ELSEVIER

Contents lists available at ScienceDirect

International Journal of Women's Dermatology



Research Letter

Rates of genital warts after the age of 26: An analysis of the National Health and Nutrition Examination Survey



Partik Singh MD^a, Katelyn B. Zumpf MS^b, Walter Liszewski MD^{a,b,*}

Dear Editors,

In 2018, the U.S. Food and Drug Administration extended the age approval for the human papillomavirus vaccine from 9 to 26 years to 9 to 45 years (McSeveney, 2018). An expanded approval may prevent genital warts in previously unvaccinated individuals. To understand which groups are at the greatest risk of genital warts and how often they first occur between the ages of 27 through 45, data from the 2013–2014 and 2015–2016 National Health and Nutrition Examination Survey (NHANES) were analyzed.

NHANES is a nationally representative survey conducted by the U.S. Centers for Disease Control and Prevention. The survey consists of approximately 5000 patients of all ages from 15 different sites over a 12-month period. The study design includes a representative sample of these groups by age, sex, and income level (National Center for Health Statistics, 2020). The inclusion criteria were at least one lifetime sexual partner and answering "yes" or "no" when asked if they have been diagnosed with genital warts by a health care provider. If "yes," NHANES asked the patient's age when first diagnosed. Only individuals age 18 to 59 years were asked about genital warts.

Demographic characteristics between individuals with and without a previous diagnosis of genital warts were compared. Within those diagnosed with genital warts, age at initial diagnosis was categorized and summarized overall and by sex and race/ethnicity. All analyses were weighted based on the NHANES sampling design in R (R-Core Team, Auckland, New Zealand). Due to NHANES's sampling design, data are reported as a weighted percentage rather than an exact numerical value.

Approximately 4.4% of individuals have been diagnosed with genital warts (Table 1). Rates were higher in certain demographic groups, notably whites (p < .001), women (p < .001), earlier age of sexual debut (p < .001), increasing number of sexual partners (p < .001), and higher levels of education (p = .046). Individuals with higher levels of education may have greater rates of wart diagnosis due to higher income and thus greater access to health

E-mail address: Walter.Liszewski@Northwestern.edu (W. Liszewski).

care. Similarly, women have higher rates than men, but this may be attributable to higher health care utilization among women (Fleischer et al., 2001).

Among all initial cases of genital warts, 66.7% occur by age 26, 29.2% occur between 27 and 45, and 4.1% occur at or after 46

Demographics of individuals with or without a previous diagnosis of genital warts.

Overall, % 95.6 4.4 Sex, % 30.0 <.001 Female 49.9 70.0 Age, mean (standard deviation), y 39.58 44.91 <.001 Race/ethnicity, % (11.65) (9.34) White 62.3 77.3 <.001 Black 12.0 8.1 Asian 4.9 1.5 Hispanic 17.2 9.6 Multiple 3.6 3.5 Education, % 4.9 1.5 High school or less 34.0 23.8 .046 Some college 33.5 40.7 20.04 College graduate 32.5 35.5 5.5 Country of birth, % 0.04 0.04 0.04 Other 18.0 8.1 8.1 Age of sexual debut, mean (standard deviation), y (3.69) (2.73) 0.04 No. of lifetime sexual partners, % 1 1.4.0 2.8 <.001 2-5 partners 33.6 21.8 6.14 partners 29.3 27.6 15+ partners 23.0 47.8	Demographic	No warts ^a	Warts ^a	p- value
Male 50.1 30.0 <.001	Overall, %	95.6	4.4	
Female 49.9 70.0 Age, mean (standard deviation), y 39.58 44.91 <.001 (11.65) (9.34) Race/ethnicity, % White 62.3 77.3 <.001 Black 12.0 8.1 Asian 4.9 1.5 Hispanic 17.2 9.6 Multiple 3.6 3.5 Education, % High school or less 34.0 23.8 .046 Some college 33.5 40.7 College graduate 32.5 35.5 Country of birth, % United States 82.0 91.9 .004 Other 18.0 8.1 Age of sexual debut, mean (standard 17.45 16.35 <.001 deviation), y (3.69) (2.73) No. of lifetime sexual partners, % 1 partner 14.0 2.8 <.001 2-5 partners 33.6 21.8 6-14 partners 29.3 27.6 15+ partners 29.3 27.6 15+ partners 29.0 90.5 ≥1 HPV vaccination, % HPV vaccination 7.9 6.2 .47	Sex, %			
Age, mean (standard deviation), y 39.58 (4.91 (9.34) Race/ethnicity, % (11.65) (9.34) White 62.3 77.3 < 0.001	Male	50.1	30.0	<.001
(11.65) (9.34) Race/ethnicity, % (9.34) White 62.3 77.3 <001	Female	49.9	70.0	
Race/ethnicity, % White 62.3 77.3 <.001 Black 12.0 8.1 Asian 4.9 1.5 Hispanic 17.2 9.6 Multiple 3.6 3.5 Education, % 3.6 3.5 High school or less 34.0 23.8 .046 Some college 33.5 40.7 40.7 College graduate 32.5 35.5 5.5 Country of birth, % United States 82.0 91.9 .004 Other 18.0 8.1 8.1 Age of sexual debut, mean (standard deviation), y (3.69) (2.73) 8.001 No. of lifetime sexual partners, % 1 partner 14.0 2.8 <.001	Age, mean (standard deviation), y	39.58	44.91	<.001
White 62.3 77.3 <.001		(11.65)	(9.34)	
Black 12.0 8.1 Asian 4.9 1.5 Hispanic 17.2 9.6 Multiple 3.6 3.5 Education, % High school or less 34.0 23.8 .046 Some college 33.5 40.7 College graduate 32.5 35.5 Country of birth, % United States 82.0 91.9 .004 Other 18.0 8.1 Age of sexual debut, mean (standard deviation), y (3.69) (2.73) No. of lifetime sexual partners, % 1 partner 14.0 2.8 <.001 2-5 partners 33.6 21.8 6-14 partners 29.3 27.6 15+ partners 29.3 27.6 15+ partners 23.0 47.8 Same-sex partners, % ≥2 6.0 9.5 .137 ≥2 94.0 90.5 ≥1 HPV vaccination, % HPV vaccination 7.9 6.2 .47	Race/ethnicity, %			
Asian 4.9 1.5 Hispanic 17.2 9.6 Multiple 3.6 3.5 Education, % High school or less 34.0 23.8 .046 Some college 33.5 40.7 College graduate 32.5 35.5 Country of birth, % United States 82.0 91.9 .004 Other 18.0 8.1 Age of sexual debut, mean (standard 17.45 16.35 <.001 deviation), y (3.69) (2.73) No. of lifetime sexual partners, % 1 partner 14.0 2.8 <.001 2-5 partners 33.6 21.8 6-14 partners 29.3 27.6 15+ partners 29.3 27.6 15+ partners 23.0 47.8 Same-sex partners, % ≥2 94.0 90.5 ≥1 HPV vaccination, % HPV vaccination 7.9 6.2 .47	White	62.3	77.3	<.001
Hispanic Multiple 3.6 3.5 Education, % High school or less Some college 33.5 Country of birth, % United States Other 18.0 Age of sexual debut, mean (standard deviation), y No. of lifetime sexual partners, % 1 partner 2-5 partners 33.6 21.8 6-14 partners 15+ partners 22.0 94.0 90.5 ≥ 1 HPV vaccination, % HPV vaccination, % HPV vaccination, % HPV vaccination, % 1 17.2 9.6 3.6 3.5 3.5 0.046 32.8 82.0 91.9 0.004 07.9 07.9 07.9 07.9 07.9 07.9 07.9 07.9	Black	12.0	8.1	
Multiple 3.6 3.5 Education, % 34.0 23.8 .046 Some college 33.5 40.7 .046 College graduate 32.5 35.5 .007 Country of birth, % .001 .004 .004 United States 82.0 91.9 .004 Other 18.0 8.1 .001 Age of sexual debut, mean (standard deviation), y (3.69) (2.73) .001 No. of lifetime sexual partners, % 1 partner 14.0 2.8 <.001	Asian	4.9	1.5	
Education, % High school or less 34.0 23.8 .046 Some college 33.5 40.7 College graduate 32.5 35.5 Country of birth, % United States 82.0 91.9 .004 Other 18.0 8.1 Age of sexual debut, mean (standard deviation), y (3.69) (2.73) No. of lifetime sexual partners, % 1 partner 14.0 2.8 <.001 2-5 partners 33.6 21.8 6-14 partners 29.3 27.6 15+ partners 23.0 47.8 Same-sex partners, % ≥2 6.0 9.5 .137 ≥2 94.0 90.5 ≥1 HPV vaccinations, % HPV vaccination 7.9 6.2 .47	Hispanic	17.2	9.6	
High school or less Some college College graduate 23.5 Country of birth, % United States Other 18.0 Age of sexual debut, mean (standard deviation), y No. of lifetime sexual partners, % 1 partner 2-5 partners 33.6 6-14 partners 15+ partners 22.3 Same-sex partners, % ≥2 40.0 2.8 2.18 6-14 partners 29.3 27.6 15+ partners 29.3 27.6 21.8 6-14 partners 29.3 27.6 21.8 29.3 27.6 21.8 29.3 27.6 21.8 29.3 27.6 29.3 27.6 29.3 27.6 29.3 27.6 29.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0	Multiple	3.6	3.5	
Some college 33.5 40.7 College graduate 32.5 35.5 Country of birth, % 32.5 35.5 United States 82.0 91.9 .004 Other 18.0 8.1 Age of sexual debut, mean (standard deviation), y (3.69) (2.73) No. of lifetime sexual partners, % 1 partner 14.0 2.8 <.001	Education, %			
College graduate Country of birth, % United States Other Age of sexual debut, mean (standard deviation), y No. of lifetime sexual partners, % 1 partner 14.0 2.8 6-14 partners 29.3 27.6 15+ partners 23.0 24.8 Same-sex partners, % ≥ 2 94.0 90.5 ≥ 1 HPV vaccination, % HPV vaccination 32.5 82.0 91.9 .004 04.0 91.9 .004 04.0 2.73) No. of lifetime sexual partners, % 21.8 4.001 2.8 4.001 2.8 4.001 2.8 4.001 2.8 4.001 2.8 4.001 2.8 4.001 2.8 4.001 2.8 4.001 2.8 4.0 9.5 1.137 2.0 2.1 2.1 4.1 4.1 4.1 4.2 4.2 4.3 4.3 4.4 4.4 4.4 4.5 4.5 4.7 4.7 4.7	High school or less	34.0	23.8	.046
Country of birth, % United States 82.0 91.9 .004 Other 18.0 8.1 Age of sexual debut, mean (standard deviation), y 17.45 16.35 <.001	Some college	33.5	40.7	
United States 82.0 91.9 .004 Other 18.0 8.1 Age of sexual debut, mean (standard deviation), y 17.45 16.35 <.001	College graduate	32.5	35.5	
Other 18.0 8.1 Age of sexual debut, mean (standard deviation), y (3.69) (2.73) No. of lifetime sexual partners, % 1 partner	Country of birth, %			
Age of sexual debut, mean (standard deviation), y 17.45 16.35 <.001	United States	82.0	91.9	.004
deviation), y (3.69) (2.73) No. of lifetime sexual partners, % 1 partner 14.0 2.8 <.001	Other	18.0	8.1	
No. of lifetime sexual partners, % 1 2.8 <.001	Age of sexual debut, mean (standard	17.45	16.35	<.001
1 partner 14.0 2.8 <.001 2-5 partners 33.6 21.8 6-14 partners 29.3 27.6 15+ partners 23.0 47.8 Same-sex partners, % ≥2 6.0 9.5 .137 <2 94.0 90.5 ≥1 HPV vaccinations, % HPV vaccination 7.9 6.2 .47	deviation), y	(3.69)	(2.73)	
2–5 partners 33.6 21.8 6–14 partners 29.3 27.6 15+ partners 23.0 47.8 Same-sex partners, % ≥2 6.0 9.5 .137 <2 94.0 90.5 ≥1 HPV vaccinations, % HPV vaccination 7.9 6.2 .47	No. of lifetime sexual partners, %			
6–14 partners 29.3 27.6 15+ partners 23.0 47.8 Same-sex partners, % ≥2 6.0 9.5 .137 <2 94.0 90.5 ≥1 HPV vaccinations, % HPV vaccination 7.9 6.2 .47	1 partner	14.0	2.8	<.001
15+ partners 23.0 47.8 Same-sex partners, % ≥2 6.0 9.5 .137 <2 94.0 90.5 ≥1 HPV vaccinations, % HPV vaccination 7.9 6.2 .47	2-5 partners	33.6	21.8	
Same-sex partners, % ≥2 6.0 9.5 .137 <2	6-14 partners	29.3	27.6	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	15+ partners	23.0	47.8	
	Same-sex partners, %			
≥1 HPV vaccinations, % HPV vaccination 7.9 6.2 .47	≥2	6.0	9.5	.137
HPV vaccination 7.9 6.2 .47	<2	94.0	90.5	
	≥1 HPV vaccinations, %			
No HPV vaccination 92.1 93.8	HPV vaccination	7.9	6.2	.47
110 III v vaccination 32.1 33.0	No HPV vaccination	92.1	93.8	

HPV, human papillomavirus.

^a Department of Dermatology, Northwestern University, Chicago, IL, United States

^b Department of Preventative Medicine, Northwestern University, Chicago, IL, United States

^{*} Corresponding author.

^a Unweighted raw values: no warts (n = 6436) and warts (n = 236).

Table 2Age range at time of first diagnosis with genital warts.

Demographic	Age	Age		
	<26 years	27-45 years	≥46 years	
All, %	66.7	29.2	4.1	
Sex, %				
Male	64.5	34.3	1.2	
Female	67.7	27.0	5.4	
Race/ethnicity, %				
Asian	61.3	33.4	5.2	
Black	79.4	20.6	0.0	
Hispanic	23.2	53.5	23.3	
White	66.8	29.1	4.1	
Other	67.3	30.4	2.3	

(Table 2). When categorizing by sex and race/ethnicity, the percentage of initial cases in the age group of 27 to 45 years are 27.0% women, 34.3% men, 29.1% white, 20.6% black, 53.5% Hispanic, 33.4% Asian, and 30.4% other/multiple races. These data demonstrate that one-third of initial genital wart cases occur after the age of 26 years. Men, Hispanics, and Asians have notably high rates of initial cases of genital warts between the ages of 27 and 45. Presumably, these individuals are more likely to benefit from expanded utilization of the vaccine past the age of 26.

Limitations of these data include that NHANES only asked individuals if they had been diagnosed at least once with genital warts. Thus, we do not know which individuals may have had multiple cases of warts, and the data may suffer from a self-reporting bias. Additionally, rates of genital warts may be underreported in NHANES because only cases diagnosed by a health care profes-

sional were included. Ultimately, one-third of initial genital wart cases occur after the age of 26. Therefore, increased utilization of the vaccine in persons older than 26 has the potential to markedly decrease rates of genital warts.

Conflicts of interest

None.

Funding

None.

Study Approval

The author(s) confirm that any aspect of the work covered in this manuscript that has involved human patients has been conducted with the ethical approval of all relevant bodies.

References

Fleischer Jr AB, Parrish CA, Glenn R, Feldman SR. Condylomata acuminata (genital warts): patient demographics and treating physicians. Sex Transm Dis 2001;28:643–7.

McSeveney M. FDA approves expanded use of Gardasil 9 to include individuals 27 through 45 years old [Internet]. 2018 [April 23, 2020]. Available from: https://www.fda.gov/news-events/press-announcements/fda-approves-expanded-use-gardasil-9-include-individuals-27-through-45-years-old.

National Center for Health Statistics. NHANES Questionnaires, datasets, and related documentation [Internet]. 2020 [April 23, 2020]. Available from: https://wwwn.cdc.gov/nchs/nhanes/Default.aspx. Accessed Apr 23 2020.