver population in this study. However, low household income was not significantly associated with the adherence of cervical cancer screening guidelines among caregivers in this study, although low-income earners (annual household income <\$30,000) showed lower odds in obtaining cervical cancer screening within 5 years among U.S. women in previous studies (63, 66). The association of age and the adherence to the cervical cancer screening guidelines could be explained by the relationship that low HPV awareness and knowledge is closely related to the low HPV screening behavior.(36, 37) Thus, older caregivers who have low HPV awareness are less likely to obtain cervical cancer screening guidelines.

Moreover, it is possible that the caregivers who have low financial resources and educational attainment may be less likely to have heard of HPV and may also be less knowledgeable of HPV. As a result, they may be less likely to acknowledge the importance of HPV screening and have fewer resources, including financial, physical, emotional, to adhere to the recommended cervical cancer screening guidelines. Small sample size could be one potential reason for the no significant association between household income and the adherence to the cervical cancer screening among caregivers. Hence, further comprehensive examination will be necessary with the larger sample population to see whether household income is associated with the adherence to the cervical cancer screening behaviors among caregivers.

In previous research, women with public health insurance had higher odds in obtaining a cervical cancer screening within 5 years than those with private insurance.(63)

As the coverage of the public insurance has increased since 2016, a study reported that government provided insurance holder's preventive health services utilization rate were also higher than that of non-government insurance holders. However, in this study, significant differences between the health insurance types were not observed in HPV awareness and knowledge, and adherence to the cervical cancer screening guidelines among caregivers. Further research will be necessary to examine the role of health insurance types in adherence to cervical cancer screening behaviors among caregivers. It will help to identify vulnerable subpopulations to improve adherence among caregivers.

Prior studies reported that African-Americans and Hispanics women had lower adherence to cervical cancer screening guidelines than non-Hispanic Whites.(63, 64) However, in this study, rather the White caregivers had lower odds in pap test guideline adherence than the Black caregiver's odds when compared to Hispanics, but it was not significant. Other ethnic groups' odds of adherence to the cervical cancer screening guidelines were higher than Hispanics' odds. Further research is recommended to investigate the association of ethnic minorities and adherence to the cervical cancer screening guidelines among caregivers.

Limitation

The current study has several limitations. First, HINTS is a cross-sectional survey at one point of the year. Hence, it cannot guarantee temporality and causal inference in the outcomes of interests in this study. Second, a low response rate (overall 32%) is concerning because those responding to the survey may be different than those who don't and so the survey may not be representative of the target population. Third, the small sample size may be related to some of the non-significant results. Although full sample weights were applied to account for non-response rate and other biases, concerns in representativeness in race/ethnicity may still exist. Lastly, the definition of caregiver may not be precise enough to distinguish the 'ongoing basis multiple-duty medical need-based caretakers' from 'mild (light hours) life aid-based caretakers.' Therefore, the intensity of their caregiving duty was not accounted for in this study. Moreover, this study did not include the rurality of residence as a sociodemographic factor despite the potential association with the disparities in HPV awareness and knowledge as well as adherence to the guidelines of cervical cancer screening. Because nearly 98% of caregivers were urban residents, we did not think we could have meaningful results out of this population distribution. However, further investigation is needed to better understand how rurality of residence affects caregivers' cervical cancer screening behaviors, including the caregiving burden among rural residents. Although the incidence of invasive cervical cancer was higher in the rural area at every stage (60, 67, 68) individuals living in resource-limited or rural areas showed lower rates of cervical cancer screening compared to the general population in the U.S.(69) Female caregivers who are residing in rural areas are experiencing a heavier caregiving burden and presenting with worse health conditions.(50) Previous studies reported the potential barriers to receive cancer screening among rural residents could be a lack of access to care, health insurance coverage, mistrust of healthcare. Along with these potential reasons, periodic cervical cancer screening may be less recommended by the healthcare professionals in rural caregivers.(70, 71) This could be partially due to the lack of healthcare services resources, including the shortage of healthcare professionals in rural areas. If a limited number of healthcare professionals are required to cover a large group of rural residents, non-urgent health issues, including preventive services, could be often less prioritized. However, the relationship between rurality and low adherence to the cervical cancer screening guidelines is still unclear.(71, 72)

Conclusion

It is important to acknowledge the association between HPV and cervical cancer screening behaviors as higher HPV awareness and knowledge are closely related to higher adherence to cervical cancer screening behaviors.(73, 74) Furthermore, adhering to the recommended cervical cancer screening is crucial for detecting cervical cancer early and reducing mortality significantly.(75, 76) Therefore, targeted intervention to improve HPV awareness and cervical cancer screening adherence will be effective and urgently required among female caregivers as this populations' health condition is at risk.

We found that sociodemographic factors, particularly age, race/ethnicity, educational attainments, were associated with disparities in HPV awareness and adherence to the cervical cancer screening guidelines among female caregivers in the U.S. The value of this study is the suggestion that targeted interventions should focus on women caregivers who are aged 51-65, have low educational attainment (high school graduate or less). Efforts to improve HPV awareness and knowledge as well as adherence to the cervical cancer screening guidelines in this vulnerable subpopulation is needed.

Abbreviations

- HINTS: Health Information National Trends Survey
- HPV: Human Papillomavirus
- BRFSS: Behavioral Risk Factor Surveillance System
- Pap Smear: Papanicolaou cytology
- USPSTF: U.S. Preventive Services Task Force

Declarations

- **Ethics approval and consent to participate**

Ethics approval and participant consent was not necessary as this study involved the use of a previously-published de-identified database. The data used in the study were publicly available.

All the methods performed in the study followed the relevant guidelines and regulations.

- **Consent for publication**

Not applicable.

- **Availability of data and materials**

The datasets generated and/or analyzed during the current study are available in the Health Information National Trends Survey, <https://hints.cancer.gov/data/default.aspx>

- **Competing interests**

We declare no competing interests regarding the research, authorship, and/or publication of this article.

- **Funding**

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- **Authors' contributions**

JK conceived the study. JK designed the study protocol and conducted literature search under the supervision of JHTD. JK and MD analyzed and interpreted the data. JK wrote the manuscript and JHTD and MD substantially contributed to the manuscript revision.

- **Acknowledgement**

Not applicable.

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Tables

Table 1
Demographic characteristics of female caregiving population 2017-2020

		Frequency, n	Percentage, % (95% CI)
age (years)	21-50	432	61.18 (56.10, 66.25)
	51-65	402	38.82 (33.75, 43.90)
		834	100.00
Race/ethnicity	Non-Hispanic White	461	63.55 (58.83, 68.27)
	Black/African American	139	13.94 (11.20, 16.67)
	Hispanic	126	13.13 (10.11, 16.16)
	Others	72	9.38 (5.62, 13.14)
		798	100.00
Household income	Less than \$20,000	151	20.45 (15.13, 25.77)
	\$20,000-less than \$35,000	96	11.87 (9.17, 14.57)
	\$35,000-less than \$50,000	104	13.73 (10.71, 16.75)
	\$50,000 or more	435	53.95 (49.15, 58.76)
		786	100.00
Years of education	High school or less	164	25.06 (20.57, 29.55)
	Some college or more	664	74.94 (70.45, 79.43)
		828	100.00
Area: Rurality	Urban	813	97.75 (96.60, 98.91)
	Rural	21	2.25 (1.09, 3.40)
		834	100.00
Employment	Employed	501	59.54 (54.29, 64.78)
	Unemployed	308	40.46 (35.22, 45.71)
		809	0.00
Marital Status	Married	499	64.02 (58.89, 69.14)
	Not Married	330	35.98 (30.86, 41.11)
		829	100.00
Health Insurance	By employment or private	484	67.34 (62.00, 72.68)
	Tricare, VA, Indian Health Services	36	3.98 (1.95, 6.11)
	Medicare	41	3.39 (2.04, 4.74)
	Medicaid	151	25.29 (20.19, 30.40)
		712	100.00

Table 2

Caregiver's HPV Awareness/knowledge and Cervical Cancer Screening Behaviors, Frequency (n) and weighted percent (%)

		HPV Awareness		HPV Knowledge		Pap Test in 3 Years	
		N / row total	Weighted percent (95% CI)	N /row total	Weighted percent (95% CI)	N/ row total	Weighted percent (95% CI)
	Total	661/834	79%	547/560	98%	671/805	83%
age (years)	21-50	369/432	84% (79%, 89%)	318/324	98% (96%, 100%)	381/416	91% (88%, 94%)
	51-65	292/402	66% (58%, 75%)	229/236	98% (96%, 100%)	290/389	75% (69%, 81%)
Race/ ethnicity	White	400/460	84% (79%, 89%)	340/345	99% (97%, 100%)	373/451	83% (79%, 87%)
	Black/African American	100/139	69% (57%, 80%)	79/81	99% (96%, 100%)	114/132	88% (80%, 96%)
	Hispanic	94/126	77% (67%, 87%)	74/75	98% (95%, 100%)	96/119	77% (68%, 87%)
	Others	17/34	53% (31%, 76%)	15/15	93% (81%, 100%)	30/32	94% (88%, 100%)
Household income	Less than \$20,000	104/150	70% (56%, 84%)	76/82	98% (95%, 100%)	113/143	80% (71%, 89%)
	\$20,000 to <\$35,000	64/96	69% (57%, 82%)	48/50	95% (85%, 100%)	65/91	86% (79%, 94%)
	\$35,000 to <\$50,000	78/104	78% (66%, 90%)	58/60	95% (88%, 100%)	82/101	80% (70%, 89%)
	\$50,000 or more	383/435	82% (75%, 89%)	338/341	99% (98%, 100%)	374/425	87% (82%, 91%)
Years of education	High school or less	98/164	61% (49%, 73%)	61/68	96% (93%, 100%)	115/153	76% (67%, 85%)
	Some college or more	559/663	83% (78%, 88%)	482/488	98% (97%, 100%)	553/648	87% (84%, 90%)
Employment	Employed	407/501	78% (71%, 86%)	348/354	98% (96%, 100%)	410/484	85% (81%, 90%)
	Unemployed	234/307	74% (67%, 82%)	185/192	98% (96%, 100%)	241/298	83% (77%, 88%)
Marital Status	Married	413/499	81% (75%, 86%)	354/360	98% (96%, 100%)	417/487	85% (81%, 89%)
	Not Married	245/329	72% (63%, 80%)	191/198	99% (98%, 100%)	249/313	83% (78%, 89%)
Health	Employment/ private	418/484	83%	365/368	99%	412/472	88%

Insurance			(75%, 90%)		(98%, 100%)		(84%, 92%)
	Tricare/VA/Indian Health	28/36	81% (64%, 98%)	24/25	99% (96%, 100%)	29/35	91% (81%, 100%)
	Medicare	32/40	76% (56%, 96%)	23/24	88% (62%, 100%)	30/38	86% (73%, 100%)
	Medicaid	109/151	73% (62%, 84%)	82/87	96% (92%, 100%)	124/147	83% (75%, 91%)

Table 3

HPV Awareness and Knowledge and Cervical Cancer Screening Behaviors Among Caregivers (Odds Ratio and 95% CI)

		HPV awareness (Heard HPV) Odds Ratio (95% CI)	HPV knowledge (HPV can cause Cervical Cancer) Odds Ratio (95% CI)	Within guidelines (Pap test in 3 years) Odds Ratio (95% CI)
age (years)	21-50	2.67 (1.61, 4.41)	1.11 (0.18, 6.68)	3.47 (2.01, 5.98)
	51-65	Reference	Reference	Reference
Race/ethnicity	White	1.63 (0.90, 2.94)	1.15 (0.26, 5.02)	1.46 (0.77, 2.79)
	Black/African American	0.67 (0.30, 1.50)	1.12 (0.06, 22.25)	2.20 (0.73, 6.58)
	Hispanic	Reference	Reference	Reference
	Others	0.35 (0.12, 1.02)	0.21 (0.01, 9.87)	4.63 (1.05, 20.38)
	Less than \$20,000	Reference	Reference	Reference
Household income	\$20,000-less than \$35,000	0.96 (0.37, 2.51)	0.44 (0.01, 24.96)	1.02 (0.45, 2.30)
	\$35,000-less than \$50,000	1.48 (0.63, 3.48)	0.53 (0.04, 7.02)	1.62 (0.66, 3.97)
	\$50,000 or more	1.96 (0.87, 4.40)	3.39 (0.28, 40.71)	1.62 (0.75, 3.50)
Years of education	High school or less	Reference	Reference	Reference
	Some college or more	3.10 (1.16, 5.79)	2.36 (0.50, 11.10)	2.08 (1.16, 3.74)
Employment	Employed	1.26 (0.68, 2.34)	1.08 (0.20, 5.93)	1.23 (0.67, 2.23)
	Unemployed	Reference	Reference	Reference
Marital Status	Married	1.62 (0.95, 2.77)	0.68 (0.18, 2.57)	1.17 (0.68, 1.99)
	Not Married	Reference	Reference	Reference
Health insurance	By employment or private	1.74 (0.77, 3.93)	4.97 (0.36, 21.63)	1.52 (0.75, 3.07)
	Tricare, VA, Indian Health	1.57 (0.46, 5.37)	2.79 (0.36, 21.63)	2.05 (0.51, 8.28)
	Medicare	1.18 (0.34, 4.08)	0.27 (0.04, 2.02)	1.27 (0.32, 5.00)
	Medicaid	Reference	Reference	Reference

***Bold-coded** is statistically significant, P-value < 0.05.