



# Disparities in HPV and the HPV Vaccine Knowledge Among Non-Hispanic Black Adults in the US - HINTS 2017–2020

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## Abstract

Disparities persists in HPV awareness and vaccination among different racial and ethnic groups. We assessed disparities in awareness of HPV and the HPV vaccine among non-Hispanic Black US adults. We analyzed the nationally representative data from the Health Information National Trends Survey of US adults 18 years or older ( $n = 16,092$ ) administered by the National Cancer Institute (HINTS5-Cycle 1,2,3,4) for the years 2017–2020, of which 2,011 ( $n = 2,011$ ) were non-Hispanic Black adults. Weighted Poisson regression models were used to estimate disparities in HPV and HPV vaccination awareness among non-Hispanic Black US adults. In the US, 63.2% of non-Hispanic Black adults had heard of HPV and 57.6% were aware of the HPV vaccine. Black females had 1.3 and 1.5 times the prevalence of HPV and the HPV vaccine awareness compared to males ( $PR = 1.3$ ; 95%  $CI = 1.2–1.4$ ;  $P \leq 0.001$ ) and ( $PR = 1.5$ ; 95%  $CI = 1.4–1.6$ ;  $P \leq 0.001$ ) respectively. Blacks with a college education had 1.8 and 2.2 times the prevalence of HPV and HPV vaccine awareness ( $PR = 1.8$ ; 95%  $CI = 1.4–2.4$ ;  $P \leq 0.001$ ) and ( $PR = 2.2$ ; 95%  $CI = 1.8–2.7$ ;  $P \leq 0.001$ ) respectively, compared to those with less than a high school education. Compared to 2017, Black adults with  $\leq \$35K$  income were less aware about HPV in 2020. There was evidence of disparities in HPV and HPV vaccine awareness among non-Hispanic Blacks. To foster improvements in HPV vaccine uptake and reduce disparities in HPV-associated cancers, future interventions must target men and disadvantaged populations, for whom awareness gaps exist.

**Keywords** Human papilloma virus · Vaccination · Awareness · Sex · HPV · HPV vaccine · Race · African Americans · Health Disparities · Health Promotion

## Introduction

In the United States, the human papillomavirus (HPV) is the most frequent sexually transmitted infection (STI), with nearly 14 million people infected every year [1, 2] Although most HPV types are asymptomatic, self-limiting, and classified as low risk, there are specific high-risk types, such as types 16 and 18, that can lead to the development

of low-grade cervical cell abnormalities, high-grade cervical cell abnormalities, and ultimately, cervical cancer. The oncogenic types are highly associated with cervical, vaginal, penile, vulvar, anal, and oropharyngeal cancers [3].

In the United States, the annual cost of healthcare associated with HPV is estimated to be approximately \$2.9 billion. This cost encompasses expenses related to the diagnosis and treatment of HPV-related cervical abnormalities and warts [4]. Between 2011 and 2014, the prevalence of any oral HPV among US adults aged 18–69 was 7.3%, and high-risk HPV was 4.0%. The prevalence of any and high-risk oral HPV was lowest among non-Hispanic Asian adults and highest among non-Hispanic Black adults. Similarly, the prevalence of any genital HPV was 42.5% among adults aged 18–59, with some variations among groups (e.g., 45.2% among males and 40% among females) [3]. Overall, the prevalence of any genital HPV was lowest among non-Hispanic Asian adults and highest among non-Hispanic Black adults [3]. Further, disparities in HPV infection and cervical cancer

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rates, particularly among Black women and those living in the Southern US, persist [5]. In the US, the prevalence of both high-risk genital HPV (40.3%) and high-risk oral HPV (7.3%) were highest among Black men between 2013 and 2014 [3].

Evidence suggests the presence of disparities in awareness among US adults, with females being more likely than males to have heard of HPV and the HPV vaccine. Additionally, in 2013–2014, HPV or the HPV vaccine awareness was lowest among non-Hispanic Blacks [6]. They were 33% and 44% less likely than non-Hispanic Whites to have heard of HPV and the HPV vaccine, respectively [6].

The American Society of Clinical Oncology (ASCO) and the American Cancer Society (ACS) issued a collaborative statement, in 2016, emphasizing the importance of cancer prevention through HPV vaccination [7, 8]. This statement aligns with the national efforts, including the Healthy People 2030 initiative, which aims to enhance HPV awareness and promote higher vaccine uptake throughout the United States [9]. Further, having valid and reliable HPV awareness estimates is important for developing targeted educational and preventive interventions. HPV awareness has been found to be associated with HPV vaccine interest, [10] acceptance, [11] intent to vaccinate, [12] and vaccination [13]. Moreover, HPV awareness among parents of adolescent children was found to be associated with a higher interest in child vaccination [10].

HPV prevalence and low HPV vaccine uptake are significant public health concerns. Racial disparities in HPV and HPV vaccine awareness rates suggest the need for additional research examining factors associated with these awareness gaps. Our objectives were to assess disparities in awareness of the human papillomavirus (HPV) and the HPV vaccine among US Black adults.

## Methods

### Study Population, Design, Setting

We analyzed the nationally representative data from the Health Information National Trends Survey of US adults 18 years or older ( $n=16,092$ ) administered by the National Cancer Institute (HINTS5-Cycle 1,2,3,4) for the years 2017–2020, of which ( $n=2,011$ ) were non-Hispanic Black adults. The details of HINTS5 have been described elsewhere [14]. This data set has been utilized previously to assess HPV awareness among adults in the US [6, 15, 16]. The sampling frame of addresses was provided by Marketing Systems Group (MSG). Institutional Review Board approval was obtained; protocol number IRB22-0589.

## Measures

### Participant Characteristics

Sociodemographic characteristics included level of education, age, sex, rural-urban residence, and household annual income. Level of education was divided into 4 categories: less than high-school, 12 years of education or high school graduate, post-high school or some college, and college graduate or more (post-graduate). Age was grouped into 4 categories: 18 to 34 years, 35 to 49 years, 50 to 64 years, and 65 years or older. Residence was defined using the US Department of Agriculture's 2013 Rural-Urban Continuum Codes. Codes 1 to 3 were designated as urban, while codes 4 to 9 were categorized as rural. Household annual income was categorized into 4 categories: less than \$35K, \$35K to \$49,999, \$50K to \$74,999, and \$75K or more. We assessed HPV awareness through the survey item 'Have you ever heard of the HPV?' and we assessed awareness of the HPV vaccine through the survey item 'Before today, have you ever heard of the cervical cancer vaccine or HPV shot?'

### Analysis

All analyses were performed using Stata (v.15.1) and accounted for the complex multistage survey design of HINTS by including weights, strata, and clusters to provide representative estimates of the US population. Weighted proportions were used to report demographic characteristics and to assess HPV and HPV vaccine awareness.

First, we used multivariable logistic regression models to evaluate sociodemographic characteristics factors influencing HPV and the HPV vaccine awareness among Black participants.

To determine which variables to include in the logistic regression models, we initially conducted preliminary univariate analyses and performed chi-square tests for associations. This allowed us to identify any variables that exhibited significant associations with the outcome variable, HPV and HPV vaccine awareness, within our study population. We calculated adjusted odds ratios (AOR) and confidence intervals (95% CI). Statistical significance was defined as a P value less than 0.05.

Weighted poisson regression models were used to estimate disparities in HPV and HPV vaccination awareness among non-Hispanic Black US adults, and prevalence ratios (PRs) with 95% confidence intervals were reported for the group with the highest prevalence compared to the group with the lowest prevalence. A butterfly chart was used to assess the prevalence in 2017 and 2020 of HPV and HPV vaccination awareness between the most disadvantaged non-Hispanic Black US adults (male, 65 years or older,

education level less than high school, income less than \$35K, and living in rural area).

## Results

### Socio-Demographic and HPV and HPV Vaccine Awareness Characteristics

Table 1 summarizes the sociodemographic characteristics of the Cycles 1–4 of HINTS 5 for the Black adults ( $n=2,011$ ). In the US, 63.2% of non-Hispanic Black adults had heard of HPV, and 57.6% were aware of the HPV vaccine. Awareness about HPV and the HPV vaccine were highest among females (HPV: 70.6%, HPV vaccine: 68.7%), younger adults age 18–34 (HPV: 74.5%, HPV vaccine: 70.8%), those who had a college degree or higher (HPV: 73.4%, HPV vaccine: 69.9%), those with income of \$75K or more (HPV: 75.0%, HPV vaccine: 72.4%), and Black adults who lived in an urban area (HPV: 63.8%, HPV vaccine: 58.1%).

HPV and the HPV vaccine awareness were lowest among males (HPV: 53.7%, HPV vaccine: 42.9%), older adults (HPV: 45.2%, HPV vaccine: 35.3%), those with an educational level of less than high school (HPV: 44.7%, HPV vaccine: 38.3%), those with income of less than \$35K (HPV: 53.7%, HPV vaccine: 48.7%), and Black adults who lived in a rural area (HPV: 55.6%, HPV vaccine: 52.0%).

### Factors Associated with HPV and HPV Vaccine Awareness Among Non-Hispanic Black Adults in the US

Black adults aged 65+ years had lower odds of being aware about HPV and the HPV vaccine compared to those 18–34 years (AOR=0.2; 95%CI=0.1–0.5;  $P\leq 0.001$ ) and (AOR=0.2; 95%CI=0.1–0.4;  $P\leq 0.001$ ) respectively. Table 2 shows that Black females had over twice the awareness odds about HPV and the HPV vaccine compared to males (AOR=2.7; 95%CI=2.8–4.1;  $P\leq 0.001$ ) and (AOR=3.9; 95%CI=2.4–6.5;  $P\leq 0.001$ ) respectively. Non-Hispanic Blacks with a college education or more had twice the odds of being aware of HPV and the HPV vaccine (AOR=2.0; 95%CI=1.0–3.9;  $P=0.047$ ) and (AOR=2.1; 95%CI=0.9–4.9;  $P=0.091$ ) respectively, compared to those with less than a high school education. Black adults with an income of  $\geq 75$  K were more than twice as likely to be aware about HPV and the HPV vaccine compared to those with and income of  $< 35$  K (AOR=2.3; 95%CI=1.2–4.2;  $P=0.008$ ) and (AOR=2.8; 95%CI=1.5–5.0;  $P=0.001$ ) respectively. (Table 2)

**Table 1** HPV and HPV vaccine awareness among non-Hispanic Black adults in the US by sociodemographic characteristics - HINTS 2017–2020

| Socio-demographic Characteristics | Total (n=2,011)        |             | Heard of HPV Yes (n=1,234) |             | Heard of HPV Vaccine Yes (n=1,124) |             |
|-----------------------------------|------------------------|-------------|----------------------------|-------------|------------------------------------|-------------|
|                                   | Weighted proportions % | 95% CI      | Weighted proportions %     | 95% CI      | Weighted proportions %             | 95% CI      |
| <b>Age</b>                        |                        |             |                            |             |                                    |             |
| 18–34                             | 19.7                   | (16.4–23.5) | 74.5                       | (62.1–83.9) | 70.8                               | (58.3–80.7) |
| 35–49                             | 31.9                   | (28.6–35.3) | 70.9                       | (64.6–76.5) | 63.2                               | (56.0–69.8) |
| 50–64                             | 34.5                   | (30.8–38.4) | 56.9                       | (49.1–64.3) | 54.2                               | (47.0–61.2) |
| 65+                               | 14.0                   | (12.5–15.5) | 45.2                       | (39.1–51.6) | 35.3                               | (30.0–41.1) |
| <b>Sex</b>                        |                        |             |                            |             |                                    |             |
| Male                              | 42.7                   | (38.8–46.7) | 53.7                       | (45.4–61.8) | 42.9                               | (35.0–51.2) |
| Female                            | 57.3                   | (53.3–61.2) | 70.6                       | (66.8–74.0) | 68.7                               | (64.8–72.4) |
| <b>Education</b>                  |                        |             |                            |             |                                    |             |
| < High School                     | 11.6                   | (9.0–14.9)  | 44.7                       | (29.9–60.4) | 38.3                               | (23.0–55.6) |
| High School                       | 27.9                   | (24.8–31.3) | 53.0                       | (45.2–60.6) | 52.5                               | (45.0–59.9) |
| Some college                      | 34.4                   | (31.6–37.4) | 69.7                       | (64.3–74.7) | 58.4                               | (52.5–64.1) |
| College or more                   | 26.06                  | (23.7–28.5) | 73.4                       | (66.1–79.7) | 69.9                               | (62.4–76.4) |
| <b>Income</b>                     |                        |             |                            |             |                                    |             |
| < 35 K                            | 45.9                   | (41.6–50.3) | 53.7                       | (46.7–60.5) | 48.7                               | (42.9–54.6) |
| 35 K–<50 K                        | 13.3                   | (10.9–16.2) | 75.2                       | (66.9–81.9) | 66.7                               | (56.5–75.6) |
| 50 K–<75 K                        | 17.1                   | (14.2–20.6) | 62.78                      | (52.3–72.1) | 55.1                               | (45.7–64.1) |
| $\geq 75k$                        | 23.6                   | (20.4–27.2) | 75.0                       | (66.0–82.3) | 72.4                               | (63.3–80.0) |
| <b>Residence</b>                  |                        |             |                            |             |                                    |             |
| Urban                             | 92.7                   | (90.8–94.3) | 63.8                       | (59.8–67.7) | 58.1                               | (54.0–62.0) |
| Rural                             | 07.3                   | (05.7–09.2) | 55.6                       | (39.8–70.3) | 52.0                               | (37.1–66.6) |

Note: n: sample size; CI: confidence interval

**Table 2** Factors associated with HPV and HPV vaccine awareness among non-Hispanic Black adults in the US by sociodemographic characteristics - HINTS 2017–2020

| Socio-demographic Characteristics |               | Heard of HPV |           |         | Heard of HPV Vaccine |           |         |
|-----------------------------------|---------------|--------------|-----------|---------|----------------------|-----------|---------|
| Variable                          | Reference     | AOR          | 95% CI    | P-value | AOR                  | 95% CI    | P-value |
| <b>Age</b>                        |               |              |           |         |                      |           |         |
| 35–49                             | 18–34         | 0.7          | (0.2–1.5) | 0.293   | 0.5                  | (0.2–1.1) | 0.103   |
| 50–64                             | 18–34         | 0.4*         | (0.2–0.8) | 0.014   | 0.4*                 | (0.1–0.9) | 0.035   |
| 65+                               | 18–34         | 0.2*         | (0.1–0.5) | <0.001  | 0.2*                 | (0.1–0.4) | <0.001  |
| <b>Sex</b>                        |               |              |           |         |                      |           |         |
| Female                            | Male          | 2.7*         | (1.8–4.1) | <0.001  | 3.9*                 | (2.4–6.5) | <0.001  |
| <b>Education</b>                  |               |              |           |         |                      |           |         |
| High school                       | < High School | 1.0          | (0.5–2.1) | 0.904   | 1.4                  | (0.6–3.2) | 0.363   |
| Some college                      | < High School | 2.2*         | (1.2–4.0) | 0.010   | 1.5                  | (0.7–3.3) | 0.265   |
| College or more                   | < High School | 2.0          | (1.0–3.9) | 0.047   | 2.1                  | (0.9–4.9) | 0.091   |
| <b>Income</b>                     |               |              |           |         |                      |           |         |
| 35k–<50k                          | < 35 K        | 2.5*         | (1.3–5.0) | 0.007   | 2.4*                 | (1.3–4.5) | 0.007   |
| 50k–<75k                          | < 35 K        | 1.3          | (0.8–2.3) | 0.332   | 1.3                  | (0.8–2.2) | 0.265   |
| ≥ 75k                             | < 35 K        | 2.3*         | (1.2–4.2) | 0.008   | 2.8*                 | (1.5–5.0) | 0.001   |
| <b>Residence</b>                  |               |              |           |         |                      |           |         |
| Rural                             | Urban         | 1.0          | (0.4–2.3) | 0.984   | 0.9                  | (0.4–2.0) | 0.736   |

Note: AOR: adjusted odds ratio; CI: confidence interval; Reference: reference group

\*Statistically significant,  $p < 0.05$

**Table 3** Disparities in HPV and HPV vaccine awareness among non-Hispanic Black adults in the US- HINTS 2017–2020

| Characteristics  | Reference group       | Heard of HPV              |         | Heard of HPV Vaccine      |         |
|------------------|-----------------------|---------------------------|---------|---------------------------|---------|
|                  |                       | Prevalence ratio (95% CI) | P-value | Prevalence ratio (95% CI) | P-value |
| <b>Age</b>       |                       |                           |         |                           |         |
| 18–34            | 65+                   | 1.6* (1.4–1.7)            | <0.001  | 1.5* (1.3–1.6)            | <0.001  |
| <b>Sex</b>       |                       |                           |         |                           |         |
| Female           | Male                  | 1.3* (1.2–1.4)            | <0.001  | 1.5* (1.4–1.6)            | <0.001  |
| <b>Education</b> |                       |                           |         |                           |         |
| College or more  | Less than high school | 1.8* (1.4–2.4)            | <0.001  | 2.2* (1.8–2.7)            | <0.001  |
| <b>Income</b>    |                       |                           |         |                           |         |
| ≥ 75k            | < 35 K                | 1.4* (1.2–1.6)            | <0.001  | 1.5* (1.3–1.7)            | <0.001  |
| <b>Residence</b> |                       |                           |         |                           |         |
| Urban            | Rural                 | 1.1 (0.9–1.5)             | 0.314   | 1.1 (0.8–1.5)             | 0.473   |

Note: PR: Prevalence ratio; CI: confidence interval; Reference: reference group

\*Statistically significant,  $p < 0.05$

### Disparities in HPV Awareness and HPV Vaccine Awareness Among Black Adults in the US

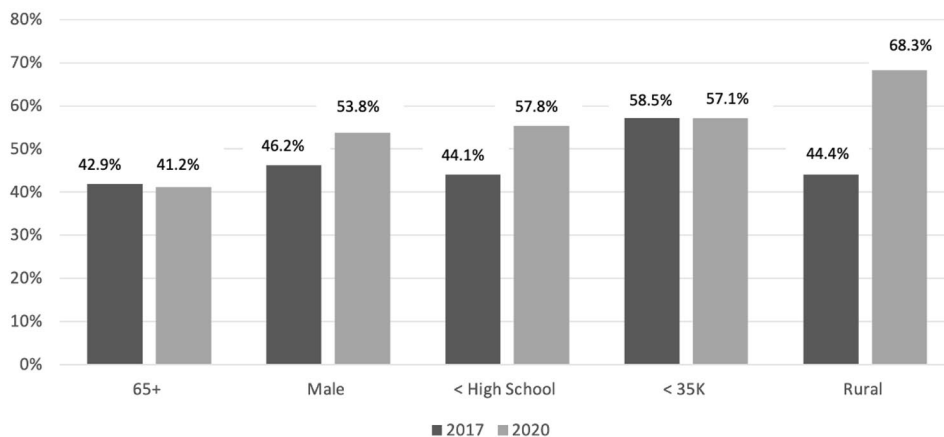
Black adults aged 18–34 years had a higher awareness prevalence about HPV and the HPV vaccine compared to the prevalence for those aged 65 years and above (PR: 1.6) and (PR: 1.5), respectively. Black females had a higher prevalence to be aware about HPV and the HPV vaccine compared to the prevalence for males, (PR: 1.3) and (PR: 1.5) respectively. Black adults with a college education or more had a higher prevalence to be aware about HPV and the HPV vaccine (PR: 1.8) and (PR: 2.2) respectively, compared to the prevalence for those with less than a high school education. Black adults with an income of  $\geq 75$  K had a higher awareness prevalence about HPV and the HPV vaccine compared

to the prevalence for those with an income of  $< 35$  K (PR: 1.4) and (PR: 1.5) respectively (all  $P \leq 0.001$ ). (Table 3)

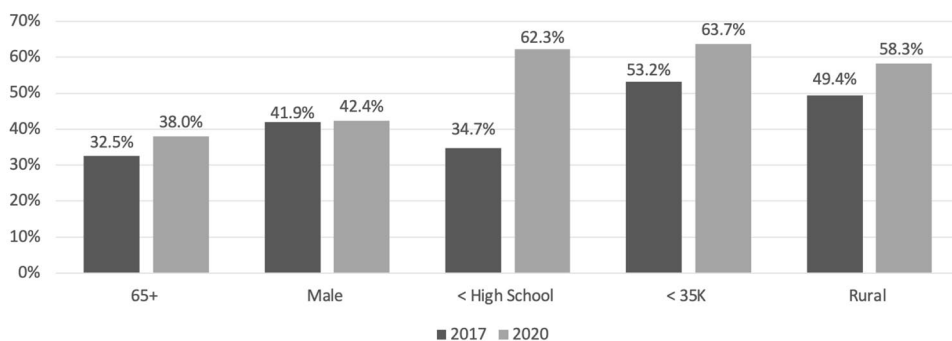
### Comparative Analysis of HPV and HPV Vaccine Awareness Among the most Disadvantaged non-Hispanic Black Group in each Sociodemographic Characteristic in the US

We studied the difference in HPV and HPV vaccine awareness among Black US adults in 2017 and 2020 by comparing the most disadvantaged group in each sociodemographic characteristic. During 2017–2020, the percentage of those who were aware about HPV increased for Black adult males (from 46.2 to 53.8%) and for those with less than a high school education (from 44.1 to 57.8%). On the other hand,

**Fig. 1** HPV knowledge among most disadvantaged non-hispanic black adults in the US- HINTS 2017-2020



**Fig. 2** HPV vaccine awareness among the most disadvantaged non-hispanic black adults in the US-HINTS 2017-2020



the percentage of Black adults who were aware about HPV decreased for adults aged 65 years and older (from 42.9 to 41.2%) and adults with an income of < 35 K (from 58.5 to 57.1%). (Fig. 1)

During the study period, there was an increase in the percentage of people who were aware of the HPV vaccine across all the variables. Black adult males had the lowest increase (from 32.5 to 38.0%), and the highest increase was seen among Black adults with less than a high school education (from 34.7 to 62.3%). (Fig. 2)

## Discussion

To the best of our knowledge, this is the first national study examining disparities in awareness of HPV and the HPV vaccine among non-Hispanic Black adults in the US using 2017–2020 HINTS data. Most non-Hispanic Black adults were aware of HPV (63.2%), and the HPV vaccine (57.6%). Disparities in awareness about HPV and the HPV vaccine existed among Black subgroups. These findings underscore the disparities among Black individuals; males, those with lower income, and those with lower education were significantly less likely to be aware about HPV and the HPV vaccine.

Between 2017 and 2020, non-Hispanic Black females were 2.7 and 3.9 times more likely than males to have heard of HPV and the HPV vaccine in the US. Our findings were consistent with those of previous studies [6, 17]. This could be because conversations around HPV and the HPV vaccine are often female-centered, especially because earlier national strategies regarding HPV education and vaccination have mostly involved offering and marketing the vaccines to females [18].

HPV and HPV vaccine awareness among non-Hispanic Blacks with a college education was 2.3 times and 2.8 times greater than those with less than a high school education. Similarly, we found that Black adults with an income of  $\geq 75$  K were more than twice as likely to be aware about HPV and the HPV vaccine compared to those with an income of < 35 K. Echoing previous studies, our results underscore the role of social inequalities in shaping awareness gaps among populations [17, 18].

Furthermore, our study highlighted disparities in awareness of HPV and the HPV vaccine among non-Hispanic Black adults. Lower disease and vaccine awareness were seen among Black adults aged 65 years and above who were males, had less than a high school education, and for those with an income < 35 K. Even though awareness levels generally increased from 2017 to 2020, the percentage of Black adults who knew about HPV decreased among those whose



age was 65 years and above, and for those with an income of <35 K. These findings mirrored those of previous reports, where non-Hispanic Black and Hispanic participants were significantly less likely to be aware of HPV or the HPV vaccine [6, 10, 19–21].

### Limitations

This paper adds to the literature on HPV and HPV vaccination awareness among Black Americans. However, HINTS data are self-reported and cross-sectional. Causal inferences, temporal associations, and associations between awareness and actual behavior (i.e., vaccination) cannot be made. HINTS measures Americans' need for, access to, and use of a variety of cancer-related health information and does not exclusively focus on HPV-associated cancers or HPV awareness. Low response rates and incomplete questionnaires, particularly among racial/ethnic minorities, may have led to a bias in the data. However, significant efforts were made to limit any biases through sampling and other procedures (HINTS5, cycle 1,2,3,4).

### Implications

A 2030 Healthy People national goal is to increase the proportion of adolescents who receive recommended doses of the HPV vaccine. Our study has several implications for creating targeted educational initiatives among adults that promote HPV awareness and hopefully vaccinations in the Black community and for supporting legislation efforts that aim to mandate vaccines among preadolescents. Significant levels of awareness are essential for vaccine uptake and to develop targeted interventions. Therefore, current and reliable estimates of HPV and vaccine awareness among racial minorities, who are at greater risk for morbidity and mortality from HPV-related cancers, are necessary [22]. However, it is worth mentioning that research suggests that increased knowledge about vaccination does not always lead to a greater likelihood of vaccination, particularly for populations who may distrust the medical establishment [23, 24].

### Conclusion

Our results underscore the importance of social inequalities in shaping awareness about HPV and the HPV vaccine among non-Hispanic Black adults in the US. The current HPV awareness disparity estimates will help inform needed interventions for subgroups and help increase vaccine uptake. Our findings suggest that it is pertinent to develop culturally appropriate awareness campaigns, communication strategies, and interventions targeting minority groups

to increase HPV-associated awareness among such subgroups. To foster improvements in HPV vaccine uptake and reduce disparities in HPV-associated cancers, future interventions must target men and disadvantaged populations for whom knowledge gaps prevail.

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**Author Contributions** “Both authors [SA and HA] contributed to the study conception and design. Material preparation and analysis were performed by [HA]. Data visualization was and first draft of the manuscript was written by [SA] and both authors edited the manuscript. Both authors read and approved the submitted manuscript.”

**Data Availability and Code availability** We used a (Public Use Dataset).

### Declarations

**Conflict of interest** The authors certify that they have not received any financial support/ funding for the research. The authors certify that they have NO affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript. The authors, also confirm that there are no known conflicts of interest associated with this publication that could have influenced its outcome.

**Ethical Approval** Ethical Approval for this research was obtained from the Harvard Human Protection Program, Harvard Faculty of Medicine, Office of Human Research Administration protocol number IRB22-0589. All authors have written and reviewed the submitted manuscript and approve the manuscript for submission. The manuscript has not been published elsewhere and is not under submission elsewhere.

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