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Abstract

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Methods. The National College Health Assessment survey provided a large diverse sample size ($N=67,762$) in which to perform descriptive and binary logistic regression analysis. Demographic characteristics were analyzed as potential barriers to HPV vaccination. Additionally, lack of certain health behaviors were explored as potential barriers to HPV vaccination.

Results. In this study, White/non-Hispanic women had a higher HPV vaccination rate when compared to minority women. Binary regression analysis demonstrated that minority women were less likely to receive the HPV vaccine. Women who received a gynecological exam were more likely to receive the vaccine, as were women who had health insurance coverage. Health indicators predictive of receiving the HPV vaccine included receiving the influenza vaccine and not reporting obesity. Furthermore, as the age of the respondents increased, the likelihood of receiving the vaccine decreased. Similarly as the number of reported sexual partners increased the likelihood of receiving the HPV vaccine increased.

Conclusion. Advocacy for increased provider visits (i.e., gynecological exams) and other preventive health services (such as influenza vaccine drives) in the female student population could be an opportunity for increased HPV education and vaccination. Realization that minority women in higher education may have lower HPV vaccination rates may be a catalyst for student health departments to explore health promotion activities to benefit these women.

Keywords

Human Papilloma Virus; vaccination; college women; health disparities; health promotion; Patient Protection and Affordable Care Act (2010)



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ABSTRACT

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INTRODUCTION

Human Papillomavirus (HPV) is the most prevalent sexually transmitted disease in the U.S. This virus causes genital warts and 98% of cervical cancers in women. According to the

Centers for Disease Control and Prevention (CDC) 50% of the reproductive-age population in the US has been infected with HPV. Both women and men between 20-24 years are at the greatest risk of infection. The average onset of cervical cancer is 45-55 years. It is important to note that HPV is also linked to vaginal, vulvar, anal and oropharyngeal cancers (Centers for Disease Control and Prevention, HPV fact sheet, 2010). Black, Hispanic, and Native American women are at an increased risk for developing cervical cancer compared to White women (Centers for Disease Control and Prevention, 2012). Unfortunately, being a member of an ethnic minority has been linked to decreased cervical cancer screening (McAlearney, Song, Rhoda, Tatum, Lemeshow, & Ruffin 2010, Swan, Coates, Rimer, & Lee, 2003, Solomon, Breen, & McNeel, 2007).

In 2006 the Food and Drug Administration (FDA) endorsed a vaccine that offers protection against the high risk HPV subtypes 16 and 18. The FDA approved the vaccine for women ages 9-26 and it was also deemed safe for males. Despite FDA endorsement and CDC recommendations, the CDC reported in 2012 that only 54% of girls under the age of 18 received the HPV vaccine. The American Public Health Association (2009) reported that only 41% of female undergraduate students surveyed were vaccinated against HPV. *Healthy People 2020* calls for an HPV vaccination rate of 80% in women. Achieving the *Healthy People 2020* vaccination target will require an understanding of current HPV vaccination patterns and barriers.

The current targeted population for HPV vaccination is adolescent girls between the ages of 11-13 years since the greatest benefit of the vaccine is realized before their first sexual encounter (Markowitz, 2007). This vaccine has the potential to decrease disease burden from cervical cancer in women between the ages of 18-26 as well. Vaccination in women up to the age of 26 years is supported by the CDC when there is no prior exposure to the virus, the virus is transient or when the vaccine can provide protection from non-present HPV strains (Elbasha & Galvani, 2005). It is important to note that this virus is not predictable after exposure. The natural history of HPV infection has proved difficult to predict due to the virus' transient nature, many infections clear the body within two years with no ill effects to the carrier (Adams, Jasani, & Fiander, 2009, Castellsague, Munoz, Pitisuttithum, Ferris, Monsoego, & Ault, 2011, Goldie, Grima, Kohli, Wright, Weinstein, & Franco, 2003, Harper, Franco, Wheeler, Ferris, Jenkins & Schuind 2004, Schiffman, Castle, Jeronimo, Rodriguez & Wacholder, 2007). Considering that high risk strains of the HPV virus that do not clear the body have the potential to cause cancer, exploring avenues to increase vaccination may be warranted.

The CDC defines the HPV vaccination catch-up group as women ages 18-26 years who may not be aware of the 2006 vaccine recommendations and/or did not receive the HPV vaccine. Women in the catch-up group could potentially suffer disproportionately from HPV related diseases when compared to their younger counterparts. The public health standpoint is that vaccinations are used to reduce harm to individuals, the HPV vaccine does that by protecting against a common virus therefore its promotion should be studied (Belong, 2009, Zimmerman, 2006). Acknowledging possible barriers to HPV vaccination has the potential to inform health promoters in designing multiple strategies that fit specific populations within college populations.

Potential Barriers to HPV Vaccination

Potential barriers to HPV vaccination include but are not limited to race, age, socioeconomic factors, absence of knowledge and lack of preventive health behaviors such as provider recommendation and health insurance. Race has been linked to lower HPV vaccination

rates in the Black, Hispanic, and Asian college women when compared to White women (Bendik, Mayo, and Parker, 2011, Licht, Murphy, Hyland, Fix, Hawk, Mahoney, 2010). Conversely some research has found that race was not predictive of HPV vaccination (Brewer & Fazekas, 2007, Caskey, Lindau, & Alexander, 2009). Existing studies regarding HPV vaccination in college women are limited and the studies that have been conducted have small homogenous sample sizes (Caron, Kispert, & McGrath, 2009, Caskey, et al., 2009, Kahn, Rosenthal, Yan, Bin, Namakydoust, & Zimet, 2008, Licht, et al., 2010, Marchand, Glenn, & Bastani, 2012, Bandik, et al., 2011, Caskey, et al., 2009, Marchand, et al., 2012). Increasing research using larger, diverse sample sizes has the potential to be more representative of the female college population.

When exploring whether or not age was a barrier to HPV vaccination, it was not surprising that 18 year olds were more likely to be exposed to the 2006 vaccination recommendation when compared to their 26 year old counterparts (Licht, et al, 2010). Increased research following HPV vaccination trends will reveal if vaccination rates reach equity across age groups as time progresses. Research has also shown that health care providers have the opportunity to impact HPV vaccination rates. Studies have revealed that provider recommendation increases the likelihood that women will seek the HPV vaccine (Bendik, et al., 2011, Brewer & Fazekas, 2007, Giambi, Donati, Declich, Salmaso, Degli, Marta, & Alibrandi, 2011, Rosenthal, Weiss, & Zimet, 2011). Similarly vaccine acceptability was higher when individuals believed that their physician would recommend it (Brewer, et al., 2007). One interesting study of professional women found that 71.6% of respondents reported that their physicians did not discuss HPV with them (Cermak, Cottrell, & Murnan, 2010). Keane, Walter, Patel, Moorthy, Stevens, and Bradley (2005) cited that doctors and nurses are sources of credible information regarding vaccination. Again, this gives them the opportunity to influence vaccination rates. Marchand and colleagues (2012) emphasized the need for increased provider to patient education to increase HPV vaccination rates in college age women. It is important to acknowledge that physicians themselves may face barriers such as safety concerns, efficacy concerns, and inadequate reimbursements when recommending the HPV vaccine (Young, Bernheim, Korte, Stoler, Guterbock, & Rice, 2011). Increasing provider recommendation needs continued research to further promote the HPV vaccine.

At first glance, one would assume that a vaccine that prevents cancer would be widely endorsed by physicians and sought after by patients. However, there is a stigma surrounding this vaccine. Public health policymakers have encountered determined resistance to the vaccine from some parents, either because of general concerns about vaccine safety or specific objections to the vaccine because of its perceived connection with sexual activity. One concern is “that vaccination against a sexually transmitted disease would increase sexual activity in young girls and unmarried women.” There is no data to support this assertion (Colgrove, 2006, National Conference of State Legislatures, 2012). While assessing the stigma of the HPV vaccination would be cumbersome, it should be a focus of future research to advance sexual health promotion.

Additional barriers to vaccination include general health, socioeconomic status and health knowledge. A 2000 study using the National Health Interview Survey found that women who reported themselves to be obese were less likely to receive Pap smears. Obese women were also found to have a higher mortality rate due to cervical cancer (Wee, McCarthy, Davis, & Phillips, 2000). Exploring obesity as a barrier to preventive care is justifiable for all groups of women. Lower socioeconomic status and the lack of health insurance are also associated with decreased

rates of cervical cancer screening (Kessels, Marshall, Watson, Brauncak-Mayer, Reuzel, & Tooher, 2012). Conversely, higher uptake of HPV vaccination has been associated with having health insurance (Kessels, et al, 2012). Additional research comparing health status and HPV vaccination patterns is warranted.

Lack of knowledge about HPV and its association with various cancers is a barrier to vaccination (Brewer & Fazekas, 2007, Giambi, et al., 2011, Rosenthal, et al, 2011). Bendik and colleagues (2011) demonstrated that 80% of college women did not believe that they were at risk for HPV, when in fact they were. Increased education regarding the HPV virus could prove to be an opportunity to increase vaccination rates. Student health is a source of sexual health care for college women and therefore, a potential source of information regarding HPV vaccination.

The President's Cancer Panel (2012) has made increasing HPV vaccination rates a national priority (National Cancer Institute, The President's Cancer Panel, 2012). In addition, the Affordable Care Act (2010) aims to increase preventive care, which makes research regarding barriers to vaccination essential. In order to increase HPV vaccination rates, a greater understanding of barriers faced by women needs to be explored. This research uses a large diverse sample gathered from numerous U.S. institutions of higher education to better understand potential barriers to HPV vaccination among college women.

METHODS

Design

The National College Health Assessment (NCHA), administered by the American College Health Association (ACHA), was used. ACHA is a non-profit organization providing advocacy to student health organizations. The NCHA survey has been utilized by 587 colleges/universities. Individual participating institutions determine classroom selection for the survey and students are then randomly selected. No identifying information is collected on participating students. This extensive survey consists of 65 questions that are wide ranging including demographics and health related questions. The themes of the questions include preventive health (including vaccination history), alcohol, tobacco and drug use, sexual health and safety, nutrition and weight management, encounters with violence and personal safety and mental wellness (American College Health Association, Who are we? 2012).

Data/Population

The obtainable data for use was from fall 2008 to fall 2010. The data provided a sample size of 67,762 women from 253 U.S. higher education institutions. This survey was found to be both valid and reliable by pilot studies from 1998-1999 and comparisons with other national survey studies including as the CDC's National College Health Risk Behavior Survey (American College Health Association-National College Health Assessment, Generalizability, reliability, and validity analysis, 2012).

Variables

The dichotomous dependent variable is HPV vaccination; the NCHA specifically asked female participants if they had received the HPV vaccination. Predictor variables included race, age (19-26 years), number of sexual partners, self-classification of obesity, presence of health insurance, routine gynecological exam in the past 12 months and influenza vaccination. Age and number of sexual partners' were continuous variables in the original survey but were changed to categorical for the analysis.

Analysis

Descriptive statistics and binary logistic regression was employed in this analysis. The IBM SPSS Statistical version 21 was used for the data analysis. The significance level was $p \leq .05$.

Hypotheses

Due to lack of prodigious research regarding HPV vaccination of college women ages 18-26 null hypotheses were assumed.

1. H_0 : There is no difference in demographic characteristics between women who receive the HPV vaccine and those who do not.
2. H_0 : There is no difference in HPV vaccination rates in women who have multiple sexual partners and those who do not.
3. H_0 : There is no difference in HPV vaccination rates between college women who describe themselves as obese and those who did not.
4. H_0 : There is no difference in HPV vaccination rates of college women who have insurance and those who do not.
5. H_0 : There is no difference in HPV vaccination rates in college women who receive yearly gynecological exams and those who do not.
6. H_0 : There is no difference in HPV vaccination rates among college women who receive the influenza vaccine and those who do not.

RESULTS

Study Population/Rates

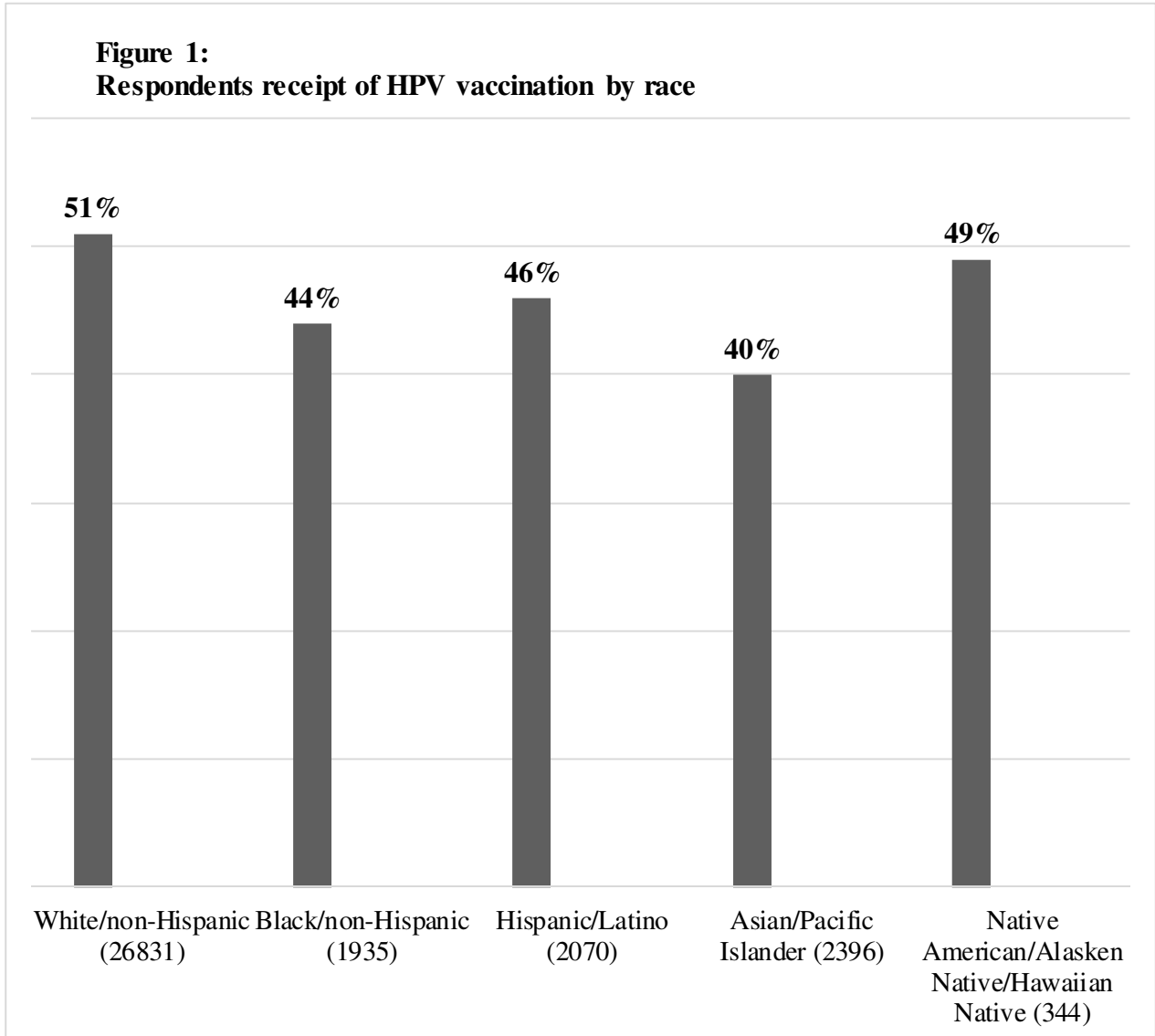
As identified in Table 1, 78% (52,584) of the population self-identified as White/non-Hispanic, 6.4% (4,404) Black/non-Hispanic, 6.5% (4,464) Hispanic/Latino, 8.8% (5,966) Asian/Pacific Islander, and 0.05% (344) American Indian/Alaskan Native/Native Hawaiian. The average age of the female respondents was 20.5 years old. Approximately 86% of respondents reported they were in college for 4 years or less and 95.5% of respondents were enrolled full time in college/university.

Table 1
Characteristics of respondents N=67,762

	<i>n (%)</i>
Race	
White/non-Hispanic	52,584 (78.0)
Black/non-Hispanic	4,404 (6.4)
Hispanic/Latino	4,464 (6.5)
Asian/Pacific Islander	5,966 (8.8)
American Indian/Alaskan Native/Native Hawaiian	344 (0.05)
Age (years)	
18-20	40,760 (60.0)
21-23	21,061 (91.1)
24-26	5,938 (8.8)
Number of sexual partners in past 12 months	
0	20,974 (31.0)
1	50,682 (43.4)
2 or more	7,717 (11.4)
Did not respond	9,630 (14.2)
Self-classification of obesity	
No	59,266 (87.5)
Yes	6,126 (9.0)
Did not respond	2,370 (3.5)
Presence of health insurance	
No	3,143 (4.6)
Yes	64,234 (94.8)
Did not respond	385 (0.6)
Routine gynecological exam in past 12 month	
No	30,644 (45.2)
Yes	37,118 (54.8)
Influenza vaccination	
No	42,382 (62.5)
Yes	25,380 (37.5)

Percentages may not equal 100% due to rounding

Overall, 49% of respondents reported receiving the HPV vaccine. The racial group reporting the highest percentage of HPV vaccination was White/non-Hispanic women at 51%. Minority women reported lower vaccination rates: Black/non-Hispanic women (44%), Hispanic/Latino women (46%), Asian/Pacific Islanders (40%), and Native American/Alaskan Native/Hawaiian native women (49%) (See Figure 1). There were statistically significant differences in vaccination rates between White/non-Hispanic women and minority women ($[X^2(4, N=67,762) = 327.957, p=.000]$).



Respondents reported an average of 1.3 sexual partners. Thirty-one percent of women reported that they had zero sexual partners in the past twelve months, 43.4% reported one sexual partner, and 11.4% had two or more partners. Furthermore, 9% of women reported that they were obese and 4.6% of respondents did not have health insurance at the time of the survey. The survey revealed that 54.8% of respondents reported that they had a gynecological exam in the past 12 months and 37.5% of women received the influenza vaccination (see Table 1).

Binary Regression:

The results of the non-linear binary logistic regression, which demonstrates statistical significance and likelihood of receiving the HPV vaccine in the presence of the independent variables, are displayed in Table 2. Compared to White/non-Hispanic women, Black/non-Hispanic women in this survey were 28% less likely to receive the HPV vaccination ($p=.000$). Asian/Pacific Islander women were nearly 25% less likely to have received the HPV vaccine ($p=.000$). Hispanic/Latino women were 8% less likely to receive the HPV vaccination ($p=.03$). There was no statistical significance when Native American/Alaskan Native/Hawaiian

women were compared to White/non-Hispanic women ($p=.704$). As women aged, they were less likely to receive the HPV vaccine. Women between the ages of 21-23 were 60% and women 24-26 years of age were near 75% less likely to have received the vaccine ($p=.000$) when compared to women in the 18-20 age group.

Reporting an increase in the number of sexual partners increased the likelihood of receiving the HPV vaccine. Women who reported one sexual partner had a 7% increase in the likelihood of HPV vaccination ($p=.002$) when compared to women who reported no sexual partners. Women with 2 or more sexual partners had a 32% increase in the likelihood of HPV vaccination ($p=.000$). Women who reported that they were obese had a 15% decrease in the likelihood of HPV vaccination when compared to their non-obese counterparts ($p=.000$). Preventive health behaviors tested in the analysis showed that women with health insurance were 1.8 times more likely to receive the HPV vaccine ($p=.000$) when compared to women who had no health insurance. Women who underwent a gynecological exam in the past 12 months were 1.8 times more likely to receive the HPV vaccine than those who did not ($p=.000$). The binary regression model also demonstrated that women who received an influenza vaccine were more than 2.5 times more likely to have received the HPV vaccination compared to those who did not ($p=.000$). There was concern regarding large sample size effect in this analysis. It was important to determine if the large sample size itself caused significance. It was found that with even a large sample the size effect was limited. Using the odds-ratios and converting to size effect, it was found that the magnitude was ≤ 1.48 which does not indicate a size effect. The *pseudo* R^2 of .165 is not prognostic for size effects. The data analysis rejects the null hypotheses.

Table 2: Odds-Ratios

	Odds-Ratio	95% Confidence interval	
		Upper	Lower
Study variables			
Race			
White/non-Hispanic (ref)	1		
Black/non-Hispanic*	.719	.667	.776
Hispanic/Latino***	.921	.856	.990
Asian/Pacific Islander*	.754	.708	.803
American Indian/Alaskan Native/Native Hawaiian	.952	.741	1.225
Age			
18-20 years (ref)	1		
21-23 years*	.411	.395	.429
24-26 years*	.242	.225	.259
Number of sexual partners			
0 (ref)	1		
1**	1.072	1.027	1.118
2 or more*	1.320	1.242	1.401
Obese			
No (ref)	1		
Yes *	.848	.797	.902
Health insurance status			
No insurance (ref)	1		
Has insurance coverage*	1.885	1.716	2.071
Gynecological exam status			
Did not receive (ref)	1		
Received*	1.894	1.819	1.973
Influenza vaccination status			
Did not receive (ref)	1		
Received*	2.683	2.586	2.784

Ref (denotes reference category)

* $P \leq .000$

** $p \leq .01$

*** $p \leq .05$

DISCUSSION

In this analysis, Black, Hispanic and Asian college women ages 18-26 all demonstrated lower HPV vaccination rates when compared to White women, which is consistent with previous research regarding HPV vaccination rates (Bendik, Mayo, and Parker, 2011, Licht, Murphy,

Hyland, Fix, Hawk, Mahoney, 2010). This study also demonstrated that minority women had a lower likelihood of receiving the HPV vaccine. This study supports past research that found younger women had higher likelihood of receiving the HPV vaccine; this is most likely due to lack of awareness of the 2006 vaccine recommendation (Licht, et al., 2010). Research expanding HPV knowledge and vaccine recommendations for all women 18-26 years of age is justifiable.

An increase in the number of sexual partners was shown to increase the likelihood of receiving the HPV vaccine. These women may have been seeking protection from sexually transmitted disease, but there is no way to confirm this postulate. Research specifically examining patient expectation(s) of the vaccine should be considered. It was also found that obese women were less likely to report receiving the vaccine which is also in agreement with past research (Wee, McCarthy, Davis, & Phillips, 2000). Increased research dealing with barriers to HPV vaccination in obese women is needed to decrease their burden of cervical cancer.

Women in this analysis who had health insurance coverage had an increased likelihood of receiving the HPV vaccine. The rates of HPV vaccination should be monitored closely as insurance coverage increases in the new US market. Theoretically, as more women are covered by insurance due to the Affordable Care Act (2010), HPV vaccination rates may increase. It is important to note that it is now mandated by the Department of Health and Human Services that the HPV vaccine be included in health insurance policies (National Cancer Institute, The President's Cancer Panel, 2012). It would be encouraging if HPV vaccination rates in the catch-up group increased as insurance coverage rates increased.

This study also demonstrated that the presence of preventive health behaviors, such as receiving a gynecological exam in the past 12 months and receiving the influenza vaccine, increased the likelihood of receiving the HPV vaccine. This research is in agreement with preceding studies that showed provider contact increased the likelihood of receiving the vaccine (Bendik, et al., 2011, Brewer & Fazekas, 2007, Giambi, Donati, Declich, Salmaso, Degli, Marta, & Alibrandi, 2011, Rosenthal, Weiss, & Zimet, 2011). One original aspect of this analysis is that only visits to gynecologists were considered. Specifically exploring gynecological exam rates and HPV vaccination rates was not explicitly done in other survey research. Furthermore, research should be expanded to other healthcare providers who deliver sexual health services for women (e.g. internists and family practice doctors). Again advocating for increased provider visits (i.e. gynecologic/primary care exams) in the female student population could be a window of opportunity for student health services to increase HPV education and vaccination. The combination of increasing health insurance rates and health provider visits could be strong catalyst for increasing vaccination rates even among women who report that they are obese. Bearing in mind that *Healthy People 2020* calls for a HPV vaccination rate of 80% in women, policy makers and the medical community may decide that strategies to increase the vaccination rate in women 18-26 years of age is warranted.

The greatest strength of this analysis is the large diverse sample size afforded by the ACHA-NCHA (N=67,762). Combining women from 253 educational institutions added to the vigor of this analysis. This large, diverse sample size provided a more inclusive examination of barriers to HPV vaccination than past studies that relied on small sample sizes in homogenous college populations where only one or two institutions were reflected (Caron, et al., 2009, Caskey, et al., 2009, Kahn, et al., 2008, Licht, et al., 2010, Marchand, et al., 2012). Another unique variable included in this analysis was the delivery of the influenza vaccine. Both the

influenza and HPV vaccines are voluntary. Exploring variables that may influence individuals to seek voluntary vaccinations against infections is warranted. Promoting voluntary vaccination in the US population could be an avenue to reduce infection/disease rates; therefore, potentially decreasing future healthcare costs.

It is important to note that Pap smear recommendations have recently changed. The past recommendation was that females obtain a yearly Pap smear after the initiation of sexual intercourse, regardless of age, or at the age of 21. As of March 2012 the screening guidelines for cervical cancer have changed. These new recommendations are due to the fact that HPV is often transient. If a woman in her 20's is infected with HPV 16 or 18; there is a high likelihood that the infection will clear her body within two years. Cancerous lesions are also extremely rare in women under the age of 40. The updated guidelines suggest that women 21-29 receive the Pap test every 3 years. It is also recommended that women 30-65 receive the Pap test every 3 years or every 5 years if testing for HPV is negative (ACS,2012). Provider contact for young women may decrease if women do not regularly seek gynecological care. The effect these new recommendations have on HPV vaccination rates needs to be monitored.

Examination of additional variables that enable or hinder these young women to receive the HPV vaccine has merit. Students of different racial backgrounds may experience different barriers to HPV vaccination. Therefore, future research regarding individual racial group barriers should be explored at greater length. Physicians and other healthcare providers may find that understanding the barriers to HPV vaccination among college women could be useful when promoting the HPV vaccine. Student health departments could also benefit from continued research, since they are a source of sexual healthcare for college women. HPV vaccination in college women is an under-explored and complex issue, all health promoters would be well served by continuous research.

Limitations exist in this study. The survey did not directly measure socioeconomic status which would have been extremely helpful in comparison with past research. Similarly the survey did not evaluate stigma of receiving the HPV vaccine. Increasing research dealing with the HPV vaccine stigma is necessary. Limitations regarding self-reporting should be acknowledged. Response bias, the tendency to answer questions a specific way regardless of the truth, is a concern when interpreting survey data. This analysis should not be generalized to all college age women, since the colleges/universities voluntarily participated in the survey. There was also no way to determine if the respondents received the full HPV vaccination series (i.e. three injections over a six month period). It can only be assumed that the respondents received at least one dose of the vaccine series. Expanding research to all women in the catch-up group is needed; this survey was limited to college students who were easier to isolate.

CONCLUSION

HPV is the most common sexually transmitted disease in the US. The long term effect of this virus is the possible development of cervical cancer. The CDC has recommended that women up to the age of 26 receive this vaccine, but the vaccine is not widely disseminated in women over 18. Using a large survey of college women, this research provided insight into HPV vaccination rate disparities and potential barriers to vaccination. Understanding these disparities and barriers are important when formulating strategies to increase HPV vaccination rates to what is desired by *Healthy People 2020*. Additionally, a goal of The Patient Protection and Affordable Care Act (2010) is to decrease health disparities faced by minorities. A greater understanding of HPV vaccination barriers in women could aid in approaching this goal. While

this study could not conceivably explore every barrier to HPV vaccination, it did provide insight into vaccination disparities and a number of barriers.

In this analysis of college women, White/non-Hispanic women had a higher HPV vaccination rate than minority women. Health promotion activities that target minority women, who are potentially under-vaccinated, could lessen the morbidity and mortality due to cervical cancer. Women who engaged in positive health behaviors, such as receiving a gynecological exam and receiving the influenza vaccine, had an increased likelihood of receiving the HPV vaccine. Promoting positive health behaviors, such as gynecological exams, could be a window of opportunity to educate women regarding the HPV vaccine. Student health departments and other facilities which provide health services to college age women could formulate strategies to advocate HPV vaccination. Increasing provider contact and health insurance coverage could potentially be an enormous step in increasing the rate of HPV vaccination in women ages 18-26. Health promoters will benefit from continued research regarding barriers to HPV vaccination. The health community should maintain a focus on women's health to afford young women the opportunity to receive the HPV vaccine along with other preventative health measures.

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