HUMAN PAPILLOMAVIRUS KNOWLEDGE AND VACCINE STATUS AMONG UNIVERSITY STUDENTS:

HOW HAVE HEALTH CARE PROVIDERS INFLUENCED THE VACCINE DECISION?

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Abstract: Variations in human papillomavirus (HPV) vaccine uptake rates across the nation are not understood, especially among college aged students. Most sexually active women and men will become infected with HPV unless they receive HPV vaccination (CDC, 2019; President's Cancer Panel, 2018). This study used both quantitative and qualitative methods to examine 254 male and female undergraduate college students' vaccine status, knowledge, and perceived risk of contracting HPV. Further, this study captured student narratives related to how health care providers influence their vaccine decision and what types of information have been shared. Females received a provider recommendation for vaccine and were fully vaccinated more often than male students. However, a group of students were unsure of their vaccine status, which was related to low knowledge and misperceptions of risk. Some students were unable to identify risk factors related to contracting HPV and many did not view the vaccine applicable to themselves. Regardless of vaccine status, students in this study had low knowledge and held misconceptions about the vaccine. Many students reported the health care provider had not been a source of information, had not been an influence on their vaccine decision, and had not recommended the vaccine. There is evidence to support health care providers should introduce or return to previous HPV conversations with college-aged patients.

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CHAPTER 1

INTRODUCTION

The Centers for Disease Control and Prevention (CDC) and the President's Cancer Panel have identified improving uptake of human papillomavirus (HPV) vaccines as a public health priority (National Foundation for Infectious Diseases, 2014). HPV is the most common sexually transmitted infection in the United States (CDC, 2019). Approximately 80 million Americans are infected with HPV and about 14 million people become newly infected each year (CDC, 2019). Health complications deriving from HPV infection most commonly include genital warts and cancers of the cervix but can develop in other locations such as the vulva, vagina, penis, or anus. HPV can also cause cancers in the back of the throat, including the base of the tongue and tonsils (CDC, 2019). Since 2006, when HPV vaccines were first developed, there have been changes in the range of protection they offer and the dosing regimen [Kaiser Family Foundation (KFF), 2018].Vaccine uptake rates are slightly improving, the percentage of adolescents who started the HPV vaccine series increased by five percentage points each year from 2013-2017 (CDC, 2018) and 66% of adolescents ages 13-17 years received the first dose to start the vaccine series.

However, only roughly half (49%) of adolescents are up to date on the HPV vaccine (CDC, 2018) and incomplete series remain a problem. There exists a significant gap in vaccine coverage of HPV among college-aged students (Rohde et al., 2018). National vaccination

coverage results indicate that many young adult women *and men* who could benefit from the vaccine have not received it (Marchand, Glenn, & Bastani, 2012).

Most sexually active women and men will become infected with HPV unless they receive HPV vaccination (CDC, 2019; President's Cancer Panel, 2018). Therefore, the CDC and the Advisory Committee on Immunization Practices (ACIP) are strongly encouraging vaccination. Advancement in HPV immunology saw the December of 2014 Food and Drug Administration (FDA) approval of the HPV Gardasil®-9 VIS. However, the CDC has cautioned without higher rates of uptake, "…it might be decades before an impact of vaccination is observed (CDC, 2014)." Since January 2017, only Gardasil®-9 has been available in the United States. ACIP recommends vaccination for females through age 26 and for males through age 21 who were not adequately vaccinated previously (President's Cancer Panel, 2018).

Variations in HPV vaccine uptake rates across the nation are not understood, especially among older adolescents and college aged students. Misinformation regarding HPV as well as a lack of HPV knowledge affects attitudes and vaccine uptake (McCutcheon & Schaar, 2017). There also are differences in by race/ethnicity, socioeconomic status, and insurance status (President's Cancer Panel, 2018). Rates are particularly low in rural areas, despite high uptake of other adolescent vaccines; over half of adolescents in urban areas are up to date on their HPV vaccination compared with only 42% in rural areas. There are lower odds of receiving the HPV vaccine reported among students attending colleges and universities outside of the northeastern United States (Lindley et al., 2013).

College students' sexual behaviors and psychosocial factors (Ratanasiripong, 2012) put them at risk for HPV exposure and infection. However, being sexually active may not be influencing the college student decision to get vaccinated to prevent HPV infection (Vasquez, et

al., 2016). The 2018 National College Health Assessment (NCHA) had 88,178 student respondents from 140 schools, and 80% of the respondents were between 18 and 24 years old. Over 60% of both males and females had one or more sexual partners (oral sex, vaginal or anal intercourse) within the last 12 months (males 65.3% and females 68.6%). Half of the women (50.4%) had vaginal intercourse within the last 30 days. Among those women, 42.4% of them either never or rarely used a condom or other protective barriers (NCHA, 2018). In this study, only 56.1% reported receiving vaccination against HPV (NCHA, 2018).

College-aged males are at high risk for contracting HPV due to a lack of HPV knowledge and low vaccination rates (McCutcheon & Schaar, 2017). College students are a high-risk population for sexually transmitted infections due to increased rates of sexual activity, multiple sexual partners, and unprotected sexual encounters (American College Health Association (ACHA), 2018). College students are of prime importance since they comprise the age groups for females at highest risk for HPV; according to national data, 20 to 24 year old females had the highest prevalence of genital HPV (Thompson et al, 2016). Sexual behavioral patterns of college students demonstrate that both males and females are equal contributors in HPV transmission (Cunningham-Erves & Talbott, 2015). Research regarding college students' vaccination uptake and HPV knowledge regarding this vaccine is beginning to appear in the literature. However, the complexities of decision making and what led to vaccination are not completely understood. The relationship between HPV knowledge and vaccine uptake has been found to be inconsistent (Ratanasiripong, 2012). While individuals may report knowledge, they may mistake being *aware* of the vaccine for a true understanding of their personal risk and need for vaccination. Risk may be deemed as a negative or undesirable outcome, and as such, is synonymous with the terms danger or hazard, or it may be viewed as a category of understanding (Wyndham-West,

2016). Commonly found in the literature, a health care provider recommendation is cited as essential to adolescent vaccine uptake. However, the precise communications between provider and college students that lead to vaccine decisions are not strongly documented. Assuming college students have more autonomy in their health behaviors; other factors that drive college students' decision making still need inquiry.

Vaccine Completion Rates in Adolescent Females

Data has been collected on vaccine initiation as well as completion in age categories since the first HPV vaccines became available. Current recommendations are for routine vaccination at age 11 or 12 (Morbidity and Mortality Weekly Report (MMWR), 2015). However, uptake rates are notably lower than the other routine childhood vaccines. The U.S. Department of Health and Human Services (2016) reported in 2008 that only 16.6 percent of females aged 13 to15 years old had received at least three doses of HPV vaccine. On average for all states in the United States in 2010, only 32% of eligible girls and women had received all three doses of the vaccines. HPV vaccination coverage among adolescent girls 13 to 17 years old failed to increase from 2011 to 2012 (CDC, 2013; CDC, 2015) and increased only modestly in 2013, and an additional 3.3 percentage points in 2014 (CDC, 2015). Based on results of the 2011 National Immunization Survey-Teen, only 53.0% of girls 13 to 17 years old received one dose of HPV vaccine, and only 34.8% received all three doses of the HPV vaccine series (CDC, 2013).

Currently, The Healthy People 2020 goal of 80% uptake of all three doses of the HPV vaccine among girls 13-15 years old is far from being met (President's Cancer Panel, 2018). In 2018, the percentage of adolescents up to date with the HPV vaccine series increased from 48.6% to 51.1%; the increase in HPV vaccination coverage was attributable to increases among

males only (increase of 4.4 percentage points in males who were up to date versus 0.6 in females) (Walker et al., 2019).

ACIP also recommends vaccination for all females aged 13 through 26 years and males aged 13 to 21 years not vaccinated previously (CDC, 2015; Petrosky et al., 2015). For college-aged students, a 'catch up' vaccine may be recommended; most college-aged students were vaccine eligible as adolescents. Noting, college-aged students today were vaccine eligible to receive one of three FDA approved vaccines in their pre-teen years. However, only 34.5 % of women age 19–26 years old report receiving at least one dose of the HPV vaccine (Wilson et al., 2016). Women ages 18–26 are lagging behind those 11–17 years old (Marchand, Glenn, & Bastani, 2012). Understanding and increasing vaccine uptake for 18–26-year-olds is particularly important, as risk for acquiring HPV increases rapidly for many women during these years (Marchand, Glenn, & Bastani, 2012).

The uptake data suggests that the HPV vaccine series is somehow presented differently by health professionals than other childhood vaccines that are more commonly received. Among unvaccinated girls, 84% had a health-care encounter in which they received a vaccine but not HPV vaccine (MMWR, 2014). If HPV vaccine was administered at health-care encounters when other recommended vaccines were administered, vaccination coverage could be as high as 92.6% (MMWR, 2014).

Vaccine Completion Rates in Adolescent Males

A disparity exists in HPV vaccination uptake in males, and research regarding young men's HPV vaccination behavior is sparse (Lee et al., 2018). When the President's Cancer Panel's 2012-2013 report was released, vaccination coverage among adolescent boys lagged far

behind that of girls, at least in part because the ACIP recommendation for boys was not issued until 2011(President's Cancer Panel, 2018). In 2012, only 20.8% of boys ages 13-17 had received at least one dose, and only 6.8% had completed the series. Immunization rates for boys remain lower than for girls (44% vs. 53% HPV up to date in 2017) (KFF, 2018); but some progress has been observed.

Since HPV vaccines were first introduced in the U.S. in 2006, there have been changes in the range of protection they offer and the dosing regimen. Furthermore, the vaccines were originally recommended only for girls and young women and were subsequently broadened to include boys and young men (KFF, 2018). There may be a widespread mindset that Gardasil, the HPV vaccine, is only for females. Consider too, the incidence and prevalence of HPV in the male population is unknown due to the asymptomatic nature of the virus in addition to limited screening procedures available to males (McCutcheon & Schaar, 2017). These and other factors have resulted in a population that does not see itself at risk for HPV and is unaware of its role in the transmission of HPV or potential role in the prevention of HPV (Pitts & Stanley, 2017).

The low vaccination rate among males is particularly troublesome because of their status as primary vectors for the transmission of HPV (Reiter, Pendergraft, & Brewer, 2010). This means that by the time males enter college, a period marked by increased sexual activity and risk taking (Arnett, 2000), a significant proportion of them are unvaccinated and at risk for the acquisition and transmission of HPV (Pitts & Stanley, 2017). In the United States, approximately 51.1% of males carry multiple strains of HPV (McCutcheon & Schaar, 2017). However, there are widespread perceptions of low HPV severity and/or susceptibility among college males, and a generally dismissive attitude toward HPV as a health concern (Fontenot et al., 2014; Pitts & Stanley, 2017).

In a study of males aged 18-26 (n = 2516), the percent of HPV vaccine series completion showed a decreasing trend with increasing year in undergraduate studies (Lee et al., 2018). In a study of 735 sexually active male college students aged 18-25, the vast majority (74%) of participants had not obtained the vaccine (Fontenot et al., 2014). For every year older, on the continuous range of 18 to 25 years, there was a 24% lower odd of having obtained the HPV vaccine (Fontenot et al., 2014).

Purpose of Study

The purpose of this study was to determine female and male university students' current vaccination status, knowledge about HPV, and how conversations with health care providers influenced vaccine decision making. For all participants, a study aim was to see if HPV related knowledge is related to vaccine status. For vaccinated and un-vaccinated participants, this study sought to understand themes in message presentation conveyed by provider and how they acted as cues to action or otherwise influenced students' decision making. The study also sought to capture any differences in HPV vaccine uptake, HPV knowledge, and if different provider messages were received by gender.

Guiding Research Questions

Research Question 1

What is the HPV vaccination status of female and male college students?

Hypothesis 1:

Female students will have higher HPV vaccine initiation and completion than male students.

Research Question 2

What are the HPV and HPV vaccine knowledge scores for female and male college students?

Hypothesis 2:1

Female students will have higher HPV and HPV vaccine knowledge scores than male students.

Research Question 3

Do HPV knowledge scores vary by vaccination status?

There will be differences between HPV knowledge scores and vaccine status.

Research Question 4

What are students' personal perceived risk of HPV infection?

Hypothesis 4:

Vaccine initiators and completers will have lower perceived risk than non-vaccinated students.

Research Question 5

What information regarding HPV and HPV vaccination was communicated by health care providers to college students?

Hypothesis 5:

Due to exploratory nature of this question, there is no hypothesis.

Significance of the Study

College-aged populations have the highest rates of HPV infection, fall within the recommended age range for HPV vaccination and are the next generation of parents for whom HPV vaccine decision-making will rely (Bynum et al., 2011). Regarding vaccination knowledge and uptake, public health efforts have surprisingly neglected college-aged women in this prevention effort, focusing largely on preadolescent girls (Hopfer & Clippard, 2017). Understanding psychological determinants of vaccination behaviors is critical to building effective communication aimed at enhancing vaccine uptake (Kim & Nan, 2015). Surprisingly, enhancing HPV-related knowledge does not necessarily result in increased vaccine uptake (Fernandez et al., 2015).

The literature has yet to firmly identify what specifically in the provider and patient encounter results in vaccination completion. There is no protocol for providers to follow regarding HPV vaccine communication according to the CDC or Advisory Committee on Immunization Practices (ACIP). Yet, both agencies are insisting that vaccine uptake rates can be improved through provider recommendations. The literature does not pinpoint vaccine uptake to a particular behavioral theory. However, this study aims to further understand themes within provider communication that led to student vaccine decision making.

Oklahoma has a low percentage of HPV vaccine uptake compared to the rest of the United States (Oklahoma Breast and Cervical Cancer Prevention and Treatment Advisory Committee (BCCPT), 2018). Screening for cervical cancer is low, and incidence and mortality rates of cervical cancer continue to be high. In Oklahoma, only 45.6% of females aged 13 to 17 are up to date on all the recommended doses (KFF, 2018). Of note, there has not been an HPV knowledge and vaccine uptake study with the intended participants of college students in this Midwestern University to date.

CHAPTER II

LITERATURE REVIEW

Research surrounding college student attitudes and knowledge about HPV and HPV vaccine uptake has been guided by an evolving timeline. This timeline reflects attempts at understanding and explaining a spectrum of attitudes and acceptance throughout the course of development of the three FDA approved vaccines and subsequent changing medical protocols for administration. Notably, the original vaccines were for females only, and only in 2009 included recommendations for males. Therefore, it is important to consider that research since 2006 has been shaped by these emerging developments. Gender differences in uptake rates, attitudes, and knowledge of HPV and vaccines understandably may also be shaped by this timeline.

HPV and Cervical Disease Etiology

Human papilloma viruses (HPVs) are a group of more than 200 related viruses, 40 of which are contracted sexually, through intimate skin-to skin contact (CDC, 2015). Sexually transmitted HPV types fall into two risk categories of risk (low and high); both have negative health outcomes for those infected (National Institutes of Health (NIH), 2015). Because the infection is so common, most people get HPV infections shortly after becoming sexually active for the first time (NIH, 2015). Further, it is possible to become infected with more than one type of HPV (CDC, 2015).

Most people with HPV do not know they are infected (CDC, 2014). Transmission can easily occur without one's knowledge, given most people with HPV never develop symptoms or health problems (CDC, 2015). HPV infection often is present without signs or symptoms, and there is no test to find out a person's "HPV status" (CDC, 2014). The CDC estimates that more than 90% of sexually active men and 80% of women will be infected with at least one type of HPV at some point in their lives (NIH, 2015).

Persistent oncogenic HPV infection is the strongest risk factor for development of cervical pre-cancerous lesions and cancers (CDC, 2010). Epidemiologic case series have shown that nearly 100% of cervical cancer cases test positive for HPV (Saslow, Solomon, Lawson, et al., 2012). It is estimated that half of the women diagnosed with cervical cancer have never been screened for cervical cancer, and an additional 10% have not been screened in the previous 5 years (CDC, 2012).

Forty HPV types infect the genital area (Markowitz, et al., 2014). Most notably, HPV types 16 and 18 cause 70% of cervical cancers. Type 16 also causes the majority of other cancers attributable to HPV. Ninety percent of anogenital warts (condylomata) and most cases of recurrent respiratory papillomatosis are caused by Type 6 or 11 (Petrosky, Bocchini, Hariri, et al., 2015).

Prevention efforts in the form of pre-exposure vaccination to young girls aged 11 to 13 has the potential to drastically reduce the burden of disease experienced within the population. Adolescent cervical cancer prevention programs should focus on universal HPV vaccination, which is safe, highly efficacious, and, when used in adolescents before they become sexually active, highly effective, and cost-effective (Saslow, et al., 2012). In clinical trials, each of the vaccines provided close to 100% protection against precancers and for Gardasil ® and Gardasil

9®, genital warts (CDC, 2015). Research also shows the vaccines are providing long lasting protection from HPV infection and associated disease (CDC, 2015). After completion of the vaccine series, there is no indication that booster immunizations will be needed (CDC, 2015). However, for all ages, HPV vaccine uptake in the U.S. remains lower than the Healthy People 2020 goal of 80% coverage (CDC, 2014). In recent years, approximately half of new infections occurred among persons aged 15 to 24 (Markowitz, Dunne, Saraiya, et al., 2014). ACIP recommends female adolescents receive three doses of HPV vaccine by age 13 to 15. ACIP is a federal advisory committee to provide expert advice and guidance to the Director of the CDC on use of vaccines; and attempts to align with recommendations made by the American Academy of Pediatrics (AAP), the American Academy of Family Physicians (AAFP), and the American College of Obstetricians and Gynecologists (ACOG) (Petrosky, et al., 2015).

Questions Shaping the Literature Review

(1) What is college students' knowledge level of HPV and HPV vaccines? (2) How is knowledge related to vaccine uptake? (3) Do college students perceive seriousness and severity of HPV infections? (4) Do college students believe they are at risk for HPV infection? (5) What is the role of provider communication and HPV knowledge and vaccine recommendations?

First, it is necessary to generally overview the development of the vaccine and its intended recipients. The literature review's primary areas of focus will include college student vaccine status and what related knowledge and attitudes towards HPV are in the literature. It is important to review what gender differences exist given the timeline of vaccine development and protocol changes that first applied to females only, then males. This is valuable as there is evident gap in vaccine uptake by gender. It is important to understand the documented role of provider influence in communicating HPV knowledge and vaccine recommendations.

Vaccine History of Development, Indications, and Intended Recipients

Historically, the first HPV vaccines were bivalent vaccine (Cervarix) containing HPV types 16 and 18. A quadrivalent vaccine (Types 6, 11, 16, and 18) developed by Merck and Company, Inc. and was FDA approved under the tradename Gardasil on June 8, 2006. At that time, Gardasil was indicated for vaccination in females and subsequently approved for use in males on October 16, 2009.

Merck and Company, Inc. received FDA approval for Gardasil 9 on December 10, 2014. It is now the only HPV vaccine used in the USA. This new vaccine has covers nine HPV types, five more HPV types (31, 33, 45, 52, and 58) than the original Gardasil (previously approved by the FDA, HPV types 6, 11, 16, and 18). Gardasil 9 has the potential to prevent approximately 90 percent of cervical, vulvar, vaginal, and anal cancers (U.S. Department of Health and Human Services, 2014). ACIP updated its HPV vaccine recommendation guidelines in March of 2015 to include this new vaccine.

The manufacturer of Gardasil 9, Merck & Co., Inc. provides this information: It was determined to be 97 percent effective in preventing cervical, vulvar, and vaginal cancers caused by the five additional HPV types (31, 33, 45, 52, and 58). Gardasil 9 is indicated in girls and women, 9 through 26 years of age for prevention of the following:

- Cervical, vulvar, vaginal, and anal cancer caused by HPV types 16, 18, 31, 33, 45, 52, and 58.
- Genital warts (condyloma acuminata) caused by HPV types 6 and 11.
- Precancerous or dysplastic lesions caused by HPV types 6, 11, 16, 18, 31, 33, 45, 52, and 58. (USDA Jan. 9, 2015).

Ideally, vaccination prior to any sexual activity is best practice; thus the target intended age of recipients has been late childhood, early adolescence. Medical science allows for rather simplistic reasoning: the earlier the initiation of vaccine, the better opportunity to protect against HPV infection. Historically, the ideal recipient of the vaccine has been young girls and adolescent females. As of October 2016, CDC recommends 11 to 12 year olds get two doses of HPV vaccine (National Foundation for Infectious Diseases (NFID), 2019). However, the vaccine can be given as early as age 9. ACIP also recommends vaccination for all females aged 13 through 26 years and males aged 13 to 21 years not vaccinated previously (CDC, 2015; NFID, 2019; Petrosky, Bocchini, Hariri, et al., 2015). For those who did not receive the vaccine when they were younger in accordance with the recommended schedule, females can receive it through age 26 and males through age 21 (NFID, 2019).

HPV Presence in College Student Population

College students suffer disproportionately from HPV (Yang & Pittman, 2017). Between 2000 and 2015, university enrollment rates among the 18- to 24-year-old population increased from 27.3 million to over 31.2 million students (Rhode, et al., 2018) This represents a significant proportion of young individuals who are now eligible for catch-up vaccination and are targetable for behavior change intervention and protection against HPV-associated cancers (Rhode, et al., 2018). A gender gap in vaccine uptake exists. A national study conducted in the Spring of 2015 reported 40% of undergraduate college men had received the HPV vaccine, compared to 62% of their female counterparts (American College Health Association, 2015).

Public health efforts have surprisingly neglected college-aged women in this prevention effort, focusing largely on preadolescent girls (Hopfer & Clippard, 2017). Although a medical checkup and measles, mumps, and rubella (MMR) vaccines may be required to enter college,

college-aged women often move through young adulthood without preventive medical visits, given their transitory life stage (Hopfer & Clippard, 2017). One vantage point is that college students represent a unique challenge for the promotion of HPV vaccine because they are less likely to see a health care provider and have fewer opportunities to discuss or receive a HPV vaccination recommendation (Rosenthal et al., 2011). Often there are too many "missed opportunities" to vaccinate when providers fail to make recommendations when students are in a health care encounter (CDC, 2019).

Provider Recommendation Key to Vaccine Information and Uptake

Despite calls to action by the National Foundation of Infectious Diseases (2014), there are no practice guidelines on how health professionals should communicate to young adult women or men about the HPV vaccine. It is not clear what proportion of clinicians raise or explicitly recommend HPV vaccination to their college-aged patients (Hopfer & Clippard, 2017). What is known is that providers are sources of knowledge and can influence the persuasive outcomes of a health message promoting HPV vaccination among young adults (Kim & Nan, 2016).

Health care providers, including nursing professionals, have a role in not only helping patients make an informed decision about starting the HPV vaccine, but encouraging completion of the entire series (Head, Vanderpool, & Mills, 2013). A body of evidence shows a physician's recommendation may significantly influence the vaccination decision (Daley, Liddon, Kempe, et al. 2006; Dillard & Spear, 2010; McRee, Gilkey, & Dempsey 2014; Jones & Cook, 2008). A physician recommendation is the strongest predictor of HPV vaccine receipt (Rosenthal et al., 2011). The CDC and the President's Cancer Panel have identified improving healthcare providers' communication as a key strategy for increasing HPV vaccine uptake (Gilkey et al.,

2015). Recommendations from health care providers increase patient and parent acceptance of vaccination (Dorrell, Yankey, & Strasser, 2011).

Physician approval of vaccine has been cited as a predictor of vaccine uptake (Fazekas, Brewer, & Smith, 2008; Kasting, et al., 2016). Note much of the existing research focuses on the interactions between providers and adolescents and their parents. Among adolescent females age 12 to 17 whose parents reported their provider recommended the HPV vaccine were eighteen times more likely to have initiated the HPV vaccine series than girls whose parents did not report receiving a provider recommendation (Soon, Dela Cruz, Tsark, Chen, & Braun, 2015). Ylitalo, Lee, and Mehta (2013) found in a national study of adolescents that those reporting vaccine discussions with their provider were 4.5 times more likely to report vaccine receipt.

While scant, there is emerging research that focuses on health care provider influence with college student populations. This literature includes the role of the health provider as a trusted influence and knowledge source. The more college students trust their health care provider, the more they intend to get the vaccine in the upcoming year (MacArthur, 2017). In a study by Ragan et al. (2017) of 527 undergraduate students of those who received encouragement from both a doctor and parent, 95.8% received the vaccine. Kim and Nan (2015) found students having talked with a healthcare provider increased perceived efficacy of the vaccine which was related to perceptions and increased likelihood of receiving vaccine.

Lindley et al. (2013) found females who had received a gynecological examination during the past year were more than twice as likely to have received the HPV vaccine. Marchand, Glenn, and Bastani (2012) found provider's recommendation, expressed as having been ''offered'' the vaccine, was the factor most strongly associated with vaccination. In one study of 383 college undergraduates, 62% of females reported a health care provider had

recommended the vaccine to them (Bernard, et al., 2017). Women reported high levels of trust in particularly physicians and nurses (Garland & Quinn, 2006). Research suggests most nurses are supportive of HPV vaccination and are in an ideal position to provide related HPV education to young women compared to other clinicians (Head, Vanderpool, & Mills, 2013).

The literature reflects an expected gender disparity in HPV knowledge and vaccine uptake, given that the vaccine series has not always been routinely recommended for males. There may be differences in communication practices of providers towards college men; yet this is not a developed area of the literature. Measures of knowledge and vaccine status are present, but with limited connections to the provider encounter. This may reflect the timeline of HPV vaccine approval and recommendation for males (Patel et al., 2013).

Some studies indicate personal biases and lack of knowledge of the guidelines for HPV vaccine impact healthcare provider recommendations of the vaccine to their patients (Sherlock, Atkinson, and Martens, 2013). Provider perception of patient risk influences vaccine recommendation. Some providers will not recommend the vaccine to girls perceived as not sexually active (Dorrell, Yankey, and Strasser, 2011). Patel et al. (2013) surveyed 4019 students; notably, far fewer males than females perceived either parental (46.2% vs. 68.9%) or healthcare provider (46.7% vs. 79.8%) approval for getting the HPV vaccine. Beshers et al. (2015) found significant gender disparity regarding receiving health care provider communication regarding the vaccine (2.5% for males vs. 77.3% for females). Bernard et al. (2017) found males were not aware there was a vaccine, and only 21.6% had received a provider recommendation. More recently, Lee et al. (2018) found male students who have had a medical examination within the last year showed the greatest percentage of HPV vaccine completion.

Lack of provider recommendation may partially explain low vaccine uptake; but little literature exists with college student populations. In a study of 527 university students, 40% of students who were undecided about the vaccine indicated their doctor did not discuss it with them (Ragan et al., 2017). The importance of HPV related provider and parent communication *is* hallmark for young people who need parental consent, thus these findings are highlighted. Lack of provider recommendation is frequently cited by parents as reason for non-receipt or non-pursuit of vaccination (Head, Vanderpool, & Mills, 2013; Kasting, et al, 2016; Perkins, et al., 2014; MMWR, 2014). Dorrell, Yankey, and Strasser (2011) analyzed data from the 2009 National, Immunization Survey-Teen (n=20,066); "…66.0% of parents reported that they did not receive healthcare provider recommendation for their adolescent to receive the vaccine". Parental reports suggest that only about half of female adolescents have ever received a recommendation for HPV vaccine (McRee, Gilkey, and Dempsey, 2014). More than one in ten parents of adolescent girls said the vaccine was not recommended to them (KFF, 2015). Smith et al. (2016) analyzed the 2010 National Immunization Survey-Teen among teen girls (n=8490); health care provider recommendation to parents led to favorable attitudes and initiation of vaccine for their teen daughters, with 48.2 percentage more likely to be fully vaccinated.

College student reported *sources* of HPV and HPV vaccine knowledge often include health care providers. Preferred information sources varied in the span of literature reviewed. Females reported health care providers were the most common sources of HPV information (Bernard et al., 2017; Bynum et al., 2011). In a study of 192 students, the main sources of information about HPV and the HPV vaccine were personal physicians, followed by the media, then family and friends (Navalpakam, Dany, Hussein, 2016). In a study of male students, sources included TV, radio, friends, and health education programs (Grace-Leitch, & Shneyderman,

2016). Male students reported the internet and school as the most common sources of HPV information (Bernard, et al., 2017). Social media was a preferred source among males (Bynum et al., 2011). For Schmotzer et al. (2013) study participants, common sources of HPV information were a doctor, TV commercial, high school/college course or health brochure.

Research is needed to describe the health care provider messages that college-aged student report receiving about the HPV vaccine (Hopfer & Clippard, 2017). Given that the HPV vaccine is available at about 72% of college and university health centers nationwide, often at reduced cost or for free depending on students' insurance, it is important to understand why students choose not to receive the vaccine to develop catch-up vaccination programs to address barriers and increase vaccine uptake (Ragan et al., 2017).

HPV Knowledge and Misunderstandings Among College Students

In this review of the past 13 years of HPV literature in college student populations, HPV attitudes can be interchanged with constructs of beliefs, opinions, vaccine acceptability, perceptions of the vaccine, and perceptions of risk of infection. Highlighted are variances in knowledge, frequent misunderstandings regarding HPV, and lack of perceived risk and susceptibility to HPV. Of particular interest is the common theme found, exemplified by Jozkowski and Geshnizjani's (2016) study, where 97% of the participants were aware of the HPV vaccine, but did not have knowledge about where they could obtain the vaccine, why the vaccine is important, or what HPV actually is.

The literature is emerging and contradictory to the expected conception that greater awareness and knowledge would result in vaccine intention or completion. Schmotzer et al., (2013) found answering questions incorrectly about HPV was associated with having been

vaccinated or planned to get the HPV vaccine. Significant associations between beliefs and vaccine status occurred when a larger proportion of people who had received or planned to get the HPV vaccine held misinformation (Schmotzer et al., 2013).

Schmotzer et al. (2013) found intention to receive the HPV vaccine was not necessarily associated with holding correct information about HPV. So, while women may be initiating the vaccine, or have completed the series, they still have misperceptions and misunderstandings (Wolwa et al., 2013). Indeed, historically, HPV is constructed as a 'female' disease (Wyndham-West, 2016). College students hold serious misconceptions about HPV (Albright & Allen, 2018).

Knowledge is not a direct predictor of health behavior; it is the first step in making informed health decisions (Sledge, 2015). Awareness alone does not lead to positive actions toward health (George et al., 2020). It has been suggested that *lack* of knowledge may be a barrier to vaccine adherence (Richman, et al., 2016). Jones and Cook (2008) found in an early study that increased knowledge was significantly associated with women accepting the vaccine. It would seem that greater perceived risk was also associated with an increased likelihood of intention to receive the vaccine (Jones & Cook, 2008). However, a body of the literature today is contradictory: knowledge alone does not equal vaccination.

Ratansiripong (2015)found knowledge was not associated with vaccine status or intention in 410 men. Patel et al. (2012) found intent to undergo HPV vaccination was not significantly associated with any of their individual HPV-related knowledge items. Despite high level of HPV-related knowledge there were not associations with intent to undergo HPV vaccination in their population. Further, their education-based intervention was not significantly associated with HPV vaccine uptake post intervention. Only (5.5%) participants received at least 1HPV

vaccine dose within 6 months of study enrollment (Patel et al., 2012). McCuthceon et al. (2017) found similarly that after an educational based intervention, knowledge and intention to vaccinate was increased, but at 3 months follow up 56% of the participants remained unvaccinated and this is despite a reported increase in the perceived risk of contracting HPV.

Bennet et al.(2015) conducted studied vaccine knowledge and uptake in 661 female university students after a tailored online educational intervention. In a randomized control trial, both groups of young women received different formats of HPV education. 331 responded to post intervention surveys three months later. While knowledge reportedly increased, risk perception and intention to be vaccinated did not change significantly from baseline to 3 months in either group. Of participants who intended to undergo HPV vaccination at baseline, 82.4% remained unvaccinated 3 months later (Bennet et al., 2015). Further, knowledge change was not significantly associated with HPV vaccine uptake at 3 months. High baseline intent to be vaccinated was the strongest predictor of receipt.

Increasing knowledge by itself is insufficient to increase vaccine uptake (i.e., behavior change) in the absence of additional measure such as explicit provider endorsement of vaccination or systems improvement to provide immediate vaccination once readiness to vaccinate is identified (Bennet et al., 2015). Knowledge is not a strong predictor of vaccine behavior. Factually driven educational interventions targeting participant knowledge have shown to have some impact on intention to be vaccinated but have not been associated with change in actual vaccine uptake. Personal or culturally tailored approaches may work by providing information that participants find particularly relevant (Bennet et al., 2015).

Richman et al. (2016) also tested an intervention among female and male students, sending educational text reminders for follow up vaccine appointments and measuring overall knowledge of HPV. Their results confirm the perplexity that although knowledge was raised, it was not related to follow up vaccination completion. Patel et al. (2012) conducted an educational intervention with 256 unvaccinated students. Among their findings were that socio demographic characteristics and sexual and medical history generally did not correlate with HPV vaccine intent, and participants who were currently sexually active were also significantly less likely to intend to undergo HPV vaccination.

The literature broadly holds that females have higher HPV knowledge than males. Beshers et al. (2015) surveyed 817 undergraduate students at two universities in 2010. Females reported significantly greater awareness of HPV, the HPV vaccine, and Gardasil; significantly more discussions with their clinician about the HPV vaccine; and significantly higher rates of HPV vaccination compared to the male respondents. These differences are likely explained by the vaccine recommendations and availability for women only at the time. Ratansiripong (2015) found low HPV knowledge in 410 college males; they also had low rates of uptake. Along with low knowledge, only 3% of men had been vaccinated for HPV in a study by Schmotzer et al. (2013).

Staggers, Mann, and Maki (2012) found evidence that while college males are aware of HPV "they hold a number of misconceptions, namely, their perceived lack of susceptibility and their ignorance of the severity of health consequences associated with HPV." Sledge (2015) surveyed 86 males, eighty-five percent (n=58) of the respondents had heard of HPV and had high knowledge scores, but the majority did not know that there was a vaccine available for young

men. This was also true in a study by Gao, Okoror, and Hyner (2016) where misperceptions were common ranging from origin of disease, transmission, and prevention measures.

The results of the Fontenot et al. (2014) study of 735 sexually active college males are particularly revealing of confusion regarding the vaccine. Lack of knowledge extended beyond not knowing about the vaccine to also not being aware of the disease. Similarly, many reported lack of risk related to lifestyle and sexual orientation/identity and believed the vaccine did not apply to them because they were homosexual (Fontenot et al., 2014). There was a common belief that the vaccine is not for men. The participants voiced confusion about whether men were supposed to be vaccinated or not, and some voiced a belief that this vaccine is not available for males (Fontenot et al., 2014). In summation, this study revealed that the college men in this sample had low HPV vaccine awareness, knowledge, perceived severity, and perceived susceptibility; thus, in part explaining lack of vaccination and intent to vaccinate. Similarly, Schmotzer et al. (2013) found more than half of their respondents had misinformation regarding men and HPV, including not knowing that there is a vaccine to protect men from HPV.

Catalano et al.(2017) in a recent study of 256 unvaccinated undergraduate men found approximately one-third (31.3%) had never heard of HPV before participating in the study, and nearly half (45.3% had never heard of the HPV vaccine. The majority (86.3%) reported they had participated in some type of sexual activity therefore already at risk of HPV infection. There was low vaccine awareness and subsequently low intention to vaccinate using the Theory of Planned Behavior as a model of indication of intent. The men's perceived social pressure to get all three doses of the HPV vaccine in the next 12 months was also low (Catalano et al., 2017).

The inaccuracy of knowledge for both genders of college student has found its way into the literature. In an early 2007 study, 29% of the female participants did not know if men could become infected with HPV and 8.8% believed males could not (Burke et al., 2010). More recently, of 192 students, "…75% of the participants incorrectly answered that the HPV vaccine can only be acquired after the age of 18 years, 71% believed that women can only contract the virus from a symptomatic sexual partner and 43% incorrectly believed that HPV infections lead to genital herpes" (Navalpakam, Dany, and Hussein, 2016). Staggers, Brann, and Maki's (2012) focus groups found that males believed HPV is a problem experienced by females and that they are only carriers of the virus. They did not recognize that they are actually at risk for certain types of cancer themselves. A study found that 72.4% of 1,401 participants falsely believed that HPV could be cured with the right treatment (Ratanasiripong, 2012). In a study of 120 males, while acceptability of the vaccine was high (72%) most participants did not know the correct symptoms (or lack of symptoms), consequences, and/or risk factors for HPV infection (Grace-Leitch & Shneyderman, 2016). There may also be a belief among women that they may not benefit from the vaccine as they get older, which is not necessarily true (Marchand, Glenn, and Bastini, 2012).

Among students who state they are *aware* of HPV; confusion has been documented. Dillard and Spear (2010) surveyed 396 undergraduate women in 2008; their results showed misunderstandings despite a reported very high level of awareness of HPV (96%). "Although responses to many of the knowledge items suggest a high level of awareness of HPV and its consequences, other responses are cause for concern." For example, 34% to 35% of the sample believed that men cannot contract HPV, There was a false belief among 42% to 45% of the sample that HPV and HIV have similar effects on the human body. 44% to 51% of the

respondents wrongly believed that the HPV vaccination is almost 100% effective in preventing all types of HPV infection (Dillard & Spear, 2010). Additionally, one-fourth of women in the Dillard and Spear study believed that because they were not sexually active, the vaccine was unnecessary. Ragan et al. (2017) found in a group of 527 students, although they were aware of HPV, approximately one-third indicated they did not know where to get the HPV vaccine.

Although this literature search was not primarily focused on minority perceptions specifically, the scant research showed college student minority groups also have low knowledge and confusion exists. Bynum et al. (2011) surveyed 575 African American students in 2011, when little research existed for this population. In their sample, there was a gender disparity in knowledge. Males (56.6%) were less likely than females (85.9%) to have heard of HPV and were significantly less likely to have heard of the HPV vaccine (65.7% vs. 95.0%) (Bynum et al., 2011). Students were least knowledgeable about the signs and symptoms of HPV infection and a majority thought that HPV vaccines protect against all HPV infections (Bynum et al., 2011).

Tung, Lu, Qui, and Ervin (2019) found low knowledge scores and lack of understanding about transmission and signs of HPV in Chinese students in the USA. The majority did not realize genital warts are caused by HPV, less than half knew the infected partner may not show symptoms. The majority did not know that the vaccination could be received after the age of 18 years. The participants did not know despite a normal Pap smear, a woman may still have HPV infection, and many were unaware a woman still needs to get Pap smear after receiving HPV vaccination (Tung, Lu, Qui, and Ervin, 2019).

Kim et al. (2017) conducted a small focus group study with Korean American female students in the USA to better understand their knowledge and attitude towards HPV. None of the

20 participants identified the HPV vaccine as a preventive method of HPV (2017). A few of these participants stated they were vaccinated prior to being in college because their mother or a health care provider had been supportive of the vaccine. Overall, the participants believed HPV was a woman's disease, that the HPV vaccine was for women only, and that they were at low risk for acquiring HPV or cervical cancer (Kim et al., 2017).

Perceived Susceptibility and Perceived Risk of HPV Infection

Early on, it was thought greater perceived risk was also associated with an increased likelihood of intention to receive the vaccine (Jones & Cook, 2008). Despite the increased risk of HPV infection among college students, few studies have thoroughly examined HPV risk perception in this population (Patel et al., 2013). Given that HPV vaccination is now strongly recommended for both females and males by the CDC, it is surprising that many college students appear apathetic in the literature that exists.

In a 2017 study of 383 undergraduate students, 90% of males stated they had not given serious thought of receiving the vaccine (Barnard, et al., 2017). Wong did not find high perceptions of risk in 215 unvaccinated women (2014). Similarly, for Stephens, Thomas, and Eaton (2016), male participants did not view HPV infection or vaccination as an immediate concern or priority. Thomas et al. (2016), found only 30% of young Hispanic men within their study believed men are at risk for acquiring HPV, and only 12% were concerned that they might contract an infection.

Fontenot et al. (2014) noticed small, voiced intention to obtain the vaccine, but this was only after participating in the survey. Pitts and Stanley (2017) conducted structured focus groups with undergraduate males to understand vaccine attitudes and barriers. Several themes were

noted including apathy towards sexual health, dismissiveness about susceptibility, lack of severity of HPV, and that it was too late to vaccinate for those who were already sexually active. Notably in the Pitts and Stanley (2017) focus groups, there was an attitude that while many may have heard of HPV, they *knew* little about HPV. This was the same for Stephens, Thomas, and Eaton (2016); men rated themselves as having some knowledge about HPV and the HPV vaccine, yet their interview responses illustrated their actual knowledge about both was consistently low. For Katz et al. (2012) despite most of the male students reporting being sexually active and being aware of HPV, students had limited HPV knowledge and concern.

In a study of 4019 students, only 18% of respondents believed that they were at risk of acquiring a genital HPV infection in their lifetime (Patel et al., 2013). Marchand et al. (2012) surveyed 178 females, among those who had heard of the vaccine but had not received any doses (n=77), 73 % reported they had 'never thought about' or were 'undecided about getting the HPV vaccine'. Tung, Lu, Qui, and Ervin (2019)recently surveyed 449 undergraduate students and found less than one-fifth believed they are susceptible to HPV infection. In another study, unvaccinated single women perceived themselves at zero risk for HPV, which was attributed to lack of sexual activity (Thompson et al., 2017). These women stated they would wait until they were sexually active to receive the vaccine. Hopfer and Clippard (2017) also found college women related HPV susceptibility primarily to relationship status.

Fontenot et al. (2014) found male participants did not believe they were at risk for contracting HPV and therefore did not perceive the need to obtain the vaccine. Similarly, in Bynum et al.(2011) study males, were significantly less likely to perceive HPV health outcomes as severe and think that there was a benefit for them to undergo vaccination. Curiously, but contradictory to the students' own self reports of ambiguity, HPV vaccine acceptance was

considerably higher than rates reported in the literature at that time (69% versus 33% to 48%). This is striking to note because these males also reported more unfavorable health beliefs and more barriers compared to the females surveyed (Bynum et al., 2011).

Vaccination Barriers and Vaccination Intention

As expected, females have progressed further than males towards taking observable steps to-wards HPV vaccination (Patel et al., 2013). Vazquez et al. (2016) surveyed 21,320 students. Sixty-nine percent of the females reported having received the HPV vaccine compared to 43% of the males. Women would appear to be stronger initiators, yet there is a return to ambiguous unknowns when it comes to series completion. Curiously, intention to receive the vaccine was unexpectedly not a predictor of vaccination uptake (Ratanasiripong, 2012). Bednarczyck et al. (2011) surveyed 577 college women, three hundred twenty-one (56%) women reported initiating the HPV vaccine series, and 255 (44%; 79% of initiators) reported completing the three dose series. There were 256 women who did not initiate the HPV vaccine series, 45 indicated their intention to receive the vaccine in the next year: 118 (46%) indicated they do not plan to get the vaccine in the next year, with an additional 91 (36%) unsure. Twenty-one percent of women who initiated the HPV vaccine, but did not complete the series (Bednarczyck et al., 2011).

In a selective meta-analysis of college women and HPV knowledge Ratanasiripong (2012) found common themes related to intention. Most importantly, intention to receive the vaccine was unexpectedly *not* a predictor of vaccination uptake. Other results of the study follow. Normative belief and social norms, perceived severity, perceived benefits, and knowledge were positively correlated with intention to obtain HPV vaccine. Vaccination intention was also inversely associated with lack of insurance, perceived barriers, pregnancy

history, and riskier sexual behaviors. When HPV is only portrayed as a common infection (potentially reduced shame perception), female participants were more likely to indicate an intention to get the vaccine right away (Yang & Pittman, 2017). HPV knowledge was an independent predictor of vaccination intention. Normative beliefs, perceived barriers, perceived severity, and pregnancy history could also be predictors (Ratanasiripong, 2012). Perceived barriers, perceived benefits, fear of a shot, perceived severity, and self-efficacy were not statistically different between non vaccinated and vaccinated groups. Almost all (90%) of non-vaccinated participants (at baseline) had neither returned to the physician nor been offered the vaccine, many of those intending to receive the vaccine might likely not have a chance to do so during the short follow-up period of 6 months (Ratanasiripong, 2012).

Barriers to vaccine uptake early in the literature (2011) included consistent themes: perception of low risk of infection due to not being sexually active or being otherwise healthy, vaccine cost, and concerns about the safety and effectiveness of the vaccine (Bednarczyk et al., 2011). Safety concerns, side effects, cost, not knowing enough, and lack of a health care provider recommendation have been reported barriers. Other frequently reported barriers included not being sexually active and not worried about getting HPV (Burke et al., 2010). Lack of knowledge, a lack of perceived susceptibility, cost, and concern about vaccine safety were given barriers (Katz et al., 2012). Safety concerns related to the HPV vaccine may be a major barrier to vaccine uptake (Bednarczyk et al., 2011). Ratanasiripong (2012) found side effects or efficacy, lack of information, lack of transportation, inactive sexual status, new vaccine, and lack of health insurance. Side effects, costs, and lack of knowledge about the vaccine were most often indicated as barriers to receiving the vaccine (Burke et al., 2010).

In the literature published after 2015, barriers include vaccine being a lack of priority, scheduling conflicts, and not needing to go to the doctor. Various studies noted that the reasons for not obtaining the HPV vaccine included cost (Kim & Nan, 2016; Sledge, 2015, Thomas et al., 2016). Benefits reported were to protect themselves and their partners from infection (Pitts & Stanley, 2017). Perceptions of stigma and shame can be detrimental in vaccination uptake and serve as barriers (Yang & Pittman, 2017). Women who know that HPV is sexually transmitted may experience higher levels of stigma, shame, and anxiety (Yang & Pittman, 2017).

In a focus group of women, Hopfer and Clippard (2017) found barriers including vaccine cost, lack of time, lack of awareness that the vaccine was available on campus, and for some, fear of having to discuss vaccination, and sex, with their parents. Cost, being in a monogamous relationship, and novelty of the vaccine were the main barriers against vaccination (Wilson, et al., 2016). For college males perceptions of time constraints, lifestyle norms, having fewer interactions with healthcare providers, and poor HPV information sources (Pitts & Stanley, 2017) were reported barriers. Moreover, males' perceptions of the HPV vaccination as emasculating, embarrassing, and stigmatizing can be barriers to vaccination acceptance (Reiter et al., 2011, 2014).

College Student HPV Vaccine Decision Making

College presents students with opportunity for making health-related decisions for the first time on their own (Jozkowski & Geshnizjani, 2016). Little research has examined how college students begin to make autonomous health care decisions (Barnard, et al., 2017; Ragan, et al., 2017). More research is needed to understand the determinants of students' decision-making process across healthcare factors in order to effectively incorporate interventions during

the transition to college (Ragan, et al., 2017). Also, little is known about the types of messages college women receive regarding HPV vaccination (Hopfer & Clippard, 2017) and, as a result, which messages will lead to vaccination.

Young adulthood is a period for autonomous decision making regarding sexual and reproductive health choices (Thompson et al., 2017). Young adults are sure of their sexual behavior in a way parents may not be of their children's (Wilson et al., 2016). University student life offers greater liberty for self-guided decision making; during this developmental period, young adults continue to learn how to independently manage their sexual health and are faced with the decision to vaccinate against HPV (Rhode et al., 2018). When teenagers enter college, there may be a shift in healthcare decision-making from parents and guardians to the students themselves (Ragan, et al., 2017).

However, Ragan et al. (2017) noted although young adults may appear to yearn for independence, with regard to HPV immunization decision-making, students continue to rely heavily on important others while taking less of a direct decision-making responsibility for themselves". Hopfer and Clippard found supportive family messages, explicit health care provider endorsement, and peer norms shaped the perceived benefits of vaccination among women (2017). Vaccinated women in this study attributed their vaccine decisions to having open lines of communication with their parents and being most influenced by the opinions and recommendations of a medical expert, almost a blind trust in their recommendation (Hopfer & Clippard, 2017).

College students' healthcare decision-making is still greatly influenced by their parents (Ragan, et al., 2017). Mother-daughter talk about the HPV was found to positively predict young

women's HPV vaccination behavior Miller-Ott and Durham (2011). Katz et al. (2012) found that only a few male students (7% in their study) made independent health care decisions without consulting their parents. Roberts et al. (2010) found that although young women were old enough to receive the vaccine without their parents' consent, perception of their mother's approval and mother-daughter communication about sex were important predictors of vaccination. Influences of friends and peers are important for establishing norms, but many college women still turn to their parents when it comes to health matters (Kopfer & Clippard, 2017).

Research is needed to describe the family, peer, and health care provider messages that college-aged women report receiving about the HPV vaccine (Kopfer & Clippard, 2017). The role of parent and sibling messages in college-aged women's HPV vaccine decisions has yet to be explored. There has been little documentation of decisional conflict or decisional regret during or after the HPV vaccine decision making process (Harper et al., 2014). Negotiating HPV vaccine decision-making requires deliberations, and many college women in Wyndham-West's (2016) interviews were widely anxious about the decision before them.

For Hopfer and Clippard (2017), many women have based decisions on the attitudes of family and health care provider messages, while having only superficial HPV knowledge. College women report physicians simply not mentioning the HPV vaccine or downplaying it. Women's uncertainty about the HPV vaccine is understandable if not expected, given the mixed messages they are exposed to, and given that even clinicians sometimes provide young adult women with incorrect information. For Hopfer and Clippard (2017), responses indicated that family and health care provider messages provided vaccine decision-relevant knowledge for college women. However, mixed messages and the absence of an explicit recommendation by

health professionals to get the HPV vaccine were interpreted by college women as meaning that the vaccine was not necessary.

It is difficult to say if student decision making is determined by the immediate factors regarding the act of vaccination or determined by more long-term benefits such as HPV protection. Some studies have found that vaccine decisions were not the product of an individual 'rational' assessment of risk/benefit (Wyndham-West, 2016). Kim and Nan (2015) hypothesized that in a group of 676 students, those high in considerations of future consequences (CPC) would show a higher rate of HPV vaccine uptake but this was not supported. They found students that were high in CFC perceived the HPV vaccine to be more effective than did those low in CFC (Kim & Nan, 2015). Considerations of future outcomes have been shown to predict a variety of health-related beliefs, attitudes, intentions, and behaviors, but not HPV vaccine uptake (Kim & Nan, 2016). Wyndham-West (2016) found similarly a mix of delayed decision making and reluctance to say 'yes' to the vaccine, even if her interviewees voiced strong acknowledgement of personal risk.

Personal Factors Related to Vaccine Intention or Uptake

Patel et al. (2012) reviewed early HPV literature. Their collective findings suggest that factors beyond HPV knowledge, such as personal beliefs, attitudes, life experiences, and emotional states should be examined. Differences in HPV vaccine uptake exist in the literature surrounding topics such as demographic/descriptive characteristics: age, race/ethnicity, international status, relationship status, primary source of health insurance, region/location of college/university, membership in a sorority, and participation in varsity or club/intramural sports during the past year (Lindley et al., 2013; Marchand, Glenn, and Bastoni, 2012).

Additionally, Lindley et al. (2013) found significant differences in receipt of the HPV vaccine were reported based on the sexual behaviors.

For female college students, age (older; aged 21 to 24 years), race/ethnicity, and international status were all found to be significantly associated with lower odds of receiving the HPV vaccine (Lindley et al., 2013). Lower socioeconomic status and lack of health insurance, as previously discussed, were likely associated with lower odds of nonwhite college women's receipt (Lindley et al., 2013). Marchand et al. (2012) found that vaccinated women were younger, perceived the vaccine to be safer, perceived HPV severity to be lower, reported more social approval, more often had a doctor's recommendation for the vaccine, and more often had a regular doctor compared to women who had not received the vaccine. Having prior consideration of a health issue may relate to stronger attitudes related to HPV vaccines (Kim & Nan, 2016). Women were less likely to state that their relationship status impacted their decision for vaccination (Thompson et al., 2017). Vaccinated single and dating women reported a more accurate risk perception for HPV and that their decision for the vaccine was not based on their relationship status (Thompson et al., 2017).

Among male undergraduates, being sexually active or having multiple partners was associated with vaccine completion (Lee et al., 2018). Parents/guardians' education and participant's sexual activity status were found to be significantly related to HPV vaccination (Lee et al., 2018). Marital status (being unmarried), practicing organized religion, and higher education were also significant predictors of vaccine initiation and completion (Lee et al., 2018). HPV vaccine acceptance among males has been associated with being aware of HPV, being sexually active, having more lifetime sex partners, having a previous STI, perceiving themselves at risk for HPV, having a direct personal benefit, having peer acceptance of the vaccine, and

believing that their parents, partners, or health care providers would encourage them to be vaccinated (Katz et al., 2012). For males, being sexually active, having multiple sex partners, some HPV-related knowledge, and greater perceptions of HPV risk and susceptibility have been linked to greater intent to vaccinate (Gerend & Barley, 2009; Liddon et al.,2010). Heterosexual males appear to be less favorable toward the HPV vaccine and have less knowledge, awareness, and perception of control over the decision to vaccinate. Peer behaviors, perceptions of peer vaccination norms, and vaccination self-efficacy also increase vaccine acceptance among young adult males (Gerend &Barley, 2009; Hopfer & Clippard, 2011; Liddon et al., 2010; Mehta et al., 2014; Rambout et al., 2014; Reiter et al.,2011). Ever having had sex, having had more than 5 sex partners, and ever having had an STD were significantly associated with men accepting the vaccine (Jones & Cook, 2008).

Health Belief Model (HBM) Applied to HPV Vaccine Decision Making

Not all studies regarding college students and HPV related knowledge, vaccine status, and decision making have a theoretical framework. Theory-based frameworks to understand determinants of health behaviors can be very helpful to understand dynamics that most influence intention to or actual behavior (Jozkowski & Geshnizjani, 2016). Ratanasiripong (2012) completed a literature review in 2010 when the vaccine had only been available a handful of years. Noticeably in this limited review, only 5 studies of 13 incorporated a theoretical framework, and the Health Belief Model (HBM) was the theory most frequently used.

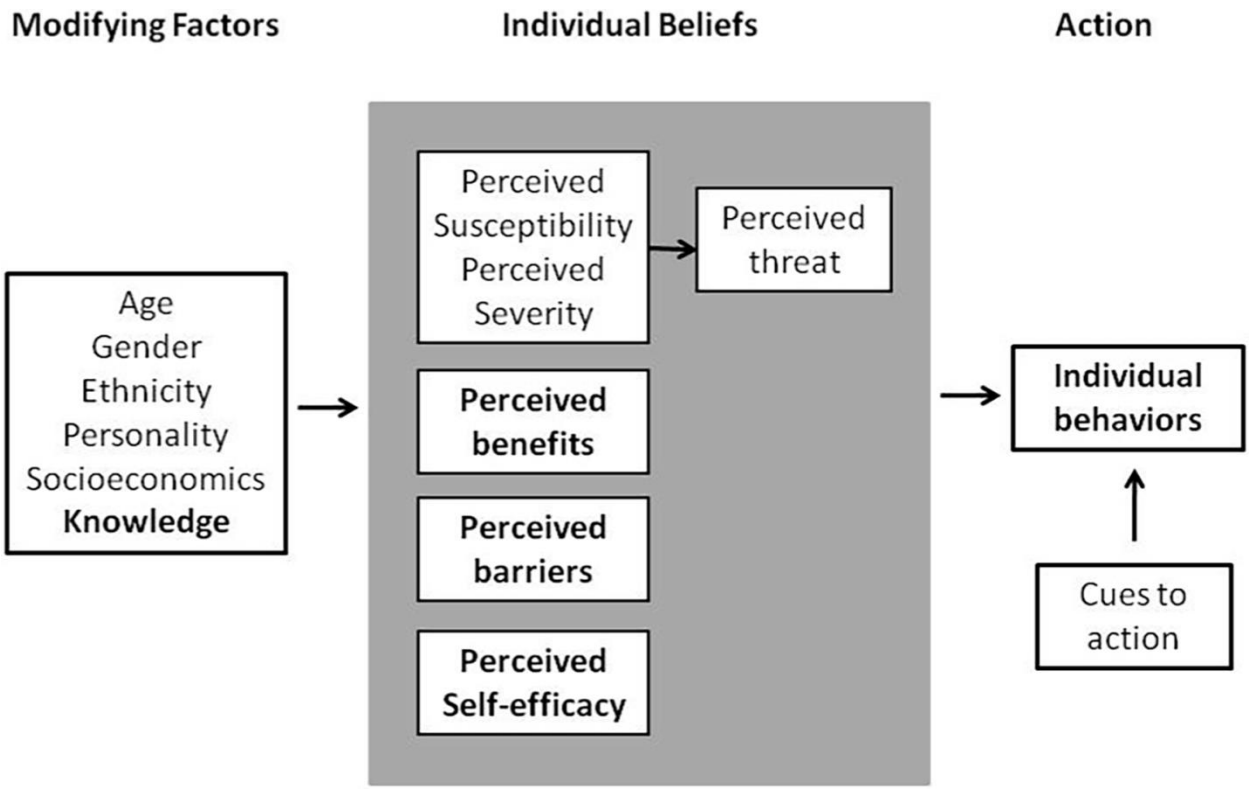
There are no current studies that have identified the precursor to action and HPV vaccine decision making in college students. The studies based on HBM components are not holistic, rather they inquire about specific constructs of the HBM. For example, Christy et al. (2016)

found the HBM useful to examine the extent to which commonly studied variables (i.e., perceived severity of HPV-related diseases, perceived risk of developing these diseases, and perceived benefits of HPV vaccination) had influenced the vaccine decision.

Given vaccination activities related to perceived risk, it is possible that greater awareness of the impact of the HBM during studies of vaccination uptake by older adolescents and young adults may offer a means for better understanding and improving vaccination levels (Bednarczyk et al., 2011). Correlates of HPV vaccine uptake and intentions among college students have been studied within the framework of the HBM (Christy et al., 2016). Commonly studied cognitive variables include perceived risk of developing an illness, perceived benefits of taking action against developing an illness, and perceived barriers to taking action (Donadiki et al., 2014).

The HBM originally attempted to explain why people fail to adopt a given preventative health intervention by identifying which beliefs are associated with behavior (Rosenstock, 1974). This model remains key in health behavior research (Glanz & Bishop, 2012). HBM predicts that people will likely engage in a positive health behavior when they perceive negative health outcomes as a real threat (i.e., severity plus susceptibility) and when the perceived benefits of the health behavior outweigh the perceived barriers (Pitts & Stanley, 2017). The HBM has six constructs that predict health behavior: risk susceptibility, risk severity, benefits to action, barriers to action, self-efficacy, and cues to action (Donadiki et al., 2014, Glanz & Bishop, 2012, and Jones et al., 2014). See Figure 1.

Figure 1: HBM Components and Linkages (Miri, et al., 2018)



Perceived Susceptibility, Severity, and Perceived Threat

Two variables of the HBM perceived susceptibility and perceived severity—are related to an individual's perceptions of a disease or health condition (Kim & Nan, 2015). These constructs relate to a person's perceived threat (or risk) of disease or subsequent conditions. Additionally, the HBM suggests that increased severity should increase vaccination, yet in a study by Jozkowskia and Geshnizjani (2016) their findings suggest the opposite. There was no significant association between perceived severity and vaccination.

Perceived susceptibility concerns the extent to which an individual believes that he or she is susceptible to a particular health problem. Susceptibility refers to the subjective risks of contracting a condition (Rosenstock, 1974). Individuals who feel that a given health problem is

more likely to afflict them tend to act on a desired health behavior (Kim & Nan, 2015). Second, perceived severity concerns the extent to which an individual considers a disease, or its consequences seriously affect him or her (Kim & Nan, 2015). This dimension includes evaluations of both medical/clinical consequences (e.g., death, disability, and pain) and possible social consequences (e.g., effects of the conditions on work, family life, and social relations) (Janz & Becker, 1984). Greater perceived severity of the health problem tends to result in stronger motivation to adopt the recommended health behavior.

Once a person is convinced of the severity of a given health threat, then his or her susceptibility should be addressed. In other words, if the health threat is deemed as trivial, the individual will not be further motivated to make an assessment of his or her susceptibility (Krieger & Sarge, 2013). Severity perceptions induced by a risk message turn into susceptibility perceptions that in turn impact behavior or behavioral intention outcomes (Krieger & Sarge, 2013).

Acceptance of one's susceptibility to a disease that is also believed to be serious was thought to provide a force leading to action, but not defining the particular course of action that was likely to be taken. This may not be the logical or recommended behavior. Again, the person's beliefs about the availability and effectiveness of various courses of action, and not the objective facts about the effectiveness of action, determine what course he will take. These personal beliefs of perceived susceptibility and severity having a strong cognitive component are at least partly dependent on knowledge (Rosenstock, 1974).

At times, the concept of risk is used similarly as the term threat in the literature. Here, the basic assumption often is that a heightened level of risk perception should lead to more

protective behaviors. People's perception of health risks influences their risk-taking or safety behavior is prevalent both in health behavior theories and applied health communication. (Gaube, Lermer, and Fischer, 2019).

Perceived Benefits and Barriers

Perceived benefits concern the benefits obtained by complying with the target behavior, often operationalized as perceived efficacy or effectiveness of the recommended behavior. Greater perceived efficacy or effectiveness will yield a greater probability of behavioral adoption. Perceived barriers concern the barriers individuals face to adopt the desired behavior, including monetary cost, psychological cost (e.g., inconvenience of visiting a doctor), or physical cost (e.g., serious side effects associated with vaccines) (Jenz & Becker, 2014).

Self-efficacy

Self-efficacy is the belief that one can successfully complete the behavior of interest despite considered barriers (Jones et al., 2014). Based originally in Bandura's Social Cognitive Theory (SCT), the higher a person's level of efficacy, the more he or she will expect positive outcomes to occur after performing the behavior (i.e., positive outcome expectancies), which in turn should motivate the person to enact the behavior (Bandura, 2004; Wong, 2014). The practical implication of this finding then is that interventions could be designed to increase young women's perceptions of self-efficacy in talking to their doctors/parents about the HPV vaccine, particularly how to approach this sensitive topic when discussing it with parents (Wong, 2014). The finding of efficacy as a central predictor of information-seeking intent speaks to the importance of developing interventions aimed at increasing young women's skills to effectively talk to their doctors about the HPV vaccine (Wong, 2014).

Cues to Action

The combined levels of susceptibility and severity provided the energy or force to act and the perception of benefits (less barriers) provided a preferred path of action. However, it is also felt that some stimulus was necessary (Janz & Becker, 1984). Cues to action refer to internal or external triggers that instigate behavior, and self-efficacy refers to belief in one's ability to execute a health behavior (Rosenstock, 1974). Cues to action can also be an instigating event occurred to set the process of an action or behavior in motion. Specific cues, such as factors in one's environment, can impact the final action one takes (Champion & Skinner, 2008). These cues to action can be internal or external, ranging from experiencing symptoms of an illness to a health care providers recommendation.

Rosenstock (1974), who created the HBM, spoke of the value of cues to action, but the unfortunate difficulty in isolating them as a cause of behavior. Those who have taken a recommended action in the past will probably be more likely to remember preceding events as relevant than will respondents who were exposed to the same events but never took the action. These problems make testing the role of cues most difficult in any retrospective setting.

Health Belief Model (HBM) Applied to Attitude and Vaccine Decision

Research exists using constructs of HBM when examining college student HPV knowledge, attitude, and vaccine decision. Sledge (2015) found in a review of the literature a limited number of studies used selected constructs of the HBM model to understand the relation to HPV and HPV vaccination. The HBM has been used extensively to study other types of vaccination beliefs and behaviors and has also been used in vaccination research to identify patients' perceptions of disease and vaccination (Donadiki et al., 2014). The HBM can also be

used to explain which beliefs should be targeted in communication campaigns to cause positive health behaviors (Carpenter, 2010, Thomas, Dalmida, and Higgins, 2016).

HBM indicates the decision to vaccinate is a balance between the perceived risk of disease severity including its health and social consequences as well as the benefits/harms of vaccination (Harper et al., 2014). Studies also expand on the HBM, including additional variables of interest such as intention and personal values. Susceptibility and self-efficacy have been positively related to their intention to talk to a health care provider (Katz et al., 2012). Women with a clear sense of what their personal value of HPV vaccination was (accept/reject) were highly satisfied with their decision (Harper et al., 2014). Intention has been positively associated with their likelihood of obtaining the HPV vaccine (Katz et al., 2012). Catalano et al. examined expectations, HPV knowledge, self-efficacy to get the HPV vaccine, situational perception, self-control to get the HPV vaccine, and self-efficacy in overcoming barriers to get the HPV (2017).

HBM suggests that a person will take part in a health-promoting behavior if that behavior's benefits outweigh the consequences of that behavior (Burke et al., 2010). Studies oriented to the HBM have identified that, if HPV is not evaluated as a risk to personal health, it is less likely that individuals will take actions to protect themselves (George, et al., 2020). The HBM leads us to conclude that females are most likely to acquire the HPV vaccination if the perceived threat of HPV and the benefits of the vaccination are high while there are few perceived barriers (Burke et al., 2010). Greater perceived barriers to HPV vaccination and fewer perceived benefits of vaccination have been associated with non-receipt of the HPV vaccine among female college students (Donadiki et al., 2014). Self-efficacy increases intentions of

female students to talk to their doctors about the HPV vaccine by increasing response efficacy, unless perceptions of both susceptibility and severity are relatively high (Krieger & Sarge, 2013).

As the HBM predicts, believing that HPV/HPV-related diseases are serious conditions increases the likelihood that an individual intends to get the vaccine; believing that the HPV vaccine is effective also increases individuals' intent to receive the vaccine (MacArthur, 2017). As the HBM indicates, health beliefs are direct and proximate correlates of HPV intentions (MacArthur, 2017). The more women perceive themselves susceptibility to cervical cancer, the more likely they are to engage in screening seeking behaviors (Wolwa et al., 2013). Women who perceived the benefit of screening and believed cervical cancer could be prevented were more likely to have a Pap test, but not necessarily the vaccine (Wolwa et al., 2013). Sledge (2015) found perceived barriers of HPV vaccination were a unique predictor of intention to receive the HPV vaccination. Although a young man may fully understand the benefit of the HPV vaccine, if he perceives the barriers to getting the vaccination to be great, then the chances that he will receive it are decreased.

Grace-Leitch and Shneyderman (2016) believe HBM constructs offer some explanations for why rates of HPV vaccine initiation and completion tend to be low, although rates of acceptability and vaccine intention have been high among college males. In their study, perceived susceptibility was positively associated with vaccine acceptability. Thus, those participants who thought they were more susceptible found getting the HPV vaccine more acceptable (Grace-Leitch & Shneyderman, 2016). Those who did not deem themselves at risk did not intend to vaccinate. Steggers, Mann, and Maki (2012) used the HBM to understand male perceptions of HPV. The lack of perceived susceptibility and severity of HPV for men were a barrier to getting vaccinated. Their participating males did not feel they needed to get vaccinated.

While benefits were acknowledged, like protecting partner health, the males were still hesitant to vaccinate. The barriers mentioned were time, cost, and perceived side effects (Steggers, Mann, and Maki, 2012). College-aged males must first determine their personal risk of HPV infection. This perceived threat may be influenced by personal beliefs, previous behaviors, and practices related to sexual behavior (such as multiple sexual partners, use of condoms, and preexisting HPV knowledge) (McCutcheon et al., 2017).

Christy et al. (2016) found women's HPV vaccine intentions were positively related to perceived risk of developing genital warts or an HPV-related cancer, perceived benefits with respect to genital warts and cancer risk reduction, and anticipated regret if one were unvaccinated and later developed genital warts. Higher levels of HPV knowledge and a subsequent increase in perceived risk of becoming HPV-infected also lead to higher levels of intention to receive the vaccine especially in women (Jones & Cook, 2008). Grace-Leitch and Shneyderman (2016) surveyed 120 male students. With this group, HPV vaccine acceptability proved quite high, and perceived susceptibility to HPV, as well as self-efficacy as it pertains to communication with a sexual partner about contraceptives, were both found to be significantly associated with vaccine acceptability. Jones and Cook (2008) also found higher perceived risk of getting HPV was associated with both men and women intending to receive the vaccine.

Contradictions Within Applications of Health Belief Model

Several studies use the specific HBM constructs of susceptibility, severity, and threat (or risk). The paradox in the literature is that the model shows predictive behavior when threat is high for some studies, and for others, it does not. High levels of perceived threat and/or risk of

HPV infection do not impact reported intention to vaccinate, contrary to the model's prediction. Examples of these contradictions in the literature follow.

Even when perceived self-efficacy and response efficacy were high, increasing levels of severity when susceptibility was high *decreased* intentions to talk to a physician about the HPV vaccine (Krieger & Sarge, 2013). That is, if a college-age female perceives herself to be highly susceptible to HPV and perceives HPV to be rather severe (Krieger & Sarge, 2013), theoretically, she would respond towards communication, information seeking, or vaccination. Krieger and Sarge (2013) note that very high levels of threat may *not* result in adaptive behavior regardless of efficacy. It is concerning that many women appear decisionally neutral towards the vaccine (Harper et al., 2014).

Knowledge and attitudes toward the vaccine were not directly associated with the outcomes of vaccination status and intention (Ratansiripong, 2015). Knowledge may impact perceptions of severity and susceptibility. Women surveyed by Thompson et al. (2017) "…were cognizant of the potential change in risk for HPV based on changing relationships, these were not motivating factors when the women evaluated their potential risk for HPV. In other words, women were evaluating their current risk for HPV; rather than recognizing the potential for that risk to change in the future (Thompson et al., 2017).

Krieger and Sarge's (2013) findings contradict HBM predictions. Even when perceived self-efficacy and response efficacy were high, increasing levels of severity when susceptibility was high *decreased* intentions to talk to a physician about the HPV vaccine. That is, if a college-age female perceives herself to be highly susceptible to HPV and perceives HPV to be rather severe (Krieger & Sarge, 2013), theoretically, she would respond towards communication,

information seeking, or vaccination. Krieger and Sarge (2013) note that very high levels of threat may *not* result in adaptive behavior regardless of efficacy. Self-efficacy increases intentions of female students to talk to their doctors about the HPV vaccine by increasing response efficacy, unless perceptions of both susceptibility and severity are relatively high (Krieger and Sarge, 2013). Once a person is convinced of the severity of a given health threat, then his or her susceptibility should be addressed. In other words, if the health threat is deemed as trivial, the individual will not be further motivated to make an assessment of his or her susceptibility (Krieger & Sarge, 2013). Severity perceptions induced by a risk message should turn into susceptibility perceptions that in turn impact behavior or behavioral intention outcomes (Krieger & Sarge, 2013).

Navalpakam, Dany, and Hussein (2016) found the majority of the participants agreed that the HPV infection is a serious and life threatening (79%); however, 50% of the participants did not believe that they themselves were at a risk of contracting HPV. In a study by Christi et al. (2016) of 233 unvaccinated students, neither HBM variables, nor prior awareness of the HPV vaccine, were associated with male or female vaccine intentions. Among women, only perceived benefits with respect to cancer risk reduction showed consistent associations with HPV vaccine intentions (Christi et al., 2016). Among women, perceived severity of HPV-related diseases was consistently unrelated to HPV vaccine intentions, as found in prior research (Christi et al., 2016, Donadiki et al., 2014).

Perceived threat and actual risk may not align. In a study of 214 students, ethnicity, history of sexual activity, and number of sexual partners were not associated with receiving or planning to receive the HPV vaccine (Schmotzer et al., 2013). Ratanasiripong (2012) also found

a history of having vaginal sex, unprotected sex with a casual partner, and numbers of sexual partners were not associated with vaccination status.

Higher uptake of HPV vaccine in those reporting a history of sexual activity may indicate that perceived risk of this sexually transmitted virus may be a particularly important motivator to receive the vaccine (Bednarczyck et al., 2011). However, for Jones and Cook's (2008) study, vaccine acceptance was not significantly associated with age, race, recruitment setting, ever having HPV or genital warts, or perceived severity of HPV. Unvaccinated single women perceived themselves at zero risk for HPV, which was attributed to lack of sexual activity (Thompson et al., 2017). Perceived severity of HPV infection or cervical cancer has not emerged as a correlate of vaccine acceptability in women (Gerend & Barely, 2009).

Criticisms of Applied Health Belief Model

The literature includes constructs of health behavior theories, yet there is no consensus on which constructs are predictive of vaccine uptake and decision making. The implications are that other models may better understand vaccine decision making and intention. Combinations of variables are therefore more evident in the literature, with incorporation of constructs from various theories. Glanz and Bishop (2012) believe researchers may pick and choose variables from different theories in a way that makes it difficult to ascertain the role of theory in intervention development and evaluation. The HBM does not specify how constructs of the model interact with one another. Therefore, different operationalizations of the theoretical constructs may not be strictly comparable across studies (Ulrich, N.D.)

Criticisms of the HBM are that self-efficacy is rarely included in HBM studies and the variables are hierarchically situated so that some moderate the meditational influence of others

(Jones, et al., 2014). Other studies have shown that the HBM is not sufficient to predict behavior. There was a weak relationship between subjects' estimate of how severe a given negative health outcome would be and their likelihood of adopting the target behavior. Additionally, the relationship between susceptibility beliefs and behavior was near zero (Jones, et al., 2014).

The HBM alone may not be the ideal theoretical framework for understanding vaccine decision making. Glanz and Bishop (2012) offer compelling insight in applying any theory to research. The strongest interventions may be built from multiple theories and there is no substitute for knowing the audience. Others suggest using constructs of several theories to best explain vaccine behaviors (Jozkowskia & Geshnizjani, 2016). Examples of other theories include The Reasoned Action Approach (RAA), the most recent formulation of the Theory of Reasoned Action, the Theory of Planned Behavior (TPB) and the Integrated Model (Fishbein & Ajzen, 2010).

According to the RAA, a woman's intention to engage in a behavior depends on her attitude towards the behavior, her perceptions of the norms of important individuals and similar others (i.e., perceived norms) and her perceived behavioral control (Jozkowski and Geshnizjani, 2016). The TPB model is highly predictive of human action. Specifically, the TPB posits that attitude, subjective norm, and perceived behavioral control influence behavioral intention, and subsequently, behavior (Catalano et al., 2017). TPB posits that intention is the main precursor to health behavior. TPB claims that attitude (the degree to which a person has a favorable or unfavorable evaluation of the behavior), subjective norm (normative influences; the perceived social pressure to perform or not perform the behavior) and perceived behavioral control (PBC; the perceived ease or difficulty of performing the behavior of interest) predict intention (Juraskova et al., 2012). A person's behavior is determined by their intention to perform the

behavior and that this intention is, in turn, a function of their attitude toward the behavior (Patel et al., 2012).

An alternative theory is The Consideration of Future Consequences (CFC), a concept coined by Strathman and colleagues (1994), is defined as ‘‘the extent to which individuals consider the potential distant outcomes of their current behaviors and the extent to which they are influenced by these potential outcomes’’ (Kim & Nan, 2015). Individuals with high CFC are more likely to adopt preventive health behaviors than are those with low CFC (Kim & Nan, 2015). Theories in risk communication address the formation of risk perception, such as the protection motivation theory (Neuwirth, Dunwoody, & Griffin, 2000) or the risk information seeking and processing model (Nan et al., 2015).

Rationale for Proposed Study

Healthy Campus 2020 provides a framework for improving the overall health status on campuses nationwide. Included in their objectives are to increase the proportion of students who report receiving human papillomavirus/HPV vaccine (American College Health Association, 2019). Yet, there exists a significant gap in vaccine coverage of the human papillomavirus (HPV) among college-aged students (Rohde et al., 2018) that has not been explained.

These gender gaps also exist in knowledge, although inconsistencies in the literature support the belief that knowledge is not directly linked to behaviors (Ajzen, 1991). Thus, raising knowledge or awareness regarding the vaccine may not adequately promote uptake (Christy et al., 2016). Given the main outcome of interest is HPV vaccine uptake, it is important to understand why college students’ perceptions of susceptibility and severity and subsequent threat are not leading to higher uptake rates.

A body of evidence shows a physician's recommendation may significantly influence the vaccination decision (Daley, Liddon, Kempe, et al. 2006; Dillard & Spear, 2010; McRee, Gilkey, and Dempsey 2014; Jones & Cook 2008). They have a role in not only helping patients make an informed decision about starting the HPV vaccine, but encouraging completion of the entire series (Head, Vanderpool, & Mills, 2013). Despite calls to action by the National Foundation of Infectious Diseases (2014), there are no practice guidelines on how health professionals should communicate to young adult women or men about the HPV vaccine. Provider communication may act as a cue to action that permits women to realize actual risk for HPV and facilitate the vaccination process (Thompson et al., 2017). However, there is little or no literature that captures the messages health providers give to college students. This study was intended to memorialize themes present in provider communication to both female and male college students regarding HPV information and vaccine need.

This study sought to understand college student HPV and HPV vaccine knowledge, vaccine status, and messages received from their health care provider. Specifically, what was the level of perceived personal risk of HPV infection and related outcomes? Given the greater awareness of the vaccine among women relative to men and previously documented gender differences in behaviors related to disease prevention (Christy et al., 2016); this study sought to understand if gender differences would be found in HPV and HPV vaccine knowledge scores and vaccine initiation and completion status.

CHAPTER III

METHODOLOGY

Research Design

This study collected primary data from a self-administered survey questionnaire distributed to undergraduate college students at Oklahoma State University (OSU). A quantitative survey was be used to evaluate student knowledge. Qualitative questions were included to gather student perspectives on provider influence on HPV vaccine decision and provider information sharing about HPV. The project was submitted to OSU's Institutional Review Board (IRB) and approved. The data collection window was for one month post IRB approval.

OSU's Institutional Research Analytics (IRA) system provided 5,000 student emails based on inclusion criteria of being a currently enrolled student between the ages of 18-24. Of the 5,000 total emails, 3,000 emails were sent to male students and 2,000 were sent to female students. Four of these emails were undeliverable. A recruitment email was sent with consent and link to a web-based, self-administered questionnaire using a Qualtrics online survey tool (http://www.qualtrics.com/). Emails were distributed via the OSU system in effort to be positively received by students as a recognized email domain. The OSU IRB recommended social distancing options for data collection; a self-administered online questionnaire was appropriate to ensure student safety.

The data collection window was for one-month post IRB approval aiming to reach the desired participant sample size (n=500). A reminder email was sent 2 weeks after the initial email to prompt non-respondents. IRB approval was received to distribute only one reminder email. Using data collection by Qualtrics was strategic in this study to provide tracking and recording of results. Features in Qualtrics survey tool allowed for exporting of results to SPSS software. The Qualtrics survey was created to align with these features.

Participants

Study participants were 254 currently enrolled female and male undergraduate students at OSU that were between 18 and 24 years old. Respondents were primarily white/Caucasian (n=188; 76.7%) female (n=167; 68.2%) students from suburban (n=134; 57.7%) and rural areas (n=69; 28.2%) during their adolescence. Per CDC and ACIP recommendations, college students in this age range have been vaccine eligible, are within range to still receive the vaccine, and health providers have been encouraged to make recommendations to this population (President's Cancer Panel, 2018). Any level of undergraduate enrollment status was eligible. To ensure eligibility, the survey included an early eligibility question and answer prompt to prevent survey completion if the student was not 18-24 years old at time of survey distribution. A full graphic of gender, race/ethnicity, place of residency as an adolescent, and undergraduate status is presented in Table 1.

Compensation for Participation

Participants were able to choose to enter a drawing for Amazon gift card lottery drawing. Two hundred dollars were distributed randomly, the amounts given were 1:$50, 2:$25, 10:$10. To be eligible to receive the lottery prize, students needed to provide their OSU email address when prompted at end of survey completion. Odds of receiving a gift card were dependent on the

total number of respondents that opted in for the drawing. Some participants did not receive compensation. Electronic gift cards were distributed two weeks after data collection ended.

Survey Instrument

After consent, the following demographics were collected at the beginning of the survey: age, gender, race/ethnicity, hometown at adolescence, and undergraduate college level classification. Students were asked in a close-ended question 'What is your HPV (Human Papillomavirus) vaccine status?' Answer choices were partially vaccinated (some doses), fully vaccinated (all doses), not all vaccinated, or unsure. The instrument included qualitative exploratory open ended response questions and a then group of HPV knowledge statements for which students could indicate true, false, or I don't know. The study included two questions regarding student perceived risk of contracting HPV.

Exploratory questions. There were two exploratory qualitative questions to gather what communication messages were received from health care providers that influenced respondents' decisions to vaccinate or not vaccinate. All respondents were asked to recall provider communications received. Open ended questions allowed students to respond with their answers to two exploratory questions: (a) What information has a health care provider given you about HPV? (b) How did the health care provider influence your decision about HPV vaccination?

Student perceived risk and HPV knowledge. Respondent perceived risk was assessed by asking for a comparative judgment: "Compared to other people my age, I think that my chance of getting HPV is…" much below average, below average, average, above average, much above average. This format has been used and adapted in previous studies (Marlow, Waller, and Wardel, 2009; Nadarzynski, Waller, Rob, and Marlow, 2012). Respondents were then asked an open ended question: "What factors influence your chance of getting HPV?"

Waller, Ostini, Marlow, McCaffery, and Zimet (2011), developed and validated their HPV Knowledge Survey, a 29-item scale measuring knowledge of HPV, HPV testing, and HPV vaccination based on previous literature and expert consultations. At the time, Waller et al. (2011) observed in HPV research there had been a tendency for each study to develop a new measure of knowledge, with minimal psychometric evaluation. Their instrument was found to have good internal consistency (α=0.849) and test–retest reliability (test–retest=0.62 and 0.69) in an internet-based study of 2409 adults internationally. Total scale reliability was α=0.838.

General HPV knowledge questions were grouped: 1) health consequences of HPV; 2) HPV and cervical screening; 3) symptoms; 4) causes, risk factors and transmission; 5) prevention and treatment; 6) prevalence; and 7) testing/vaccination. Refer to Appendix 1: Knowledge Instrument. Twenty-six knowledge questions from the Waller et al. (2011) instrument were used in this current study. Respondents could answer true, false, or don't know to the items. Question 'The HPV vaccine requires three doses' was not used from the original instrument, as dosing protocols have changed over the generations of vaccines. There were 16 'true' answers and 10 'false' answers. The knowledge score was determined by the number of total correct answers provided. The higher the number of correct answers provided, the higher the knowledge score; and similarly, the lower the number of correct answers, the lower the knowledge score.

Data Analysis

Statistical Package for the Social Sciences software (SPSS) was used to analyze quantitative data collected in this study. Descriptive statistics were used to present student demographics and vaccine status. Scores for knowledge were generated. An independent samples T-tests was used to compare student knowledge scores by gender. Chi-square tests were used to compare student perceived risk by gender and student perceived risk by vaccine status. An ANOVA was performed to compare knowledge scores by vaccination status.

After answering demographics and background questions, 157 respondents answered one or more of the qualitative exploratory questions and completed the knowledge questions; these written responses were analyzed. Responses were saved in an excel file format, for each of the three exploratory questions. For each question, responses were then read and individually coded by themes adding new codes as needed. For the question ‘What factors influence your chance of getting HPV? apriori themes were created based on the literature HPV vaccine benefits, risk of HPV disease, cancer prevention, recommendation of provider. The excel file was used to organize and track findings of the common themes/codes. Findings by theme were then reported with selected representative quotes to illustrate participant responses and capture diversity of respondent responses (World Health Organization (WHO), 2018).

CHAPTER IV

FINDINGS

This chapter presents results from the analysis of data. There are four sections of results that align with the study research questions: student HPV vaccine status, HPV knowledge scores, student perception of risk, and how health care provider communication to college students influenced the vaccine decision (including what information was shared).

HPV Vaccination Status

Students were asked to report their vaccination status. Eleven students (4.5%) reported they were partially vaccinated; these students were combined with the fully vaccinated group (n=129; 52.7%) for all analyses and are designated as fully/partially vaccinated here forward. Vaccination status categories were 'unsure if vaccinated' (n = 78; 32%), 'not at all vaccinated' (n=26; 10.7%), and 'fully/partially vaccinated' (n=140; 57.4%). It was hypothesized that female students would have higher HPV vaccine initiation and completion than male students. The vaccine rates by gender were 'unsure if vaccinated' (female n = 51; 20.9%; male n = 27; 11.1%), 'not at all vaccinated' (female n=17; 7%), male (n=9; 3.7%), 'fully/partially vaccinated' (female n=99; 40.6%; male n=41;16.8%). To determine if vaccination status varied by gender, a chi-square test of independence was run. Prior to analysis, one participant was removed from the sample as they indicated being transgender. The hypothesis was not supported by the chi-square test; there was no significant difference by gender [$X^2(2, N= 244) =.785, p =.675$]. (See Table 2).

HPV Vaccine Recommendation Status

Students were asked if a health care provider had ever recommended an HPV vaccine to them. Over half of the students indicated they had received a recommendation (n=142; 58%). To determine if provider HPV vaccine recommendations were different by gender a chi-square test of independence was performed. The patterns of provider recommendation were significantly different by gender [$X^2(1, N= 242) =4.563, p =.033$]. The pattern among students receiving provider recommendations was higher for females (n=61; 63.3%) than males (n=39; 48.7%).

To determine if provider recommendations differed by student residence at adolescence, a chi-square test of independence was performed. Prior to analysis, the categories of urban and extra-large city were combined. Categories for hometown were suburban (n=134; 57.7%) rural (n=69; 28.2%) , urban (n=42; 17.1%). There were no significant differences in recommendations by where students reported they were raised [$X^2(2, N= 243) =9.69, p =.616$].

HPV Knowledge Scores

Total knowledge scores were calculated by sum of total correct answers provided, the possible range 0 to 25. Participants who had incomplete or missing answers were not included in calculations or analysis. The overall mean score was 12.2 (SD=6.14); and the mean score was slightly higher for females (M=12.5; SD=5.94) compared to males (M=11.4; SD= 6.65). Only twenty students had a total score of twenty or greater, one student got all items correct.

Table 8 presents percentages of correct individual knowledge items for comparison. Upon review of each knowledge statement, differences in content knowledge exist. Overall, students scored highest on the knowledge statements that related HPV to sexual behaviors: Having many sexual partners increases the risk of getting HPV (84.4%), HPV can be passed on during sexual intercourse (81.1%), and Using condoms reduces the risk of getting HPV (72.8%).

However, these high scores were not consistent for all statements related to sexual behaviors. For example, only 54.4% correctly knew HPV can be passed on by genital skin-to-skin contact.

For thirteen of the twenty-five questions, students had the lowest percent correct (below 41.9%). Students knew least about HPV screening and testing, total percent of correct answers for three of these statements ranged from 10.7% to 15.2%, (i.e. HPV usually doesn't need any treatment; When you have an HPV test, you get the results the same day; If HPV test shows…woman does not have HPV, her risk of cervical cancer is low). Students did not score well on the statement: Most sexually active people will get HPV at some point in their lives (25.4% correct). Students scored low on statements related to the benefits and timing of the vaccine, only 24.7% scored correctly for both of these items: HPV vaccines are most effective if given to people who have never had sex and HPV vaccines offer protection against most cervical cancers.

An independent samples T-test was used to determine if total knowledge scores were significantly different by gender. It was hypothesized that females would have higher knowledge scores than males. However, this was not supported by the T-test analysis. There was no significant effect for gender [$t(177) = 2.214$, $p = .139$]. Additionally, a one-way ANOVA was used to examine whether where students were raised (e.g., suburban, rural, urban) impacted total knowledge scores. There was no significant difference at the $p < .05$ level for the three conditions [$F(2,177) = .973$, $p = .380$].

It was predicted that there would be differences in HPV knowledge scores according to vaccine status; this was supported. A one-way ANOVA was used to analyze the effect of vaccination status on total knowledge scores. There was a significant effect of vaccination status on total knowledge scores at the $p < .05$ level [$F(2,177) = 4.495$, $p = .012$]. (See Table 4). Post hoc

comparisons using the Tukey HSD test indicated that the mean total knowledge scores were significantly higher for both the fully/partially vaccinated (M=12.86) and not at all vaccinated (M=13.7) compared to the unsure group (M=10.11).

Student Perceived Risk of HPV Infection

Participants were asked to self-report their perceived risk of contracting HPV using five response choices: much above average (n=1; .5%), above average (n=5; 2.6%), average (n=52; 27.1%), (below average (n=57; 29.7%), and much below average (n=77; 40.1%). There were not sufficient responses for the much above average and above average categories; therefore, these categories were added to the average category. Three categories were used for analysis: average (n=52; 28%), below average (n=57; 30.6%), and much below average (n=77; 41.4%). It was hypothesized that students who had started the vaccine or completed the vaccine series would have lower perceived risk of infection than those not vaccinated. This was supported in the analysis. A chi-square test of independence was performed to examine student perceived risk and their vaccine status. There was a significant vaccine pattern across student perceived risk [X^2 (4, N=186) =10.164, p = .038]. (See Table 3). Fully/partially vaccinated students were more likely to report their perceived risk as much below average (n=50; 48.1%) or below average (n=30; 31.7%) compared to the students who are unsure of their vaccination status (n=17, 28.8%). Students who were unsure of their vaccine status were more likely to view their risk as average (n=25, 42.4%) compared to the fully vaccinated/partially vaccinated (n=21, 20.2%) and not at all vaccinated students (n=6, 26.1%).

Two separate chi-square tests of independence were performed to see if there were differences in perceived risk by gender or race/ethnicity. There were no significant differences in level of risk perception by gender [X^2 (2, N=185) =3.846, p = .146]. Race/ethnic group

classification was reported by students. The respondents were mostly white/Caucasian (n=188; 76.7%). The other categories were combined into one minority category due to the low number of responses within each of the separated categories: American Indian (n=15; 6.15), Asian (n=12; 4.9%), Black/African American (n=6; 2.4%), Hispanic (n=17; 6.9%), Native Hawaiian or Pacific Islander (n=1; .4%), Bi-racial (n=6; 2.4%). For data analysis, the white and minority categories were compared, there were no significant differences in level of risk perception by race/ethnicity [$X^2(2, N=186) = 2.750, p = .253$].

Health Care Provider Communication About HPV

A focal point of this study was to collect college student perspectives on how HPV and HPV vaccination is communicated by health care providers to them. The survey instrument contained three sections (demographics, knowledge quiz, and exploratory questions); 157 students completed all three sections. The analyses presented below include only complete student responses (i.e., students who completed all three sections of the survey). Findings for the three open ended questions were separately transcribed, and responses were coded by themes. This provided an overview of the student responses. Each line of transcribed student response was coded manually for each question.

Information sharing about HPV and HPV vaccination. Students were asked what types of information their health care provider had shared about HPV or the HPV vaccine. Table 5 provides a summary of these results. Upon review of the responses, there appears a strong separation between students who did not recall provider communications (n=63; 41.7%) and those who had spoken to their provider about HPV (or the HPV vaccine) (n=77; 51%) . For students who recalled a provider conversation, they received vaccine recommendations presented

with HPV education. A small group indicated they were vaccinated when younger, therefore the provider addressed conversations to the parent, not to them.

Most student (female n = 41, male n = 22) responses included having not received any information from a provider. Students answered, *"I do not know"*, *"I do not remember*", or they had no provider conversations about HPV. One student recalled, "*Nothing. I've never had a health care provider tell me about HPV*." Similarly, another said, "*I have not received any information about it.*" Some students stated they do not know what HPV is: "*I haven't even heard of HPV before this survey*." Similarly, a student said, "*I have heard nothing and am actually unsure of what it is.*"

For students recalling provider communications, there were specific educational messages and information sharing related to the nature of HPV and that a preventative vaccine was available. Many students (female n=44, male n=5) stated their provider spoke of prevention, or specific prevention of cervical cancer with one participant indicating, "*that it is good for both men and women to get. The FDA recommends it. It is effective in preventing HPV which can lead to cervical cancer.*"

Additionally, some students (female n=15, male n=7) received a specific provider recommendation for the HPV shot with information, such as receiving a pamphlet or that HPV was a sexually transmitted infection, such as "*this vaccine prevents one of the most common forms of STIs and is important to get".* Another student stated, "*They gave me paperwork that talked about the benefits of having the HPV vaccine. Mainly they emphasized how it won't necessarily harm me, but I could harm a future girlfriend for a partner in the future without it."*

A small group of 11 students (female n=11, male n=2) stated the communication was directed towards their parents when they were younger and explained that is why they do not

know about HPV. An example of this mindset is, "*my mom was who they talked to at the time of the vaccine, so I have no idea what it's about*."

Another group of students indicated they do not know what HPV is, despite having seen a health care provider. For example, one student said, "*I still don't know what HPV is*." There were 6 students (female n=2, male n=4) that recalled receiving a vaccine recommendation, but without any HPV information provided with one student reporting they were told that "*a vaccine will reduce my chance of getting it, although I was never really told exactly what it was."*

Influence on college student HPV vaccination decision making. When asked "how did the health care provider influence your decision about HPV vaccination?" student responses aligned with four distinct experiences: (1) provider approval, (2) not applicable, (3) no influence, and (4) parent made decision.

A group of 30 students (female n=19, male n=11) indicated the provider had not influenced them. This set of responses also included statements such as "*none*" or "*N/A*". Reviewing the data set closer, none of these 30 students had received a provider recommendation for the vaccine, which provides context for their open-ended responses. Twenty-six students (19 female, 7 male) stated their provider "*didn't influence me*" or that their provider "*didn't bring it up*." Of these students, 18 had not received a vaccine recommendation and four students (female n=1, male n=3) stated they did not get the shot.

Most students (female n=41, male n=12) relayed confidence in receiving a provider recommendation for the vaccine. The narratives implied they had made vaccine decisions based on provider communications directed towards them. For example, one student said, "*a big influence, would never have known about the risks otherwise.*" The favorable approval of the provider for the vaccine was a salient theme. One student recalled, the provider "*... influenced*

my decision because he is an expert regarding health." Students in this group also provided examples of education messaging partnered with the vaccine recommendation that favorably influenced them. An example of this provider recommendation with information shared is within this student quote: "*they recommended I receive it to protect myself against cervical cancer*." Table 6 provides a summary of these responses.

Another theme from the student responses was that parents were the vaccine decision maker. Most of these 21 (female n=17, male n=4) students indicated they had received the vaccine when they were young. They stated their mother was the primary information source or decision maker: "*I didn't decide my mom did*." Another student recalled, "*He* [referring to her provider] *didn't influence my opinion either way. My mother influenced me to get it*."

Perspectives on factors that influence contracting HPV. Participants were asked, "What factors influence your chance of getting HPV?" The responses were coded for thematic analysis. A group of students clearly stated that "*I do not know*" (n=22; 16.7%). Another small group provided erroneous answers or had mis-read the question prompt. Among the rest, multiple different perspectives were voiced; some answered by broadly identifying risk factors and others took a more personal approach by relating the question to their own behaviors. Participant responses were coded using both apriori and emergent themes. Apriori themes for organizing student answers included risk factors, specifically related to being sexually active, and engaging in sexual behaviors and protective factors, such as having the vaccine or being a virgin (or celibate). These thematic categories used to organize student responses into two overarching themes: risk factors and protective factors.

An expected overarching theme relating to HPV risk factors was engaging in risky sexual behaviors. Eighteen (female n=13, male n=5) stated unprotected sex is associated with HPV.

One student offered, "*If you don't have the vaccine and have unprotected sex with a lot of people*." Fifty-three (female n=39, male n=14) stated number of partners and engaging in sexual activity. "*If I go sleeping around with multiple people and one of them carry the virus but I don't do that so my chance of getting it is low*."

Students identified protective factors related to vaccine status or relationship status. Students specifically emphasized either abstinence or monogamy as important. Twenty-seven (female n=19, male n=8) provided answers related to celibacy, not engaging in any sexual activity, or being a virgin lowered their potential HPV risk. One student illustrated the latter response by saying:

> "*I am not sexually active, nor have been, nor will be until I get/ if I get married. I will only have sex with that one man... therefore there is a slim to none chance of me ever getting it."*

Fourteen students (female n=11, male n=3) related low risk of HPV to being monogamous and faithful to their partner. Most of these students identified as being in a committed relationship with only one partner as illustrated by this student response, "*I currently would not consider myself at high risk for getting HPV because I am in a long-term, monogamous relationship with a woman."*

A small group 15 (female n=12, male n=3) identified the HPV vaccine as a protective factor. It was anticipated that students would associate their own vaccine status with their risk, or mention the vaccine as lowering one's risk.

There were 17 erroneous answers that were grouped together by responses that implied lack of HPV knowledge and risk misperceptions about contracting HPV. One student said, "*I know condoms don't prevent it*" while another said, "*I work in a higher risk environment*

delivering to people, so I could be at a higher risk to get it." Among these 'unexpected' responses were smoking and family genetics: "*smoking, taking birth control, sexual history, etc.*" and "*I'm assuming that as with a lot of sicknesses genetics could influence it*". An additional six students appear to have misunderstood the question prompt. Curiously, ten of the students that fell in the category of erroneous responses reported they had been fully vaccinated or were partially vaccinated in a previous question.

A group of 22 students (female n=15, male n=7) stated they did not know what influences their chance of getting HPV. One student commented, "*I am not sure as I have never been told*." It was noted that18 of these students had not received a provider recommendation for the vaccine. Furthermore, six students responded "N/A" with three of those students having not received the vaccine. A student said, "*the amount of sex you have? I honestly have no clue about HPV or what causes it.*"

CHAPTER V

CONCLUSION

This study contributed to the limited literature regarding college student HPV knowledge and vaccine decision making. Research questions included (a) What were students' vaccine status? (b) What were students' HPV knowledge scores? (c) What were students' perceived risk of contracting HPV? A critical exploratory component of this study was to understand how health care providers influence student HPV vaccine decision making by asking students about their conversations with their health care providers and what information providers are sharing. This study used a self-administered, web-based quantitative survey with qualitative exploratory questions to arrive at the study aims.

In this study, 58.8% (n=142) of students overall had received a vaccine recommendation, and 57.2% (n=140) had been fully or partially vaccinated. These rates align with the literature that states HPV immunization rates in college students are significantly below the US Department of Health and Human Service's Healthy People 2020 goals of 80% being fully covered (Kellogg et al., 2019). The CDC (2020) continues to report higher uptake and earlier initiation of the series for females than males. The CDC (2020) also reports higher percentages of women who have received one or more dose (53.6%) compared to men (27%). The literature holds a physician recommendation is the strongest predictor of HPV vaccine receipt (Fazekas, Brewer, & Smith, 2008; Kasting, et al., 2016; Kim and Nan 2016; MacArthur, 2017; Rosenthal et al., 2011). In this study, 58.8% (n=142) of students overall had received a vaccine

recommendation, and 57.2% (n=140) had been fully or partially vaccinated. Females (n=105; 63%) were more likely to report they had received a provider recommendation for vaccine than males (n=37; 48.7%) The specific narratives of vaccinated students showed the provider attitude and confidence directed towards the student (or to their parents when they were younger), was a powerful influence for getting the vaccine. One student recalled, the provider "*… influenced my decision because he is an expert regarding health."*

In contrast, there was also a considerable group of students who reported they were unsure of their vaccine status (n=79; 32.2%). There was no difference by gender in these results. Both female and male students reported they were uncertain if they had been vaccinated, and many said they have never received a provider recommendation for the vaccine. Half of the males (n=39; 51.3%) had not received the recommendation (e.g., "*I didn't get one because I can't remember one ever being recommended"*).

These categories of vaccine status will be presented in the discussion below, as they shape the student narratives in these data. It appears the student stories are divided among those who have the vaccine and those who are unsure of their vaccine status. The existing literature is supported in this study's findings which present similar nuances that originally drove this study. The following discussion includes themes of the findings: (a) HPV knowledge is limited, and misinformation exists, (b) students' perception of risk may be underestimated; therefore, students seem to think the vaccine does not apply to them and (c) the health care provider should be a communicator of HPV information and vaccine recommendation.

HPV Knowledge is Limited

This study demonstrated college students do not have thorough knowledge of HPV; instead, students hold many misconceptions and have limited knowledge about the nature of the disease. The literature has been consistent since the introduction of the HPV vaccine in that knowledge scores vary by gender and across *specific questions* related to disease and vaccine (Fontenot et al., 2014; Gao, Okoror, and Hyner, 2016; Jozkowskia and Geshnizjani, 2016; Staggers, Mann, and Maki, 2012). Kellogg et al. (2019) found similar variations in knowledge: there is a lack of more detailed understanding of the virus and its related health conditions, lack of awareness among college students regarding the prevalence of HPV, and their risk of becoming infected with the virus.

The knowledge scores for this study were quite low. Females had slightly higher HPV knowledge scores, but there were no significant differences by gender. Despite 57.4% of students being vaccinated, overall knowledge scores had a mean of 12.16 (of a possible 25). This aligns with some studies in the literature where students' vaccination status was associated with lower HPV knowledge (Schmotzer et al., 2013). In the current study, students who were not vaccinated had slightly higher scores than those who were fully/partially vaccinated. Ratansiripong (2015) found knowledge was not directly associated with the outcomes of vaccination status and intention. In the current study, students that had slightly higher knowledge may have made an informed decision to not be vaccinated. Existing literature is contradictory, some studies show that HPV knowledge and awareness correlate with having received the vaccine, others have shown that knowledge was not correlated with HPV vaccination status (Kellogg et al., 2019). Kellogg et al. (2019) also noted self-perceived or actual level of HPV knowledge did not influence the self-reported immunization status.

Students who were unsure of their vaccine status had the lowest knowledge scores. Kellogg et al. (2019) found one-quarter (23.6%) of the college students in their study did not know their immunization status, demonstrating a lack of communication between the provider and these patients. This concern exists in the current study. Students in the unsure category scored significantly lower and were unable to identify risk factors related to contracting HPV. Health care provider interactions with college students unaware of their vaccination status should provide education and counseling on risk factors related to the disease. Some students may believe the vaccine is only administered to younger individuals (Kellogg et al., 2019), health care providers should explain to college age students they can indeed benefit from the vaccine as this age group is viewed as the 'catch up' opportunity (Boersma & Black, 2020).

Boersma and Black (2020) report in 2018, 18.5% of adults who had ever received one or more doses of HPV vaccine received their first dose of HPV vaccine at age 12 or under, 25.6% at age 13−14, 34.5% at age 15−17, and 21.4% at age 18−26. Given young age of first dose, it is likely that many college students did not directly have educational messaging from their health care provider. Students vaccinated in their youth likely did not receive HPV education, as provider communication was geared toward the parent (e.g., *I was given the vaccination when I was a child, so my parents made the decision. I was not told anything about it that I remember*"; *"I don't remember them telling ME anything, they spoke to my mom and got HER permission"; "It was all done prior to me turning 18"*). Another position is that students who were vaccinated may not have received or remembered HPV related information. In this situation, students may be *aware* of HPV, but lack specific knowledge about it. Several students commented to this last point in the exploratory questions as they were told to get the vaccine but were not given details related to HPV (e.g., *"I still don't know what HPV is"* and *"a vaccine will reduce my chance of*

getting it, although I was never really told exactly what it was"). When asked what information providers had communicated to the students, 41.7% of students stated they received no information from their provider or do not remember (e.g., *Nothing. I've never had a health care provider tell me about HPV*."

Each of the instrument's knowledge statements were examined closer to identify where the gaps in knowledge lie (See Table 8: Knowledge of HPV and HPV Vaccines). Students knew the least about HPV screening methods and methods of HPV treatment. Consistently, student scores related to the five screening and testing statements were less than 37%, four of those were below 24.3%. Of interest, there were no student narratives recalling messages of HPV testing or HPV treatment from their providers. Karymova, Harrison, and Pascal (2019) similarly found students knew the least about HPV screening and testing. College students stand to benefit comprehensive HPV education. The American College of Obstetricians and Gynecologists (ACOG) (2016) recommends comprehensive sexuality education should begin in early childhood and continue through a person's lifespan. It is quite likely that screening and testing was not discussed with students that were vaccinated when younger. Further, it may be that students did not have sexual health education during adolescence, thus explaining low knowledge in several content areas in this study.

Of concern, only 25.4% of students correctly answered 'most sexually active people will get HPV at some point in their lives'. College students have not correctly understood this risk in other studies, where they underestimate risk and do not get this knowledge question correct (Karymova, Harrison, and Pascal, 2019). This is surprising given that 76.1% of participants correctly answered that HPV is not 'very rare'. For these two knowledge statements, students did not appear to see the linkage between how common HPV is and personal susceptibility. This

phenomenon has been cited in the literature, in a study of over 4,000 students, only 18% of respondents believed that they were at risk of acquiring a genital HPV infection in their lifetime (Patel et al., 2013). Previous research previous research with college populations has found a large portion of women who believe themselves to be "not at risk" for HPV actually test positive (Karymova, Harrison, and Pascal, 2019). This is concerning because college students comprise the age groups for females at highest risk for HPV, specifically with 20 to 24-year-old females having the highest prevalence of genital HPV (Thompson et al, 2016). Recall, most people with HPV do not know they are infected (CDC, 2014). According to the Health Belief Model (HBM) low perceived risk for HPV is likely to decrease an individual's willingness to engage in vaccination (Karymova, Harrison, and Pascal, 2019). College health centers could play a key role in raising awareness of how common the disease, and promotion of behaviors to lessen risk.

Students had the greatest understanding of the relationship between HPV and sexual behaviors; but this may be limited to the following specific knowledge statements. 84.4% correctly answered that having many sexual partners increases the risk, and 81.1% knew HPV can be passed during sexual intercourse. 72.8% also knew that condoms reduce the risk of getting HPV. This aligns well with the answers provided in the student narratives. More than half related greater risk of contracting HPV to number of partners, having unprotected sex, and being sexually active (e.g., "*Unprotected sex, sex with multiple partners" and "Sleeping around with a lot of people, especially people you don't know that well").* Some students spoke about their own behaviors and perceived reduced risk: *"If I go sleeping around with multiple people and one of them carry the virus but I don't do that so my chance of getting it is low*."

When asked what information providers conveyed about HPV or the vaccine, only six students specifically described their providers had communicated about transmission through

sexual activity. Just over half (54.4%) knew that 'HPV can be passed on by genital skin-to-skin contact', a finding similar to that of Kellogg et al. (2019). This is quite interesting considering many students correctly answered other questions relating HPV to sexual behaviors. The implications are that students may have different definitions of sexual behaviors and that HPV information comes from multiple sources. Sexual health education historically has been limited to abstinence only messaging with medically accurate messaging varying by definition from state to state and within school districts (ACOG 2016). It is plausible that many students in this study received limited or no sexual health education from a health care provider as an adolescent or their parent. ACOG (2016) reports one third to one half of female adolescents 15 to 19 years old have never discussed sexual related topics such as STIs with their parents. The lack of sexual health conversations would explain weak scores on specific knowledge questions and the contradictions in knowledge that students hold.

This study aligns with the common finding in the HPV literature that college students hold misconceptions about HPV and the vaccine (Albright and Allen, 2018; Schmotzer et al., 2013, Wolwa et al., 2013). The misconceptions were shown by the low percent of students able to identify the false statements within the knowledge scale, and some students' narrative answers the open-ended questions. Students were presented the statement 'HPV can cause HIV/Aids'; only 21.2% correctly identified this statement as false. Similarly, only 14% knew this statement was false: 'when you have an HPV test, you get the results the same day'.

Seventeen students provided erroneous narratives when asked about risk factors related to getting HPV. It is interesting that ten of these students had been fully or partially vaccinated. One student said, *"I'm not sure. I know condoms cannot prevent the spread, so I guess limiting the number of sexual partners you have."* These misconceptions included use of birth control (e.g.,

"*long term use of oral contraceptive (birth control))*", genetics, and smoking. Several students indicated heredity and genetics played a role, "*I'm assuming that as with a lot of sicknesses genetics could influence it*." A small assortment of other misconceptions presented: one student stated, "*I know condoms won't prevent it*." A few students indicated their work environment and exposure to other people at work would impact risk (e.g., "*I work in a higher risk environment delivering to people, so I could be at a higher risk to get it"*).

Some students mentioned their health care provider discussed the vaccine as an avenue to prevent cervical cancer or cancers. However, this seems specific only for those who had received a provider recommendation for the vaccine. Overall, students had varying knowledge related to the purpose or nature of the HPV vaccines with many misunderstandings. Of the knowledge items presented, very few students (24.7%) knew 'HPV vaccines are most effective if given to people who have never had sex' or 'HPV vaccines offer protection against most cervical cancers'. Another knowledge item had surprising results; 43.6% thought the HPV vaccines offer protection against all sexually transmitted infections.

The body of the literature is confounding, where knowledge is assumed to be a driver of vaccine acceptance, many studies indicate knowledge alone is not sufficient to increase uptake (Bennet et al., 2015; Ratansiripong, 2015; Patel et al., 2012). For example, Richman et al. provided educational interventions to increase knowledge, although knowledge was raised, it did not result in vaccine uptake (2016). Except for the linkage between HPV and sexual behaviors, low HPV knowledge scores and misperceptions about the vaccine seem common among all students. This an important consideration moving forward, as student narratives related to sexual activities or the lack thereof, were a salient theme among students discussing their personal perceptions of risk and overall risk factors.

College and university campuses can take lead to initiate discussions about HPV and vaccination (Karymova, Harrison, and Pascal, 2019), from the severity and commonness of the disease, to preventative measures. Sexual health messaging and HPV education can open conversations between students and their health care provider to determine their vaccine status, and whether testing and screening would be beneficial. Ultimately, health care providers should not assume based on vaccination status the extent of a student's HPV knowledge. Instead, they should tailor messaging to each student to close gaps in knowledge and resolve misconceptions that exist.

College Students May Underestimate Their Risk of HPV

There were differences in level of perceived risk of contracting HPV by vaccination status. Interestingly, both fully/partially vaccinated and unvaccinated students largely reported their perceived risk 'much below average' and 'below average'. Students unsure of their vaccine status reported their risk as 'average' most often. Furthermore, students were specifically asked in an open-ended question 'What influences your risk of getting HPV?' The student narratives provided insight to their perceptions of risk. In the literature, perceived severity of HPV infection or cervical cancer has not emerged as a correlate of vaccine acceptability in women (Gerend & Barely, 2009). Students in this study seem to judge their risk perception not on perceived seriousness or severity of HPV as suggested by the Health Belief Model, but on their personal behaviors, which is consistent within the literature (Hopfer & Clippard, 2017; Thompson et al., 2017).

Thompson et al. (2017) found unvaccinated single women perceived themselves at zero risk for HPV, which was attributed to lack of sexual activity. In the current study, many students

reported perceptions of low risk of getting HPV due to not being sexually active, similar to other studies (Bednarczyk et al., 2011, Burke et al., 2010; Thompson et al., 2017)**.** Students in this study also based their risk perception on their relationship status, which is also documented in the literature (Hopfer & Clippard, 2017; Thompson et al., 2017). Thompson et al. (2017) believe that perceptions of risk may not align with vaccine uptake. Studies have shown students possess a "…dismissiveness about susceptibility." (Pitts & Stanley, 2017). Fontenot et al. (2014) found male participants did not believe they were at risk for contracting HPV and therefore did not perceive the need to obtain the vaccine. Students appear to be judging their risk based on current behaviors, rather than thinking of the benefit of the vaccine in the future (as seen in Thompson, et al., 2017).

In this current study, a group of students believe that being monogamous, being a virgin, or not currently being sexually active is protective from HPV (e.g., "*I am not sexually active and my chances as of now are 0%").* None of these students overtly indicated they were intentionally delaying the vaccine, but it appears they believe the vaccine is not necessary for them. Specifically, there seems to be an underlying mindset the vaccine does not apply to them because they are not having sex (e.g., "*I am a virgin and plan on only having one sexual partner*" and "*Well, considering that HPV is an STD, not having sex increased my chances of not getting it. I am waiting for marriage, so I will not have multiple partners*). This belief system is seen in the literature where students not sexually active were not worried about getting HPV (Burke et al., 2010). These students do not seem to recognize they would receive the greatest benefit from the vaccine if vaccinated prior to starting any sexual activity. Recall that most students did not know the vaccine is most effective when given to those that have never had sexual activity. Only

fourteen students overtly stated that having the vaccine was protective of HPV (e.g., *"I have the vaccine so I should be safe compared to those who don't have it").*

The existing literature holds some students are waiting until they are sexually active to get the vaccine; they believe that if they are not sexually active, the vaccine is unnecessary (Dillard and Spear, 2010). This may be the case for students in the current study. This is concerning from a primary prevention standpoint. Most people get HPV infections shortly after becoming sexually active for the first time (NIH, 2015), and it is possible to become infected with more than one type of HPV (CDC, 2015). The literature also indicates students lack perceived susceptibility and do not understand the severity of health consequences associated with HPV (Staggers, Mann, & Maki, 2012). Of note, not even half of the students in this current study knew that 'there are many types of HPV'. The HBM holds that when HPV/HPV-related diseases are perceived as serious conditions, this increases the likelihood that an individual intends to get the vaccine (MacArthur 2017). However, in this current study, students' low knowledge scores related to HPV causing genital warts and types of cancer indicates students do not understand HPV as a serious condition.

The rationale for delaying vaccination until initiation of sexual activity may not provide the protection necessary. Gardasil9, the current vaccine, requires several doses for efficacy. For many, the series will span six months from initiation to completion (Merck, 2020). It may be that students are not aware of the dosing schedule; or rather, there is an erroneous outlook that when they initiate sexual behaviors, they can get the HPV vaccine and secure immediate protection.

The student narratives in this study show a group of students were unable to identify HPV risk factors. Frank statements include: *"the fact that I don't know what it is and don't have*

a doctor"; *"the amount of sex you have? I honestly have no clue about HPV or what causes it"*; and *"I am not sure that's why I think I am just average; I have never heard that I am at high risk for it or low risk for it*." Even more common to this group of students' responses was the simple statement *"I do not know."*

Health Care Provider Communication Needed

An important study aim of this study was to gather student perspectives on how health care providers communicate HPV and HPV vaccine messages to college students. The HBM construct of 'cue to action' would suggest the provider recommendation is the best predictor for improvement of vaccination uptake. Given the opportunity to recall conversations, students provided a host of narrative responses. The CDC and the President's Cancer Panel have identified improving healthcare providers' communication as a key strategy for increasing HPV vaccine uptake (Gilkey et al., 2015).

There appears a triangulation within the study findings that a group of students have not received a provider recommendation for the vaccine, they have low HPV knowledge, and they cannot identify HPV risk factors. According to the HBM, a cue to action in the form of a provider recommendation has significant implications that influence vaccine uptake. In the current study, often the provider did not serve in this role. This belief was strengthened by examining the student narratives closer: the same students that stated they were not influenced by their provider had not received a vaccine recommendation. Similarly, students that did not know what influences their risk had not received a recommendation.

About 45.7% of the students believed the health care provider was not an informational source nor an influence on the vaccine decision (39%). One student said, "*I cannot recall a*

conversation with my health care provider about HPV." Narratives came from students in each group (those that had and had not received recommendation to vaccinate; and within each vaccination status group) that they had received little, or no information related to the nature of HPV. These students said the provider was not an influence (e.g., "*The healthcare provider did not influence my decision about the HPV vaccination*" and "*They haven't as I am unaware of what it is*"). While some were influenced by the provider's *attitude* towards the vaccine, many reported not receiving HPV information at the same time (e.g., " *I still don't even know what it is"*). This finding is consistent with Hopfer and Clippard's (2017) study where many women based their decisions on provider attitudes and health care provider messages, while having only superficial HPV knowledge.

An additional group of students stated the provider was not a direct information source or influence on them because provider educational messaging was relayed only to the parent. It is evident in this study that knowledge and educational messaging were not transferred from the provider, nor the parent, to the adolescent. Students often identified their parents as the key HPV vaccine decision makers when they were younger. One student stated, '*they didn't tell ME anything, they just talked to my mom'*. Whether the vaccine is received or not, the young person may leave the provider's office without HPV specific knowledge related to the nature of the disease, the outcomes, routes of transmission, etc. For males and females, the mother was often specified as the HPV decision maker whose approval, or lack thereof, was the key factor of whether they were vaccinated or not. A few female students in this current study briefly mentioned they had discussed the vaccine with their mothers as well as their health care providers.

Much existing literature focuses on the predominance of provider communications to parents of children and adolescents (Daley, Liddon, Kempe, et al. 2006, Dillard & Spear, 2010; Dorrell, Yankey, & Strasser, 2011; McRee, Gilkey, and Dempsey 2014, Jones & Cook, 2008). It was not a goal of this study to understand to what extent college students had family communications about HPV or included their parents in HPV vaccine decision making. This may be a valuable avenue for future investigation because the role of the parent in health care decision making likely extends into young adulthood when students are in college. There is an assumption that college students are autonomous decision makers; however, parental influence may continue related to the HPV vaccine. Omitting children from the vaccine conversation is understandable as it may be objectionable to discuss topics of sexuality, cancer prevention, etc. with children at the lower end of the recommended age groups (9-15 years old). However, a gap in HPV knowledge and risk perception will persist as the child enters young adulthood and college as illustrated by the 32% of students who were unsure of their vaccine status.

Limitations

While this study contributed to the body of literature related to college student knowledge about HPV and provider conversations with college students about HPV, the study sample was relatively small (N=254) and comprised primarily of white/Caucasian female students (n=167; 68.%) from suburban communities (n=134; 57.7%). While this study purposefully oversampled males with the initial email distribution in efforts to collect a higher percent of male respondents, the male response rate was sluggish. The current study had 57 (23.3%) of the respondents identify within a minority race/ethnic group; but no individual race/ethnic groups were strongly represented. Unfortunately, this study did not contribute more to minority college student perspectives on HPV. The existing literature is lacking minority perspectives related to many

HPV topics and points towards future research in such areas as uptake rates, decision making, information sources, knowledge, etc.

Conclusions

Even though 18–24-year-old college students have been vaccine eligible since the HPV vaccines were initially manufactured; there should be continued investigation as to why uptake remains low, why college student knowledge surrounding HPV is sparse, and why health care providers are not recommending the vaccine more often. While the role of the health care provider is widely known to increase uptake, Bennett et al. (2015) suggest strategies should not be limited to only provider conversations. On-campus strategies to assist in increasing college-aged vaccination rates are recommended; these involve providing college students with HPV education and offering the HPV vaccine during orientations or clinics (McCutcheron & Schaar 2017). ACOG (2016) also supports continuing sexuality education through the lifespan. For college students, this education can be facilitated through health education professionals and peer education efforts on campus. Tailored online educational interventions may also serve to reach students that are not having provider contacts (Bennett et al., 2015).

Medically accurate sexual health education is needed for all students. Providers interacting with college age students should be alert that HPV knowledge is poor *regardless* of vaccine status. The results of this study indicate it is necessary for the health care provider to re-visit the HPV conversation with college students when given opportunity. Students hold misconceptions about testing, transmission, and the benefits of the vaccine. The Health Belief Model constructs may not apply to college student vaccine decision making, given students' low knowledge about the seriousness and severity of the disease in this study and that many do not know what makes them at risk of contracting HPV.

Students do not understand the best time to be vaccinated is prior to having any sexual activity. Instead, there is a belief that if one is not sexually active, one can wait to vaccinate. For students vaccinated when they were younger, a return to the HPV conversation would clarify benefits of the vaccine and resolve misunderstandings. Additionally, health care providers should be the cue to action, making the vaccine recommendation to both the unvaccinated student and to those students who believe the vaccine does not apply to them, by explaining how they are the prime candidate for the vaccine.

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APPENDICES

Appendix 1

HPV Knowledge Instrument

Consent Information

Q1 As of today's date are you between 18 and 24 years old?

- Yes
- No

Skip To: End of Survey If As of today's date are you between 18 and 24 years old? = No

Q2 What is your gender?

- Male
- Female
- Transgender

Q3 What is your race/ethnicity?

- American Indian or Alaska Native
- Asian
- Black or African American
- Hispanic, Latino, or Spanish
- Native Hawaiian or Pacific Islander
- White
- Bi-Racial

Q4 What is your current college classification?

- ○ Freshman
- ○ Sophomore
- ○ Junior
- ○ Senior
- ○ Graduate(or higher)
- ○ Concurrent, still in high school taking college classes

Q5 How would you describe the area where you spent most of your adolescence (10-19)?

- ○ Rural (small towns or cities isolated from larger areas or farming communities)
- ○ Suburban (community near a bigger city, often part of a metropolitan region)
- ○ Urban (big city – i.e., Austin, Little Rock, Memphis, Tulsa)
- ○ Megalopolis (extra-large city with an especially diverse population – i.e., New York City, Chicago, Los Angeles)

Q6 What is your HPV (Human Papillomavirus) Vaccine Status?

- ○ Partially HPV vaccinated (some doses, but not all)
- ○ Fully HPV vaccinated (all doses received)
- ○ Not at all HPV vaccinated
- ○ Unsure

Q7 Has a health care provider (doctor, nurse) ever recommended an HPV vaccine to you?

- ○ Yes
- ○ No

This study wants to understand what health care providers say to college students about HPV (Human Papillomavirus). Please think back to conversations you have had with your doctor or nurse.

Q8 What information has a health care provider given you about HPV?
Q9 How did the health care provider influence your decision about HPV vaccination?
Q10 Select one choice based on the statement given:

	much below average	below average	average	above average	much above average
Compared to other people my age, I think that my chance of getting HPV is…	○	○	○	○	○

Q 12 What would influence your chance of getting HPV, or not getting HPV?

Q13 Select if the statement is True, False, or I Don't Know.

If you don't know the answer, please select 'I Don't Know' instead of guessing.

	True	False	Don't Know
HPV can cause cervical cancer (1)	○	○	○
A person could have HPV for many years without knowing it (2)	○	○	○
Having many sexual partners increases the risk of getting HPV (3)	○	○	○
HPV is very rare (4)	○	○	○
HPV can be passed on during sexual intercourse (5)	○	○	○
HPV always has visible signs or symptoms (6)	○	○	○
Using condoms reduces the risk of getting HPV (7)	○	○	○
HPV can cause HIV/Aids (8)	○	○	○
HPV can be passed on by genital skin-to-skin contact (9)	○	○	○
Men cannot get HPV (10)	○	○	○
Having sex at an early age increases the risk of getting HPV (11)	○	○	○
There are many types of HPV (12)	○	○	○
HPV can cause genital warts (13)	○	○	○
HPV can be cured with antibiotics (14)	○	○	○
Most sexually active people will get HPV at some point in their lives (15)	○	○	○
HPV usually doesn’t need any treatment (16)	○	○	○

Girls who have had an HPV vaccine do not need a Pap test when they are older (17)	○	○	○
One of the HPV vaccines offers protection against genital warts (18)	○	○	○
HPV vaccines offer protection against all sexually transmitted infections (19)	○	○	○
Someone who has an HPV vaccine cannot develop cervical cancer (20)	○	○	○
HPV vaccines offer protection against most cervical cancers (21)	○	○	○
HPV vaccines are most effective if given to people who have never had sex (22)	○	○	○
If an HPV test shows that a woman does not have HPV her risk of cervical cancer is low (23)	○	○	○
HPV testing is used to indicate if the HPV vaccine is needed (24)	○	○	○
When you have an HPV test, you get the results the same day (25)	○	○	○
HPV can sometimes spontaneously clear without treatment (26)	○	○	○

Q14 Do you want to be entered into a lottery drawing for a chance to win an Amazon gift card? Prizes are 1:$50, 2:$25, and 10:$10 gift cards. Your answers to the survey are still anonymous.

○ Yes

○ No

Display This Question: If Do you want to be entered into a lottery drawing for a chance to win an Amazon gift card? Prizes... = Yes No

Q15 If you win one of the Amazon gift cards, you will be contacted by email. Your answers to the survey are still anonymous, your answers are not linked to your email. Please provide the best email to reach you if you are a winner.

Oklahoma State University Institutional Review Board

Date:	11/12/2020
Application Number:	IRB-20-512
Proposal Title:	College Health Survey
Principal Investigator:	Tracy
FreudenthalerCo-Investigator(s):	
Faculty Adviser:	Kelley
RhoadsProject Coordinator:	
Research Assistant(s):	
Processed as:	Exempt
Exempt Category:	

Status Recommended by Reviewer(s): Approved

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in 45CFR46.

This study meets criteria in the Revised Common Rule, as well as, one or more of the circumstances for which continuing review is not required. As Principal Investigator of thisresearch, you will be required to submit a status report to the IRB triennially.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp areavailable for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be approved by the IRB. Protocol modifications requiring approval may include changes tothe title, PI, adviser, other research personnel, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period. Thiscontinuation must receive IRB review and approval before the research can continue.
3. Report any unanticipated and/or adverse events to the IRB Office promptly.
4. Notify the IRB office when your research project is complete or when you are no longer affiliatedwith Oklahoma State University.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions aboutthe IRB procedures or need any assistance from the Board, please contact the IRB Office at 405-744- 3377 or irb@okstate.edu.

Sincerely,
Oklahoma State University IRB

Table 1

Characteristics of Participants

Demographics		**% Responders (n)**
Gender		
	Female	68.2 (167)
	Male	31.4 (77)
	Transgender	1 (.4)
Race/ethnicity		
	White	76.7 (188)
	American Indian	6.1 (15)
	Asian	4.9 (12)
	Black or African American	2.4 (6)
	Hispanic, Latino, or Spanish	6.9 (17)
	Native Hawaiian/Pacific Islander	.4 (1)
	Biracial	2.4 (6)
College classification		
	Freshman	31.8 (78)
	Sophomore	20.4 (50)
	Junior	26.9 (66)
	Senior	19.6 (48)
	Concurrent/ High School	1.2 (3)
Location during adolescence		
	Suburban	57.7 (134)
	Rural	28.2 (69)
	Urban	15.9 (39)
	Megopolis	1.2 (3)
Received a provider Recommendation		
	Yes	58.8 (142)
	No	41.2 (100)
HPV vaccine status		
	Fully vaccinated	52.7 (129)
	Partial/initiated	4.5 (11)
	Not at all vaccinated	10.6 (26)
	Unsure	32.2 (79)

Note: N=245. Participants were between 18 and 24 years old. *N*=243 question: Did a health care provider ever recommend an HPV vaccine to you? *N*= 254 question: What is your HPV vaccine status?

Table 2

Chi-Square Results by Gender: Vaccine Status, Provider Recommendation, and Perceived Risk

Study Variables	Male		Female		χ^2
	n	%	n	%	
Vaccine Status					
Fully/Partially Vaccinated	41	53.2%	99	59.3%	.675
Not Vaccinated	9	3.7%	17	0.2%	
Unsure	27	35.1%	51	30.5%	
Provider recommendation					4.56*
Yes	37	48.7%	105	63.3%	
No	39	51.3%	61	36.7%	
Perceived risk					.146
Much Below Average	19	35.8%	58	43.9%	
Below Average	14	32.6%	43	30.8%	
Average	20	37.7%	51	27.6%	

**significant p <.05*

Table 3

Chi-Square Results for Perceived Risk and HPV Status

Study Variables	Fully/Partially Vaccinated		Not Vaccinated		Unsure		χ^2
	n	%	n	%	n	%	
Perceived risk							
Much Below Average	50	48.1%	10	43.5%	17	28.8%	10.16*
Below Average	33	31.7%	7	30.4%	17	28.8%	
Average	21	20.2%	6	26.1%	25	42.4%	

**significant p <.05*

Table 4

ANOVA Results for Knowledge Scores

Variable	Knowledge Score		ANOVA	
	M	SD	F ratio	df
Vaccine Status			4.495*	2,177
Fully/Part. Vaccinated	12.9	5.90		
Not Vaccinated	13.7	5.93		
Unsure	10.1	6.30		
Hometown			.973	2,177
Rural	11.5	3.23		
Suburban	12.1	6.45		
Urban	13.4	4.93		

**significant p <.05*

Table 5

What Information Has a Health Care Provider Given You About HPV?

Salient Themes	Example Quote	Frequency, n (%)
I don't know	I've never been told what HPV is.	63 (41.7)
Prevention focused	This vaccine prevents one of the most common forms of STIs and is important to get.	49 (32.4)
Recommendation, with information	They told me to look into it before I headed to college. And said it would be good to get. They then explained what it was.	22 (14.6)
Talked to parent	My mom was who they talked to at the time of the vaccine so I have no idea what it's about.	11 (7.3)
HPV=STI	That it will help prevent me from getting a sexually transmitted disease.	6 (4.0)
Recommendation, no information	Nothing. Only that I need it. Still don't know what HPV is.	6 (4.0)
Print materials received	When going in for a well woman's exam it was mentioned to me. I also got a pamphlet about a shot that I could get that had to do with HPV.	5 (3.3)

Table 6

How Did the Health Care Provider Influence Your HPV Vaccine Decision?

Salient Themes	Example Quote	Frequency, n (%)
Provider approval	A big influence, would never have known about the risks otherwise.	53 (37.06)
Not applicable*		30 (21.0)
No influence	They have not because I do not recall them ever telling me to get the vaccination.	26 (18.2)
Parent made decision	My mom took me to get it as a teenager, never knew much about it.	21 (14.7)
Risk, fear, guilt message	They tried scaring me into thinking I would get cancer if I did not get this vaccine.	11 (7.7)

*These students responded they were not vaccinated in a previous question.

Table 7

What Influences Your Risk of HPV Infection?

Salient Themes	Example Quote	Frequency, n (%)
Number of sexual partners, Sexual activity	How sexually active you are.	53 (34.0)
Celibacy, no sexual activity	I am not sexually active, nor have I ever been.	26 (16.7)
Faithfulness, monogamy	I am only sexually active with one person, and he is only sexually active with me.	23 (14.7)
I don't know	I am not sure as I have never been told.	22 (16.7)
Vaccinated or not	I have the vaccine so I should be safe compared to those who don't have it	18 (11.4)
Unprotected sex		18 (11.5)
'Unexpected' answers	Smoking, taking birth control, sexual history, etc. Genetics Long term use of oral contraceptive (birth control)	17 (11.0)

Table 8:

Knowledge of HPV and HPV Vaccines:

Knowledge items	% correct(n)
Having many sexual partners increases the risk of getting HPV	84.4 % (180)
HPV can be passed on during sexual intercourse	81.1 % (180)
A person could have HPV for many years without knowing it	76.1% (180)
HPV is very rare	76.1 % (180)
Men cannot get HPV	73.9 % (180)
Using condoms reduces the risk of getting HPV	72.8 % (180)
HPV always has visible signs or symptoms	68.3 % (180)
Girls who have had an HPV vaccine do not need a Pap test when they are older	65.2 % (178)
Someone who has an HPV vaccine cannot develop cervical cancer	60.1 % (178)
HPV can cause cervical cancer	58.9% (180)
HPV vaccines offer protection against all sexually transmitted infections	56.4 % (179)
HPV can be passed on by genital skin-to-skin contact	54.4 % (180)
HPV can cause genital warts	53.1 % (179)
There are many types of HPV	41.9 % (179)
HPV testing is used to indicate if the HPV vaccine is needed	39.3 % (178)
Having sex at an early age increases the risk of getting HPV	38.8 % (178)
HPV can be cured with antibiotics	37.6 % (178)
Most sexually active people will get HPV at some point in their lives	25.4 % (177)
HPV vaccines offer protection against most cervical cancers	24.7 % (178)
HPV vaccines are most effective if given to people who have never had sex	24.7 % (178)
HPV can sometimes spontaneously clear without treatment	24.3 % (177)
One of the HPV vaccines offers protection against genital warts	22.7 % (176)
HPV can cause HIV/Aids	21.2 % (180)
If HPV test shows…woman does not have HPV, her risk of cervical cancer is low	15.2 % (178)
When you have an HPV test, you get the results the same day	14.0 % (178)
HPV usually doesn't need any treatment	10.7 % (178)

VITA

Tracy Freudenthaler

Candidate for the Degree of

Doctor of Philosophy

Dissertation: HUMAN PAPILLOMAVIRUS KNOWLEDGE AND VACCINE STATUS AMONG UNIVERSITY STUDENTS: HOW HAVE HEALTH CARE PROVIDERS INFLUENCED THE VACCINE DECISION?

Major Field: Health. Leisure, & Human Performance: Health & Human Performance

Completed the requirements for the Doctor of Philosophy in Health & Human Performance at Oklahoma State University, Stillwater, Oklahoma in May 2021.

Completed the requirements for the Master of Public Health at University of Oklahoma Health Sciences Center, Oklahoma City, OK in 2009.

Completed the requirements for the Bachelor of Arts in Psychology at Northeastern State University, Tahlequah, OK in 2007.

Experience: Professional experience includes both higher education and clinical research in women's reproductive health. Instructional experience includes over 10 years at various undergraduate and graduate levels; this experience spans college and university settings and vocational schools. Clinical research experiences include vaccine development, cervical cancer research, and pharmaceutical development.

Professional Memberships: Professional memberships are primarily related to public health and include Oklahoma Public Health Association (OPHA), Oklahoma Medical Reserve Corps (OKMRC), etc.