Human Papillomavirus Education in Military Service Members

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Abstract

The human papillomavirus (HPV) is a sexually transmitted infection (STI) that is associated with several types of cancer and genital warts. No cure exists for those currently infected with HPV, but a vaccine is available that can prevent the virus and development of cancers associated with HPV. Military servicemembers are at a high risk for contracting HPV; it is one of the most common STIs among active duty service members. The health consequences of HPV can impact a servicemember's military readiness. The HPV vaccine is not required for military servicemembers, but it is offered free of charge. HPV vaccination rates among military service members remain relatively low. The purpose of this evidence-based project was to increase the level of knowledge about HPV, improve health beliefs regarding HPV, increase HPV vaccine intention, recommendation, and uptake. Using the *Health Belief Model* as an organizing framework, a population targeted eight-minute education video on HPV and HPV vaccination was developed. It was implemented at an outpatient military treatment facility located in the southwest United States over a 6-week period, to newly reported service members. Participants included 116 military service members aged 18 to 45. A pretest and posttest questionnaire were used to assess the impact of the intervention. HPV level of knowledge increased significantly from pretest to posttest mean scores were 3.00 to 4.39 respectively ($p < .001$). HPV vaccine intention increased from 62% to 66% ($p = .739$). HPV vaccine recommendation increased from 62% to 85% ($p < .001$).

Keywords: Human papillomavirus, HPV vaccination, military, service members, sexually transmitted infections.

Human Papillomavirus Vaccination in the Military

The human papillomavirus (HPV) is a sexually transmitted infection that can be transmitted through vaginal, oral, or anal intercourse. Nearly half of all sexually active individuals will contract the virus (Buechel & Connelly, 2018). HPV is preventable through receiving the vaccine series. Among military service members, HPV infection is higher than the national average (Buechel, 2018). It is important for military service members to be protected against HPV because they are at increased risk of contracting the virus and HPV infection can adversely impact military readiness.

Problem Statement

There are approximately 14 million cases of genital HPV annually in the United States (Kwon, Lay, Hrncir, & Levin, 2018). Half of these cases occur in adolescents and young adults aged 15 to 24 (Kwon, Lay, Hrncir, & Levin, 2018). HPV has been conclusively identified as the cause of cervical cancer and most cases of genital warts. Other cancers strongly linked to HPV include vaginal, rectal, penile, and oropharyngeal cancers. Currently no cure exists for those that are infected with HPV. The HPV vaccine can prevent the nine most common types of HPV that are associated with genital warts and cancer (Meites et al., 2019).

HPV is one of the most common sexually transmitted infection (STI) reported among United States military service members (Daly, Hansen, Kwon, & Roberts, 2018). HPV is more prevalent among military servicewomen when compared to the civilian population, military dependents, and retirees (Daly et al., 2018; Goyal, Mattocks, & Sadler, 2012; Masel et al., 2015). Many cases of HPV among service members are preventable with the HPV vaccine (Mesel et al., 2015). The HPV vaccine is available free of charge to all service members and their dependents. Despite the vaccination being free to service members there is still a relatively low rate of HPV

vaccination among military service members (Buechel, 2018; LaRocque & Berry-Cabán, 2011). When compared with the national average, service members have higher rates of HPV and lower vaccination rates (Buechel, 2018).

Purpose and Rationale

HPV vaccination adherence for military service members is important because it can promote military readiness. Being diagnosed with HPV may require additional screening, procedures, and treatments. Due to the high incidence of HPV among service members, vaccination uptake needs to be improved in the military. The HPV vaccine is highly effective at preventing HPV related cancers and genital warts. A diagnosis of HPV can ultimately affect service member's health and prevent them from performing their military duties (Buechel & Connelly, 2018; Daly et al., 2018). The purpose of this project was to identify an appropriate intervention for increasing HPV vaccination among service members that would address the facilitators and barriers to vaccination, implement the strategy, and evaluate the efficacy of the intervention.

Background and Significance

Upon entering the military, all service members receive mandatory vaccinations that are in accordance with the Advisory Committee on Immunization Practices (ACIP) to prevent infectious diseases that could interfere with training and performance (Buechel, 2018). The United States military does support HPV vaccination; however, the HPV vaccination is not a mandatory vaccination that service members must receive when entering the military (Stahlman & Oetting, 2017). Some service members assume they are receiving the HPV vaccine when they receive their mandatory vaccines at their initial military training because they confuse the hepatitis B virus (HBV) vaccine with the HPV agent (Buechel & Connelly, 2018). The military

currently recommends that the HPV vaccine should be offered to male and female service members at their permanent duty station after their initial military training (Buechel, 2018).

Maintaining high rates of HPV vaccination is important among military service members because they have higher risk factors for contracting the virus compared to other groups who share similar sociobehavioral characteristics (Daly et al., 2018; Goyal et al., 2012; Wedel, Navarrete, Burkard, & Clark, 2016). Risk factors associated with HPV among service members include being on active duty, women who are young, unmarried, new to military service, and engaging in high risk sexual activity (Daly et al., 2018; Goyal et al., 2012; Wedel et al., 2016).

Genital HPV is the second most common STI reported among military service members. Incidence rates of genital HPV from 2010 to 2018 among all active duty service members were 61.1 per 10,000 persons-year (Stahlman et al., 2019). For active duty women incidence rates of genital HPV increased slightly from 199.6 per 10,000 person-year in 2007-2016 to 250.2 per 10,000 persons-year in 2010 to 2018 surveillance period. For male active duty service members genital HPV decreased from 37.2 per 10,000 person-year in 2007-2016 to 31.5 per 10,000 persons-year in 2010 to 2018 surveillance period (Stahlman et al., 2019; Stahlman & Oetting, 2017). The total incident cases of genital HPV during the surveillance period of 2010 to 2018 for active duty male and females was 71,138, which is a slight decrease from the previous surveillance. HPV infection incidences were highest among service members in the age group 20 to 24, and 25 to 29. Non-Hispanic blacks had the highest incidence of genital HPV when compared to other racial ethnicities. Airforce service members had the highest incidence of HPV when compared with other military branches. The service members that worked in healthcare occupations had the highest incidence of genital HPV when compared to all other military

occupations. Service members at the junior enlisted rank of E1 to E4 had the highest incidence of HPV followed by the junior officer's rank of O1 to O3 (Stahlman et al., 2019).

Service members on deployment during 2008 to 2016 received more healthcare encounters for genital HPV than any other STI (Stahlman & Oetting, 2017). During the surveillance time frame there were 2,887 healthcare encounters for genital HPV with 2,037 individuals with the diagnosis of genital HPV (Stahlman & Oetting, 2017). Of these individuals, 61% had no previous diagnosis prior to deployment (Stahlman & Oetting, 2017). During the surveillance time frame, the incidence of genital HPV during deployment was more than herpes simplex virus, chlamydia, gonorrhea, and syphilis combined (Stahlman & Oetting, 2017).

These statistics further justify the importance of HPV vaccine for preventative healthcare to promote military readiness. HPV can cause comorbid conditions that limit service members' deployable status or military duties (Buechel & Connelly, 2018). A diagnosis of HPV can also affect service members physically and emotionally (Buechel, 2018). The HPV vaccine could provide a preventive measure to reduce healthcare costs associated with treatment of genital warts and cancer caused from HPV (Daly et al., 2018).

The Food and Drug Administration (FDA) recently expanded the approved age range for the HPV vaccine (Meites et al., 2019). The vaccine was previously available to only male and females aged nine to 26. The expanded age range now include adults aged 27 to 45. The current recommendations for the HPV vaccine from the Center of Disease Control and Prevention (CDC) and the ACIP suggest that routine vaccination should occur in female and males aged 11 to 12 but can begin as early as age nine (Meites et al., 2019). If vaccination does not occur during the routine ages, catch up vaccination is recommended for both males and females through age 26 (Meites et al., 2019). For adults aged 27 to 45 that are not vaccinated with HPV, the ACIP

recommends shared clinical decision-making with one's primary care clinician regarding HPV vaccination (Meites et al., 2019).

The Defense Health Agency-Immunization Healthcare Branch (DHA-IHB) (2019), released a standing order to allow healthcare professionals and nurses providing care within the Department of Defense (DoD) to vaccinate all adults aged 18 to 45 who have not completed their HPV vaccine series. This standing order reflects the new expanded age range for HPV vaccination and allows military service members to be vaccinated with HPV without an order or referral from a healthcare provider (DHA-IHB, 2019).

The vaccine consists of two to three doses depending on the age of the recipient (Meites, Kempe, & Markowitz, 2016). Recipients aged nine to 14 should receive two doses, six to twelve months apart (Meites et al., 2016). Individuals receiving HPV at ages 15 to 45 should receive three doses, with the second dose occurring two months after the first, and third dose occurring four months after the second dose (Meites et al., 2019).

There are several national initiatives to improve HPV vaccinations rates in the United States. Healthy People (2019), has set a national goal to increase HPV vaccination to 80% for male and female adolescents aged 13 to 15 by year 2020. The National HPV Vaccination Roundtable is a national organization that is dedicated to reducing incidence and mortality of HPV cancers through coordinated leadership and strategic planning (National HPV Vaccination Roundtable, 2019) Their goals is to increase the frequency and strength of clinical recommendations for the HPV vaccine, decrease the missed opportunities for HPV vaccine administration, and to increase the HPV vaccination rate at national and state levels (National HPV Vaccination Roundtable, 2019)

HPV can interfere with deployable status if a service member receives a diagnosis of precancers lesions or cancer. According to the Department of Defense Instruction 6490.07, which outlines health conditions that prevent service members and DoD civilian employees from deploying (Department of Defense, 2010). A service member's deployment status can be limited based on unresolved health conditions that require care, treatment, and affect the individual's duty performance. This includes acute illnesses, chronic health conditions, cancer, or precancerous lesions (Department of Defense, 2010). Service members with HPV related genital warts, precancerous lesions, or cancer may limit their deployable status based on the identified DoD instruction. Service women that have a Papanicolaou (Pap) test that indicates precancerous cells on the cervix, which is caused from HPV, may be prevented from deploying. The Department of the Army (2019), regulation states that soldiers with chronic complications from a STI may be classified as unfit for military service. Based on this regulation, service members in the Army with HPV that experience chronic issues, such as genital warts, may be discharged from military service.

Internal Evidence

A low rate HPV vaccination among service members has been identified in an outpatient military treatment facility located in the southwestern United States. There are 1,307 service members ages 26 and younger that have not been vaccinated against HPV. The rate of HPV vaccination among service members aged 26 to 45 may be low because expanded age range for vaccination has only recently been implemented. The completion rate of the HPV vaccine is 28%, which includes service members, dependents, and civil service employees that are registered on base. Service members often decline the vaccine because they are unaware of what the HPV vaccine is, and because it is offered as an optional vaccine (Airmen at the military base, personal

communication, October 10, 2018). Associated factors that contribute to the low rate of HPV vaccination at this treatment facility include: the vaccine is a three-dose series, the HPV vaccine is administered in the vaccination clinic, and there is no process in place to ensure patients go to the immunization clinic and/or receive their HPV vaccine after educating them in the primary clinic (A. Wholly, personal communication, October, 2018).

Medical Right Start is a mandatory briefing for service members newly assigned to the military base of the project site. The briefing occurs every Tuesday at 9am in the project site's conference room. During this meeting education is presented about health services available to service members and information about sexually transmitted infections. This could be an opportune time to present information about HPV, HPV vaccination, and the value to the military service member to be vaccinated against HPV.

PICOT Question

This inquiry has led to the PICO question; "Among military service members (P), how does targeted education (I), compared to current standard of care (C), affect HPV vaccination initiation rates? (O)"

Search Strategy

The three databases that were searched include: Academic Search Premier, Cumulative Index of Nursing and Allied Health Literature (CINAHL) Database, and PubMed. All searches included key terms related to the PICO question. Initial key terms included: *immunization* OR *vaccination* OR *vaccine OR Gardasil*, AND *human papillomavirus* OR *HPV* OR *human papilloma virus*. The intervention key term of *education* was added but this was too broad and additional key terms were needed to narrow down the body of evidence. The intervention key terms included: *education intervention* OR *health education.* The last key terms including the

population were added but it narrowed the search too significantly. The key terms used for the population included: *military* OR *servicemembers* OR *armed forces* OR *service members.* Filters that were applied included: a publication date from 2012 to 2019, subject age of 18 years or older, human species, and English language. The same search strategy including key terms and filters were used for each database search.

In CINAHL, the key terms search yielded 260 citations. After applying filters of a publication date from 2012 to 2019, subject age of an adult, human species, and English language the final search yielded 74 articles. The second search that included the military population key terms and the same filters yielded only one article.

In PubMed, the first search including intervention key terms yielded 1,619 citations. After applying filters of a publication date from 2012 to 2019, subject age of an adult 19 years or older, human species, and English language the final search yielded 571 articles. The key terms *vaccine initiation* OR *vaccine intention* were added to narrow the search yield to 83. The second search that included the military population key terms and the same filters yielded four articles.

In Academic Search Premier, the first search including intervention key terms yielded 468 citations. After applying filters of a publication date from 2012 to 2019, human species, and English language with an additional key term of *adult,* the final search yielded 45 articles. The second search that included the military population key terms and the same filters yielded one article.

The titles and abstracts of the final yield of articles were reviewed for each database. The articles were evaluated based on the inclusion criteria. The inclusion criteria included males or females, military or civilian population, HPV education intervention, and measurement of HPV vaccination initiation or vaccine intention. Articles were excluded if they included persons less

than 18 years old, were published before 2012, written in a non-English language, included species other than humans, or did not have interventions to change rates of HPV vaccination. In all three databases, there were 14 articles that met the inclusion criteria. These articles were critically appraised and ten were determined to be most relevant to the PICO.

Critical Appraisal and Synthesis

The ten articles have been selected for the inclusion in the literature review were evaluated using rapid critical appraisal to evaluate the quality of the evidence (O'Mathuna & Fineout-Overholt). The appraisals of the articles are presented in the evaluation table (Appendix A). All of the studies were higher level of evidence including, seven randomized control trials, and three quasi-experimental designs (Appendix A).

Seven studies were conducted in the United States, two studies were conducted in China, and one study was conducted in Canada. All ten articles reported the funding source for the research and no bias was identified in any of the studies (Appendix A).

Sample sizes were adequate for all selected studies. Seven of the studies included samples sizes greater than 100 participants, and two studies had greater than or equal to 90 participants. With the largest sample size consisting of 1,396 participants in a study reported by Change et al. (2013), and the lowest sample size consisting of 62 participants in a study reported by Perez et al. (2016).

Included studies demonstrate a heterogeneity in demographics, although all studies included adult civilian participants. The participant ages ranged between 18 to 71 years of age, with the majority of studies including participants aged 18 to 26 (Appendix A). Two studies included a mixture of both male and female participants, six studies focused on female participants, and two studies focused on male participants (Appendix A). For the education

intervention mode of deliverance, three studies administered the education in video, one study education was delivered in a web-based format, five studies education intervention was presented in person lecture, and two studies education was presented in a written format (Appendix B).

A pretest posttest design was used to measure outcomes in nine studies and one study used posttest measurement only (Appendix A). Additionally, four of the studies used pretest posttest design, also had a follow up measurement. Measurement outcomes varied slightly but the majority of studies measured HPV knowledge and vaccine intention. Other outcome measured include vaccine acceptability, vaccine self-efficacy, and vaccine initiation (Appendix A).

The results of the studies were homogenous, with each intervention increasing either HPV knowledge or vaccine intention or both. The current evidence strongly suggests a variety of education intervention can increase HPV vaccine intention or HPV knowledge. This literature review demonstrates that a range of education interventions can be used effectively to improve HPV vaccine intention and HPV knowledge which is the foundation to guide this project of improving HPV vaccination rates among military service members. To improve HPV vaccination rates among military service members, a combination of education methods identified in the literature will be used. The education intervention that will be implemented encompasses three aspects: population targeted, presented in a group setting, and that the education is presented in a video.

Conceptual Framework

The Health Belief Model (HBM) (Rosenstock, 1960) is a conceptual framework that can be used to understand phenomena of one engaging in a health promotion behavior, such as

receiving the HPV vaccine (Appendix C). The HBM is based on four dimensions that include: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Becker, 1974). Perceived susceptibility is one's perception of personal risk of contracting a condition (Becker, 1974). Perceived severity is one's perception of the seriousness of a condition and the consequences associated with the condition (Becker, 1974). Perceived susceptibility and perceived severity influence the perceived threat of the disease (Appendix C). Perceived benefits are one's belief in the effectiveness of the recommended action in decreasing the disease threat (Becker, 1974). Perceived barriers are one's perception of negative aspects of or impediments to completing the recommended action (Becker, 1974). Perceived benefits of the recommended action are negatively affected by the perceived barriers, the result of this relationship is the likelihood of engaging in a health promotion behavior (Appendix C).

A person's demographics and socio-economic factors influence three domains in the model: perceived susceptibility and seriousness of the disease, perceived threat of the disease, and the perceived benefits and barriers to recommended action (Becker, 1974). A cue to action is described as an internal or external incentive that can activate one's perception of the perceived threat of the disease. One's perceived threat of the disease ultimately influences the likelihood of engaging in a health promotion behavior (Appendix C). The HBM can be applied to an evidence-based project to improve HPV vaccination rates because the model will help identify factors that contribute to understanding the benefits to the participants of obtaining HPV vaccination for them that outweigh the fact that it is not required and may require extra effort on their part to obtain the service. In addition, the HBM can be used to aid with developing education initiatives that targets the primary concepts of the model.

An education intervention could increase knowledge about HPV and HPV vaccination among military service members. If a service member chooses to get vaccinated, it may reduce their risk for acquiring HPV related conditions. Increased rates of HPV vaccination among military service members can promote military readiness because service members would not absent from work for healthcare appointments related to HPV treatment. Long-term outcomes of the interventions would include a decrease in diagnosis of HPV of among service members, decrease in HPV related cancer in service members, decrease in costs associated with HPV treatment, fewer healthcare appointments associated with HPV, and enhanced military readiness.

Evidence-Based Practice Model

A Model for Evidence Based Practice developed by Rosswurm and Larrabee (1999), is an evidence-base model that fits within the characteristics of the organization and problem identified (Appendix D). This model consists of six linear level steps that can be applied in developing and integrating an evidence-based project. The model provides a systematic process that can easily be followed to ensure each phase of an evidence-based practice project is completed and provide the best chance of obtaining the desired outcome (Appendix D).

The initial step is to assess the need for change in practice (Rosswurm & Larrabee, 1999). This step was completed by meeting with key stakeholders, collecting internal data about the current practice for HPV vaccination, and identifying the problem of low vaccinations rate. The second step is linking the problem with interventions and outcomes (Rosswurm & Larrabee, 1999). This step was completed with the identification of the PICOT question and completing a literature review to find tested interventions that were effective in addressing the problem in service members. The third step is to synthesize the current evidence (Rosswurm & Larrabee, 1999). This step has been accomplished with evaluating the current evidence regarding HPV

education methods to increase vaccine intention, assessing the quality of the available evidence and identifying common themes and approaches that worked. The fourth step is to design a practice change using an appropriate theoretical framework to apply the interventions in ways that address the constructs of the model (Rosswurm & Larrabee, 1999). This step can be applied in this evidence-based project by designing an education intervention program that will enhance patient perceptions of personal susceptibility and threat related to HPV infection while illustrating the personal benefits and removing barriers to HPV vaccination to increase the HPV vaccination rate among the service members. The fifth step is to implement the project and evaluate the practice change (Rosswurm & Larrabee, 1999). This can be accomplished by implementing an education intervention and collecting and analyzing data in a way that will capture any change in HPV knowledge and HPV vaccination rates. Based on the outcome of the evaluation of practice change, the sixth and final step is used to integrate and maintain the practice change (Rosswurm & Larrabee, 1999). This step can be completed by integrating the project interventions into standards of care and policies for HPV education among military service members.

Methods

The ASU institutional review board (IRB) assessed the project protocol and deemed it exempt from review. The project goal was to implement an educational video that could increase vaccine intention, HPV level of knowledge, HPV health beliefs, and HPV vaccination initiation among military service members. Those who have studied factors that facilitate participation in vaccination have found that a combination of patient educational methods that could improve HPV vaccine intention and HPV knowledge, which may ultimately increase vaccine uptake and series competition. The education was presented in a video format that is approximately eight

minutes in length. The video content discusses HPV related susceptibility, threats to health and military readiness, and benefits of HPV vaccination.

Potential participants in the project included men and women military service members, aged of 18 to 45, attending Medical Right Start. Medical Right Start is a mandatory briefing for service members newly assigned to the project site. The briefing occurs every Tuesday at 9am in the MTF's conference room. During this time education is presented about health services available to service members and information about sexually transmitted infections. The project was implemented during Medical Right Start over a six-week period from October 2019 to November 2019. Those who attended the Medical Right Start and met the project criteria were provided with a participation/consent letter that describes the project, what they are being asked to do, and invites them to participate in the project. All those that attended the mandatory Medical Right Start meeting and met the project criteria were given the participation/consent letter with the pre- and post-intervention questionnaire.

Those who wanted to participate were asked to complete the pre-intervention questionnaire right before the video was played. The pre-intervention questionnaire takes approximately 5 minutes to complete. After completing the pre-intervention questionnaire, the HPV education video was played. After the education video was complete, participants were instructed to complete the post-intervention questionnaire printed on the back of the pre-intervention form. The post-intervention questionnaire takes approximately 5 minutes to complete. Participant questionnaires were then collected.

Outcome Measurement

The outcomes measured by the questionnaire include service members' knowledge of HPV, health beliefs regarding HPV and vaccination against the virus, vaccination intention, and

vaccine recommendation. These outcomes were measured using a pre-intervention and post-intervention questionnaire (Appendix E; Appendix F). The questionnaire was originally developed by Kim (2012). Guvenc, Seven, and Akyuz (2016), adapted the questionnaire and used psychometric testing to determine the validity and reliability of the instrument to measure knowledge, beliefs, intention, and recommendation related to HPV infection and vaccination. Guvenc gave permission to use the "Health Belief Model Scale for Human Papilloma Virus and It's Vaccination" and the "Human Papilloma Virus Knowledge Scale." The questionnaire was condensed and revised to apply to military service members. Some questions were eliminated because they were not applicable to the population. The pre-intervention questionnaire consists of 24 questions and the post-intervention questionnaire consists of 18 questions (Appendix E; Appendix F). The first set of questions includes five questions that evaluate demographic characteristics. These questions inquire about age, gender, race/ethnicity, branch of service, and pay grade/rank. Descriptive statistics were obtained to describe the participants and compare results among the outcome variables. Five true or false questions evaluate knowledge of HPV. If the question is answered correctly, one point was given, if answered incorrectly, or answered as "I don't know" than zero points were given. A total knowledge score was derived by summing the number of correct responses, for a maximum score of five (Guvenc, Seven, & Akyuz, 2016). Eleven questions are used to measure health beliefs about HPV and HPV vaccination. The health beliefs constructs are derived from the theoretical framework of the Health Belief Model (HBM) and include the domains of perceived susceptibility, perceived benefits, perceived severity, and perceived barriers (Becker, 1974). These question statements include a four-point Likert Scale, in which the subjects evaluate their agreement with the statement, choosing from one "disagree," two "slightly disagree," three "slightly agree," and four "agree." One question measures vaccine

intention. This question is a multiple-choice question that answers include "Yes, No, or I already have the HPV vaccine series." One question measures willingness to recommend the HPV vaccine. This question is a multiple-choice question that answers include, "Yes, No, or I don't know." One question measures current HPV vaccination status. This question is a multiple-choice question that answers include, "Yes, No, or I don't know."

Validity and Reliability

Guvenc, Seven, & Akyuz (2016) conducted an analysis of their original instrument for validity and reliability. Construct validity was used to assess the four factors of the health belief model, perceived susceptibility, perceived benefits, perceived severity and perceived barriers. Kaiser-Meyer-Olkin measurement of sampling adequacy and Bartlett test of sphericity were used to determine adequate sampling for factor analysis. These results suggested that the sample size was adequate, and variables were correlated, which indicated the variables were suitable for factor analysis (Guvenc, Seven, & Akyuz, 2016). The reliability of the original instrument was evaluated using the mean scores, item total correlations, Cronbach α coefficients, test-retest correlation, and retest Cronbach α coefficients. Cronbach α coefficients demonstrated acceptable internal consistency with an α value between 0.71 and 0.78. Item-total correlations analysis scores of 0.36 and 0.64, which indicated satisfactory homogeneity of the 14 items measuring health beliefs. Test-retest reliability was used to assess stability of the questionnaire. The values for test-retest intraclass correlation ranged from 0.81 to 0.88, which demonstrated good reliability. The retest Cronbach α value was between 0.69 and 0.83 (Guvenc, Seven, & Akyuz, 2016).

The relationship between health beliefs and HPV knowledge were evaluated. HPV knowledge and health beliefs of perceived severity and benefits were positively correlated with

each other ($p < .001$). A statistically significant relationship was identified between HPV vaccination intention, median knowledge scores, and median health belief scores ($p < .001$) respectively. Paired comparisons identified that participants who were "extremely likely to undergo HPV vaccination" exhibited higher knowledge scores, higher perceived severity, perceived susceptibility, perceived benefits, and lower perceived barriers ($p < .05$) (Guvenc, Seven, & Akyuz, 2016).

An indirect measurement of this project is overall HPV vaccination rates for service members assigned to receive care at the MTF. This data was obtained by a non-commissioned officer in charge of the Women's Health Clinic in an excel document and provided to the Project Director. This data does not include any patient information. An electronic database is used at the project site to track all service members' military readiness and immunization status. This electronic database is called the Aeromedical Services Informational Management System (ASIMS). This program is unique and only the Air Force uses it to track vaccination status. HPV vaccination data is already being collected by the organization using the ASIMS database. Vaccination rates were measured from the organizational data collection in ASIMS, which includes the raw number of individuals that initiated one dose of the HPV vaccine and raw number of individuals that have completed the vaccine series. "Vaccine initiation" represents service members receiving their first dose of the HPV vaccine. "Vaccine completion" represents services members receiving the third dose and final dose of the HPV vaccine that was started at another location. HPV Vaccination rates were assessed before the intervention began and one week following the intervention period. Other demographic data that was collected from the ASIMS database includes military duty status, age, and HPV vaccination status.

Budget

There are no external funding sources for this project. The organization costs are estimated to be $6,846 (Appendix G). Personal expenses for the projected director are estimated at $29 (Appendix G). In-kind expenses for the project are estimated at $22,652 (Appendix G). Participants were not compensated for their participation. The benefits of the HPV vaccine include the following potential cost savings: The HPV vaccine could provide a preventive measure to reduce costs associated with treatment of genital warts and cancer caused from HPV. Long-term outcomes of the interventions would include a decrease in diagnosis of HPV of among service members, decrease in HPV related cancer in service members, decrease in costs associated with HPV treatment, and fewer healthcare appointments associated with HPV.

Results

A total of 116 military service members participated in watching the HPV education video. After excluding incomplete questionnaires, 101 participants' pre- and post-intervention questionnaires were used in data analysis of HPV level of knowledge, HPV health beliefs, HPV vaccine intention, and HPV vaccine recommendation. Intellectus Statistics (2020), an online data analysis product, was used to analyze the data.

Demographics

Descriptive statistics display characteristics of the participants in Table 4, which include the demographic information and HPV vaccine status of the participants (Appendix I). The most frequently observed gender was male (n = 91, 78%). The most frequently observed category of ethnicity was non-Hispanic white (n = 72, 62%). All participants whose data was included in the project serve in the US Air Force (n = 116, 100%). The most frequently observed military pay grade/rank was E3 (n = 60, 52%). The majority of the participants did not know their HPV

vaccine status (*n* = 65, 58%). The average age was 23.91 with a range of 18 – 45 years (*SD* = 5.29) with age 19 being reported most frequently (*n* = 25, 22%). The summary age statistics can be found in Table 5 and Figure J1 (Appendix J).

HPV Knowledge

A two-tailed paired samples *t*-test was conducted to examine whether the mean difference of pretest and posttest HPV knowledge scores were significantly different from zero. The result of the two-tailed paired samples *t*-test was significant based on an alpha value of 0.05, $t(100) = -9.31$, $p < .001$. The mean of pretest knowledge ($M = 3.00$) was significantly lower than the mean of posttest knowledge ($M = 4.39$). The results are presented in Table 6 (Appendix K). A bar plot of the mean scores is presented in Figure K1 (Appendix K).

A Wilcoxon Signed-Rank test was used to supplement the results of the paired samples *t*-test, because the data violated the assumptions of normality and homogeneity of variance. The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, V = 80.00, z = -7.02, $p < .001$. The median of pretest knowledge (Mdn = 3.00) was significantly lower than the median of posttest knowledge (Mdn = 4.00).

For the pretest, the observations of HPV knowledge scores had an average of 3 (*SD* = 1.44, Min = 0, Max = 5, Mode = 3). For the posttest, the observations of HPV knowledge scores had an average of 4.39 (*SD* = 0.77, Min = 0, Max = 5, Mode = 5). The summary statistics can be found in Table 7 (Appendix K).

Health Beliefs Regarding HPV and HPV Vaccination

A two-tailed Wilcoxon signed rank test was conducted to examine whether there was a significant difference between pretest and posttest health beliefs regarding HPV and HPV vaccination. This data is presented in Table 8 (Appendix L). The two-tailed Wilcoxon signed

rank test is a non-parametric alternative to the paired samples *t*-test and does not share its distributional assumptions (Conover & Iman, 1981).

For each statement measuring health beliefs regarding HPV and HPV vaccination, participants answered with their agreement to each statement. Responses to the statements included disagree, slightly disagree, slightly agree, and agree. Frequencies and percentages for the pretest and posttest health beliefs response were calculated using descriptive statistics and are presented in Table 9 (Appendix L).

Health Belief: Perceived Benefit

HPV vaccine can prevent genital warts.

The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, V = 105.50, z = -5.95, p < .001 (Appendix L). For the pretest, the most frequently observed response for the statement "HPV vaccine can prevent genital warts" was Slightly Agree (n = 42, 42%). For posttest, the most frequently observed response was Agree (n = 75, 74%). Frequencies and percentages are presented in Table 9 (Appendix L).

HPV vaccine can prevent cancer in both men and women.

The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, $V = 55.50$, $z = -6.58$, $p < .001$ (Appendix L). For the pretest, the most frequently observed response for the statement "HPV vaccine can prevent cancer in both men and women" was Slightly Agree ($n = 34$, 34%). For the posttest, the most frequently observed response was Agree ($n = 81$, 80%). Frequencies and percentages are presented in Table 9 (Appendix L).

I trust the safety and efficacy of the HPV vaccine.

The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, $V = 33.00$, $z = -5.48$, $p < .001$ (Appendix L). For the pretest, the most frequently observed response to the statement "I trust the safety and efficacy of the HPV vaccine" was Agree ($n = 43$, 43%). For the posttest, the most frequently observed response was Agree ($n = 72$, 71%). Frequencies and percentages are presented in Table 9 (Appendix L).

Health Belief: Susceptibility

Likelihood of getting genital warts is high if I am not vaccinated against HPV.

The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, $V = 296.50$, $z = -4.36$, $p < .001$ (Appendix L). For the pretest, the most frequently observed response to the statement "Likelihood of getting genital warts is high if I am not vaccinated against HPV" was Agree ($n = 37$, 37%). For the posttest, the most frequently observed response was Agree ($n = 66$, 65%). Frequencies and percentages are presented in Table 9 (Appendix L).

Likelihood of getting HPV related cancer is high if I am not vaccinated against HPV.

The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, $V = 213.50$, $z = -4.28$, $p < .001$ (Appendix L). For the pretest, the most frequently observed response to the statement "Likelihood of getting HPV related cancer is high if I am not vaccinated against HPV" was Slightly Agree ($n = 36$, 36%). For the posttest, the most frequently observed response was Agree ($n = 61$, 60%). Frequencies and percentages are presented in Table 9 (Appendix L).

Health Belief: Perceived Severity

HPV infection is a serious disease that can affect my military readiness.

The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, $V = 127.00$, $z = -3.34$, $p < .001$ (Appendix L). For the pretest, the most frequently observed response to the statement "HPV infection is a serious disease that can affect my military readiness" was Agree ($n = 62$, 61%). For the posttest, the most frequently observed response was Agree ($n = 80$, 79%). Frequencies and percentages are presented in Table 9 (Appendix L).

HPV infection can cause death.

The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, $V = 335.50$, $z = -2.13$, $p = .033$ (Appendix L). For the pretest, the most frequently observed response for the statement "HPV infection can cause death" was Agree ($n = 51$, 50%). For the posttest, the most frequently response was Agree ($n = 68$, 67%). Frequencies and percentages are presented in Table 9 (Appendix L).

HPV infection would threaten a relationship with my partner.

The results of the two-tailed Wilcoxon signed rank test were not significant based on an alpha value of 0.05, $V = 56.00$, $z = -1.33$, $p = .183$ (Appendix L). For the pretest, the most frequently observed response to the statement of "HPV infection would threaten a relationship with my partner" was Agree ($n = 72$, 71%). For the posttest, the most frequently observed response was Agree ($n = 77$, 76%). Frequencies and percentages are presented in Table 9 (Appendix L).

The thought of HPV infection scares me.

The results of the two-tailed Wilcoxon signed rank test were not significant based on an alpha value of 0.05, $V = 249.50$, $z = -0.57$, $p = .571$ (Appendix L). For the pretest, the most frequently observed response to the statement "The thought of HPV infection scares me" was Agree ($n = 53$, 52%). For posttest, the most frequently observed response was Agree ($n = 57$, 56%). Those disagreeing with this statement increased from 9% ($n = 9$) to 13% ($n = 13$) respectively. Frequencies and percentages are presented in Table 9 (Appendix L).

Health Belief: Perceived Barriers

I doubt that the HPV vaccine is safe and effective.

The results of the two-tailed Wilcoxon signed rank test were not significant based on an alpha value of 0.05, $V = 284.00$, $z = -0.80$, $p = .426$ (Appendix L). For the pretest, the most frequently observed response to the statement "I doubt that the HPV vaccine is safe and effective" was Disagree ($n = 47$, 47%). For the posttest, the most frequently observed response was Disagree ($n = 60$, 59%). Frequencies and percentages are presented in Table 9 (Appendix L).

Possible side effects of HPV vaccination make me worry.

The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, $V = 273.00$, $z = -3.34$, $p < .001$ (Appendix L). For the pretest, the most frequently observed response to the statement "Possible side effects of HPV vaccination make me worry" was Slightly Disagree ($n = 29$, 29%). For the posttest, the most frequently observed response was Disagree ($n = 48$, 48%). Frequencies and percentages are presented in Table 9 (Appendix L).

Vaccine Intention

A two-tailed Wilcoxon signed rank test was conducted to examine whether there was a significant difference between pretest and posttest HPV vaccine intention question "Do you intent to get the HPV vaccine?" Questionnaires were excluded if the participant answered "I already have the HPV vaccine series" to the question. Only questionnaires that answered "Yes" or "No" were included in the data analysis (n = 76). The results of the two-tailed Wilcoxon signed rank test were not significant based on an alpha value of 0.05, V = 20.00, z = -0.33, p = .739, presented in Table 10 (Appendix M). From pretest to posttest vaccine intention increased from 62% (n = 63) to 66% (n = 67). Frequencies and percentages for vaccine intention responses are presented in Table 11 (Appendix M).

Vaccine Recommendation

A two-tailed Wilcoxon signed rank test was conducted to examine whether there was a significant difference between pretest and posttest HPV vaccine recommendation question "Will you recommend the HPV vaccine to other service members to improve their military readiness?" Responses to the question included "Yes," "No," or "I don't know." The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, V = 12.50, z = -4.49, p < .001, presented in Table 12 (Appendix M). From pretest to posttest, vaccine recommendations increased from 62% (n = 63) to 81% (n = 82) respectively. Frequencies and percentages for the vaccine recommendation responses are presented in Table 13 (Appendix M).

Vaccine Uptake

Vaccine uptake was an indirect measure of the project. Pre-intervention and post-intervention HPV vaccination rates for all active duty service members assigned to the military base were collected from the ASIMS database. Descriptive statistics were used to analyze the

data. Summary statistics were calculated for age. Frequencies and percentages were calculated for branch of service, HPV vaccine dose series, and HPV vaccine status.

From pre-intervention to post-intervention data collection the most frequently observed branch of service was Air Force 95% (n = 1974) and 96% (n = 1994), respectively and is presented in Table 14 (Appendix N). The average age of service members pre-intervention was 22.29 (SD = 1.85, Min = 17.00, Max = 25.00, Mode = 21.00). The average post-intervention age was 22.27 (SD = 1.86, Min = 18.00, Max = 25.00, Mode = 21.00). Summary statistics for age are presented in Table 15 (Appendix N).

HPV Vaccine Dose Series

The HPV vaccine series is classified as zero doses, one dose, two doses, and three doses. Service members with zero doses have never had the HPV vaccine. Service members with one dose have started the vaccine series, and those that three doses have completed the vaccine series.

When comparing the pre-intervention and post-intervention HPV vaccine dose series, service members with zero doses of the HPV vaccine decreased from 38% to 36%, respectively. Those that had at only one dose of the HPV vaccine was decreased slightly from 28% to 26%. Service members with two doses of the HPV vaccine increased from 15% to 17%. Service members that had all three doses increased from 19% to 21%. This data conveys that during the intervention period more service members received the HPV vaccine that already had at least one dose of the vaccine. Frequencies and percentages are presented in Table 14 (Appendix N).

HPV Vaccine Status

HPV vaccine status in ASIMS is reported as due, overdue, current, unknown, or exempt. Due and overdue vaccine statuses were combined for data analysis. Due status represents that the

service member that already had one or two doses of the HPV vaccine and is due for their next dose. Current status represents service members that have one, two, or three doses of the HPV, and has either completed the vaccine series or is not yet due for the second or third dose. Unknown status represents service members that have no record of receiving a dose of the HPV vaccine in their military health record. Exempt status represents service members have been exempt from receiving the HPV vaccine.

When comparing the pre-intervention and post-intervention HPV vaccine status, service members that were due for their next HPV vaccine dose decreased from 35% (*n* = 731) to 32% (*n* = 669) respectively. Service members that were current on the HPV vaccine series increased from 27% (*n* = 552) to 32% (*n* = 667) respectively. Those that received a HPV vaccine dose during the intervention period would be classified as current because they would not yet be due for their next dose or they would have completed the vaccine series. This data is the closest measurement to vaccine uptake. Service members with an unknown HPV vaccine status decreased from 35% (*n* = 723) to 33% (*n* = 680). This data conveys that service members that were either due for their next dose of the HPV vaccine or those that had never received a dose of HPV increased uptake of the vaccine which may have increased those classified as current. This data is represented in the bar graph in Figure N1 (Appendix N). Frequencies and percentages are presented in Table 14 (Appendix N).

Discussion

Total HPV knowledge scores significantly increased ($p < .001$), from pretest to posttest. The average pretest score was 3.00, indicating that service members had some knowledge of HPV prior to receiving the education. Knowledge scores increased after watching the video (M = 4.39), which indicated that the video was successful in increasing their knowledge on HPV.

Continued use of the video is recommended among military service members to improve HPV knowledge.

There were some limitations in the ability to directly track HPV vaccine uptake in those who attended the intervention. The only way to track vaccine status was to use the ASIMS vaccine tracking system that was already established. Unfortunately, there is no way to determine those who participated in intervention actually received the HPV vaccine. The data collection from ASIMS represents service member that are assigned to the base and are registered at the MTF. The data could be misrepresented because during the intervention period its possible service members could have changed stations that did not have the HPV vaccine or newly assigned service members could already have the HPV vaccine, or vice versa. However, a 5% (n = 115) increase on current HPV vaccine status could also be correlated with the number service members that attended the intervention, (N = 116) or were recommended to get the vaccine from a service member that attended the intervention.

All domains of health beliefs regarding HPV and HPV vaccination improved. Service members perceived benefits of the HPV vaccine and perceived susceptibility of contracting HPV were the lowest health belief domains in the pretest. Their perceived benefit and perceived susceptibility also improved the greatest percentage points after watching the education video. This data suggests that service members have lower perceived benefits to HPV vaccination and lower perceived susceptibility to HPV, which may be hindering their likelihood of receiving the HPV vaccine. The intervention greatly improved their perceptions on benefits and susceptibility which may eventually increase HPV vaccination for service members over time.

Service members perceived severity of HPV also improved, but their pretest scores were higher than the benefits and susceptibility domains. This indicates that service members already

had a higher-level perceived severity of HPV before watching the education video. This data suggests that service members already know the seriousness HPV and how it might affect life, military readiness, relationships, and their emotions.

Service members perceived barriers to HPV vaccination decreased. In the pretest, half of the service members reported that possible side effects the of HPV vaccine were worrisome, and 40% of participants were still concerned about vaccine side effects after watching the education video. This data suggested that more education needs to be provided to service members to address their concerns about vaccine side effects to decrease their barriers to vaccination.

Prior to the intervention, service members reported a high percentage for vaccine intention (62%) and recommendation (62%). Vaccine intention did increase slightly, although not statistically significant ($p = .739$). The education video significantly increased service members willingness to recommend the HPV vaccine ($p < .001$) to other service members to improve their military readiness represented in Table 12 (Appendix M). The video could be used to educate senior officers and enlisted service members to increase HPV vaccine recommendation by the chain of command (COC). Buechel and Connelly (2018), reported that service members were more likely to receive the HPV vaccine if they believed their COC recommended it. Military members are trained to respect individuals with authority and those superiors to them. Individuals in the military may act on certain behavior choices base on their COC recommendations (Buechel & Connelly, 2018).

The evidence-based practice education video could be implemented at annual military training to address a wider audience of service members and not just those newly assigned to the military base. The video could also be uploaded online to and already existing in the military education webpage, such as Joint Knowledge Online or My Navy Portal. This could improve

knowledge, health beliefs, vaccine recommendation, and potentially vaccine uptake among all service members on the base.

Establishing a program or patient reminder system to help maintain HPV vaccination schedules could assist service members in completing their HPV series. Because the HPV vaccine is optional, military treatment facilities do not send out patient reminders to notify the service member they are due for their second or third dose of the vaccine. Many individuals only receive their first dose of the HPV vaccine, which does not provide complete protection against the virus. Military units should consider participating in immunization days with allotted time off work or are assigned times to go to the immunization clinic to receive their HPV vaccine (similar to what they do for flu vaccines every year). MTFs should consider a mobile immunization clinic to deliver vaccines at the unit's workplace and provide the vaccine onsite to increase series adherence and allow for readability to service members.

Service members need to be healthy to perform their military duties. Service members experience high levels of stress on a daily basis because they are expected to work long hours, be physically fit, be deployed for months at a time, and are commonly separated from their families. Becoming infected with a vaccine preventable disease that could cause cancer decades later only adds to their existing adversities that they are dealing with.

This topic is important for health professions because there is a need to improve education being provided to adults about the HPV vaccine. Healthcare providers can benefit from education about best practices in discussing the HPV vaccine with adults. A search for continuing education resources did not produce an online training product that focuses on strategies to increase the HPV vaccine uptake among adults educating healthcare providers that care specifically for that age group .

The current body of literature primarily focuses on adolescence vaccine uptake because routine HPV vaccination occurs at age 11 and 12. There are few resources for guidance on increasing HPV vaccination uptake among adults serving in the military. The body of evidence suggests that there needs to be more research that includes this population to identify interventions that could increase HPV vaccine uptake or vaccine adherence among adults. There is a need for more evidence to support the best ways to increase HPV vaccine uptake among civilian and military adults. Additionally, there are few campaigns or patient education training offerings that focus on HPV vaccination for adults and those who serve in the military.

Leaders in the military and the Department of Defense should strongly consider a policy reform to include the current ACIP recommendations on the HPV vaccination. The current policy does not mandate active duty service members to receive the HPV vaccine (Buechel, 2018; Daly et al., 2018; Wedel et al., 2016). The high prevalence rates of HPV among service members and low vaccination rates indicate the need for a change in the current policy (Buechel, 2018). Buechel (2018), recommends making the HPV vaccination mandatory among service members. Mandating the HPV vaccination for service members could increase health promotion, military readiness, and decrease the rates of HPV among military service members.

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Appendix A

Table 1

Evaluation Table

Citation	**Theory/ Conceptual Framework**	**Design/ Method/ Purpose**	**Sample/Setting**	**Major Variables Studied and Definitions**	**Measurement/ Instrumentation**	**Data Analysis**	**Findings/ Results**	**Level of evidence/ Decision for Use/Application to Practice**
Chang et al., (2013). Effect of an educational intervention on HPV knowledge and vaccine attitudes among urban employed women and female undergraduate students in Chine: a cross-sectional study **Country:** China, USA	Health Belief Model	**Design:** Multi-center, cross-sectional, pre-post-test design. **Purpose:** Assess HPV and HPV vaccine knowledge, and to evaluate the effect of a brief educational intervention on HPV knowledge and vaccine acceptability in Chinese undergraduate students and employed women.	N= 1703 **Demographics:** Employed F: 1146 Undergraduate F students: 557. **Setting:** 5 representative cities of 5 main GRs of China. 6 comprehensive universities and 16 companies. **Inclusion:** Women, employed or undergraduate students. **Exclusion:** Not specified.	**IV1:** Employed F **IV2:** Undergraduate F student **IV3:** HPV Education – 1 hour group lecture **DV1:** Pre-intervention HPV-related knowledge **DV2:** Post-intervention HPV-related knowledge **DV3:** Attitudes/Accepta	62 item, multiple choice questionnaire Questions included HPV related knowledge, and attitude/acceptability of HPV vaccine. Questionnaire was given to both groups pre- and post-intervention.	EpiData 3.1 database manager SPSS software version 18.0 Chi-square or F-test, multivariate analysis, logistic regression, odd-ratios based on Wald Chi-square	**DV1:** Baseline HPV LOK was low in both groups. HPV LOK did not differ significantly across GRs (p>0.05). **DV2:** Both groups had significant LOK increases. Among employed F, HPV causing cervical cancer LOK increased 4.2 times (x^2=1041.8, p <0.001), and 7 times for undergraduate F students (x^2=287.5, p<0.001). HPV Diseases and risk LOK increased significantly for both groups. For example, ability to identify vaccination prior to sexual debut increased significantly in both	**LOE: III** **Strengths:** Relatively large population sampled across 5 main GR of mainland China, populations used have not been surveyed before, findings consistent with previous studies. **Weaknesses:** Cross sectional design, strength of causality is limited by absence of a control group, no scale applied to assess validity of the questionnaire, higher education levels of participants may not be indicative of the entire Chinese population. **Application:** Can be used to measure the effects on LOK after a group receives an educational based intervention on the HPV

Key: **ANCOVA-**analysis of covariance; **ANOVA-** analysis of variance; **CDC-**Center for Disease Control and Prevention; **CI-**confidence interval; **CG-**control group; **CS-**convenience sample; **CSS-**cross-sectional survey; **CR-**completion rate; **DV-**dependent variable; **F-** female; **GR-**geographic region; **HPV-** human papillomavirus; **IG-**intervention group; **IMB-**information-motivation-behavioral; **IV-**independent variable; **LOK-** level of knowledge; **M-** male; **MANCOVA-** multivariance analysis of covariance; **N-** number of participants; **n-**subset; **NP-**nurse practitioner; **RCT-**randomized control trial; **SD-**standard deviation; **SPSS-** Statistical Package for the Social Sciences; **VI-**vaccine initiation; **VR-**vaccination rate; **YGBM-** young gay and bisexual men; **YO-**year-old.

Funding: Not specified, supported by Fogarty International Center, National Institutes of Health Office, Office of AIDS Research, National Cancer Center, National Heart, Blood, and Lung Institute, and NIH Office of Research for Women's Health **Bias:** None identified.			**Attrition:** Post-intervention analysis: 1061 for employed F, and 325 undergraduate F students were used due to incomplete questionnaires.	bility of HPV vaccine			groups (x^2= 79.6, p<0.001) **DV3:** Willingness to receive HPV increased significantly in both groups: employed F: 77% to 90%, undergraduate students 73% to 82% (p<0.01). Willingness to vaccinate children among employed increased significantly 44% to 81% (x^2= 261.7, p <0.001)	vaccine and how it effects peoples acceptability and attitudes towards the vaccine.
Citation	**Theory/ Conceptual Framework**	**Design/ Method/ Purpose**	**Sample/Setting**	**Major Variables Studied and Definitions**	**Measurement/ Instrumentation**	**Data Analysis**	**Findings/ Results**	**Level of evidence/ Decision for Use/Application to Practice**

Key: **ANCOVA-**analysis of covariance; **ANOVA-** analysis of variance; **CDC-**Center for Disease Control and Prevention; **CI-**confidence interval; **CG-**control group; **CS-**convenience sample; **CSS-**cross-sectional survey; **CR-**completion rate; **DV-**dependent variable; **F-** female; **GR-**geographic region; **HPV-** human papillomavirus; **IG-**intervention group; **IMB-**information-motivation-behavioral; **IV-**independent variable; **LOK-** level of knowledge; **M-** male; **MANCOVA-** multivariance analysis of covariance; **N-** number of participants; **n**-subset; **NP-**nurse practitioner; **RCT-**randomized control trial; **SD-**standard deviation; **SPSS-** Statistical Package for the Social Sciences; **VI-**vaccine initiation; **VR-**vaccination rate; **YGBM-** young gay and bisexual men; **YO-**year-old.

Gerend et al., (2013). Increasing HPV Vaccine Acceptability by Tailoring Messages to Young Adult Women's Perceived Barriers **Country:** USA **Funding:** National Cancer Institute of the National Institutes of Health **Bias:** None recognized.	Health Belief Model	**Design:** Randomized Pre-post test with control group. **Purpose:** To investigate whether tailoring intervention materials to women's perceived variables would increase their interest in receiving the HPV vaccine.	N= 94 IG= 45 CG= 49 **Demographics:** F age – 18 to 26. Multiple ethnic and racial groups. **Setting:** A southeastern university. **Inclusion:** F age – 18 to 26, received no doses of HPV vaccine, not currently pregnant. **Attrition:** Not specified.	**IV1:** Tailored Messages **IV2:** Nontailored messages **DV1:** Perceived Barriers to HPV Vaccination **DV2:** HPV awareness and knowledge **DV3:** HPV Vaccination Intentions **DV4:** Evaluations of Health Information	Pre-post test was utilized with questions that address the listed DVs. Questions included HPV related knowledge, perceived barriers to HPV, sexual history, HPV Vaccine Intentions, and Evaluations of Health Information. For the tailored group, education on specific barriers were based on those chosen by the participants. The control group was given standard information from CDC website.	SPSS version 19 T test, x2 analyses, mixed-factor-design analysis of variance, parital η^2 is measure of effect size. All tests were 2 tailed.	**DV1**: 3 most common barriers analyzed. Adverse affects of HPV Vaccine most common. CG, 74% compared to IG, 36%: x^2 (1, N=94) = 13.64, $P < 0.001$. **DV2**: Significant increase for both groups pre test (mean [SD], 4.99 [2.22]) and post test (mean [SD], 8.23 [1.20]; F1, 92 = 216.71; $P <$ 0.001; partial -η^2 = .702) **DV3:** HPV VI increased both groups ($F_{1, 90}$= 54.63, P<0.001, partial η^2=0.378). Greater in IG (P < 0.001, partial η^2= 0.316) than CG (P<0.001, partial η^2=0.138). **DV4:** CG and IG did not differ significantly. IG perceived information to be more personalized (mean[SD], 3.96[0.88]) and relevant (mean[SD], 4.40[0.75]) than CG (mean[SD], 3.39[1.10; t_{92}=-2.76; P=0.007] and 4.04 [0.91; t_{92}=-2.07, P=0.041], respectively).	**LOE:** II **Strengths:** Tailored messages directly addressed perceived barriers of HPV vaccine, barriers reported were consistent with previous studies, study suggests the importance of individualized messages rather than generic, one-size-fits-all information. **Weaknesses:** Small sample size, participants recruited from a convenience sample of women attending college, the primary outcome variable was HPV VI instead of behavior. **Application:** Findings demonstrate promising evidence of the effectiveness of tailoring HPV vaccination messages in young women. Due to few interventions being tested, this shows a promising was forward to increase vaccination rate.

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Hopfer, Suellen (2012). Effects of a Narrative HPV Vaccination Intervention Aimed at Reaching College Women: A Randomized Control Trial. **Country:** USA **Funding:** CDC **Bias:** None recognized.	Social Cognitive Theory. Exemplification Theory. Culture-centric narrative theory.	**Design:** Four-arm RCT. **Purpose:** To increase HPV vaccination and to support theoretical predictions about message source.	N= 404 CG= 152 IG Peer= 101 IG Peer & Provider= 101 IG Provider= 50 **Demographics:** F age – 18 to 26. Multiple ethnic and racial groups. **Setting:** One university. **Inclusion:** F age – 18 to 26. **Exclusion**: Already vaccinated. **Attrition:** Not specified.	**IV1:** Control Group; general HPV knowledge, information video about narratives, or no message **IV2:** Peer delivered vaccine decision narratives. **IV2:** Medical provider delivered vaccine decision narratives **IV3:** Combination of peer and medical provider delivered vaccine decision narratives **DV1:** HPV Vaccination **DV2:** HPV Vaccine Intention and Self-Efficacy	A post-intervention survey asked their intent and vaccine self-efficacy. A follow-up email was given 2 months after the intervention to measure HPV vaccination.	Logistics regression, structural equation modeling using Mplus 5.21, Fill information maximum likelihood (FIML) method.	**DV1**: Peer & Provider group twice as likely to vaccinate compare to control (OR=2.07; 95% CI=1.05, 4.10; p=.036). Peer only and expert only showed no increase. **DV2**: Peer & Provider group significantly increased vaccination (γ = .590, p<.000) via self-efficacy (γ = .263, p<.000) and intent (γ = .480, p<.000), while the peer-only (γ = .116, p<.057) and the expert-only (γ = -.089, p<.100) did not.	**LOE: II** **Strengths:** RCT. **Weaknesses:** Measured only VI, not completion of HPV vaccine series. Ages limited to college aged females, largely Caucasian. Prior HPV diagnosis information was not collected. Provider-only intervention was shorter in length. **Application:** Shows that peer-provider intervention can increase HPV vaccination. Shows a low-cost intervention to increase HPV vaccination.

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Kester et al., (2013). The effects of a brief educational intervention on human papillomavirus knowledge and intention to initiate HPV vaccination in 18-26 year old young adults. **Country:** USA **Funding:** GlaxoSmith Kline	Health Belief Model	**Design:** RCT **Purpose:** To evaluate the effects of a brief educational intervention on HPV LOK and HPV Vaccination Intent among young adults, 18-26 years of age within a minority community health setting fair.	N= 131 CG= 63 IG= 68 **Demographics:** M and F age – 18 to 26. 77% non-Hispanic Black, 11% non-Hispanic White, and the rest various ethnic groups. 70% F, 30% M. **Setting:** 27th annual INShape Black and Minority Health Fair. **Inclusion:** Ages 18 to 26. **Exclusion**: Not specified.	**IV1:** CG; survey completed prior to education intervention. **IV2:** IG; survey completed after education intervention. **DV1:** HPV LOK **DV2:** HPV Vaccine Intention**,** for those who have not initiation vaccine (n = 79).	Survey that included socio-demographics, healthcare utilization, physician discussion and recommendation of HPV vaccine. There were 15 LOK questions and also questions on HPV vaccine history and intent.	ANOVA, binary logistic regression	**DV1:** IG (M = 9.1; SD = 1.8) higher LOK than CG (M = 7.0;SD = 2.9; F(df = 1) = 22.5, p < .001). **DV2:** IG significantly higher (86%) compared to CG (67%) (OR = 3.09; 95%CI = 1.02-9.36; p < 0.05).	**LOE: II** **Strengths:** RCT. Results similar to studies done previously. **Weaknesses:** Relatively small sample size. Convenience sample of mostly Black, female young adults, sample may not be representative of population. Only measured intent, not vaccination. **Application:** Demonstrates that direct provision of information about HPV and HPV vaccination may be a simple and effective way to motivate young adults to seek or initiate HPV vaccination.

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Bias: None recognized.			**Attrition:** Not specified.					
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Krawczyk et al., (2012). How to Inform: Comparing Written and Video Education Interventions to Increase Human Papillomavirus Knowledge and Vaccination Intentions in Young Adults **Country:** Canada **Funding:** Canadian Institutes of Health Research (CIHR)	Health Belief Model	**Design:** Randomized Pre-posttest with control group. **Purpose:** To compare efficacy of 2 HPV educational interventions on increasing HPV knowledge and vaccination intentions in college students.	N= 200 CG= 65 IG Video= 74 IG Written= 61 **Demographics:** M (N=60), F (N=140). Various ethnicities, undergraduate students. Mean age = 20.4, high socioeconomic status. **Setting:** A university in Montreal, Quebec, Canada. **Inclusion:** Not specified. **Exclusion**: Already received HPV Vaccine.	**IV1:** Control Group; education pamphlet on general cancer prevention **IV2:** IG Video – 5 minute video on HPV vaccine susceptibility, severity, benefits of vaccination, perceived barriers, and cues to action. **IV3:** IG Written– A pamphlet on HPV vaccine susceptibility, severity, benefits of vaccination, perceived barriers, and cues to action. **DV1:** HPV LOK	Online questionnaire pre and post-intervention. Included sociodemographic data and questions regarding heath and sexual history. Asked if participant intends to get the HPV vaccine. Awareness measured by 2 questions. LOK assessed on 22-item scale.	SPSS 16.0. Descriptive statistics, ANOVA, Post hoc Turkey's honestly significant difference tests.	**DV1:** Significant time by group interactive effect ($p < .001$), with post hoc Turkey's tests found both IG written (M_{pre}=10.48, SD=4.86, M_{post}=17.46, SD=2.09) and IG video (M_{pre}=11.49, SD=4.25, M_{post}=16.70, SD=2.19) increased LOK, and CG no significant change (M_{pre}=10.89, SD=4.15, M_{post}=12.06, SD=4.15). Also overall IGs scores were higher. No statistical difference between IGs. **DV2:** Significant effect between time and group ($p < .01$), with post hoc Turkey's tests found both IG written (M_{pre}=3.52, SD=1.94, M_{post}=4.57, SD=1.90) and video intervention (M_{pre}=3.14, SD=1.85, M_{post}=4.39, SD=1.86)	**LOE: II** **Strengths:** RCT. Evidence-based. **Weaknesses:** High socioeconomic status of participants, participants were self-selected, post-intervention questionnaire was given immediately after, limited long-term effects. **Application:** Demonstrates that both video and written education on HPV are both effective. Also proves that written was just as effective as a video, which shows the validity of a written pamphlet, which is a cost-effective educational method.

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Bias: None recognized.			**Attrition:** Not specified.	**DV2:** HPV Vaccine Intention			increased vaccine intention, and CG no significant change (M_{pre}=3.51, *SD*=1.90, M_{post}=3.88, *SD*=1.77). Also overall IGs scores were higher. No statistical difference between IGs.	
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Li et al., (2015). Effect of a group educational intervention on rural Chinese women's knowledge and attitudes about HPV and HPV vaccines. **Country:** China **Funding:** Bill and Melinda Gates Foundation	Health Belief Model	**Design:** Questionnaire-based, cross-sectional study. Participants randomly chosen from 22 randomly selected villages. **Purpose:** To assess short-term effectiveness of a hospital-based, brief, HPV-focused session on rural Chinese women's knowledge and attitudes.	N= 913 **Demographics:** F aged 25-64. Han ethnicity. Majority married and only primary or middle school education. **Setting:** Local hospital, Yangcheng county, Shanxi Province, China. **Inclusion:** Women 25-65 YO **Exclusion:** Pregnant women, history of Cervical Intraepithelial	**IV1:** HPV Education – group education on PPT, approximately 40 minutes long. **DV1:** HPV LOK and Awareness **DV2:** Attitude about HPV Vaccination	Pre and post HPV questionnaire that asked questions regarding LOK and attitude toward HPV.	SAS statistical software version 9.1. Descriptive statistics, frequency calculations, Student's *t*-test, Chi-squared test or Fisher's exact tests, two-tailed tests with α level of 0.05	**DV1:** HPV awareness increased from 5.9% to 59%, *P*<0.001. Higher educated women had higher LOK, and younger women understood associations between HPV and cervical cancer better. LOK better among higher education and younger age (*P*<0.05). **DV2:** 82% were willing to vaccinate their daughters, 80.3% themselves prior to education. Both numbers rose to 88% post-intervention. No significant statistical change.	**LOE: III** **Strengths:** No other study completed focusing on changing low HPV awareness in rural China. **Weaknesses:** Baseline knowledge of HPV was not assessed, only awareness. Only used healthcare provider education, no other sources. Study took place in one rural area, may not represent general Chinese population. No match control group. Only a short-term study, with no long-term outcomes. **Application:** Verifies that the short-term effectiveness of a one-time brief group

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Bias: None recognized.			Neoplasia, cervical cancer, or hysterectomy, mentally or physically competent to give informed consent. **Attrition:** Not specified.					education intervention provided in a hospital environment appears to be valid in raising awareness among Chinese women from rural China.
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McRee et al., (2018). Outsmart HPV: Acceptability short-term effects of a web-based HPV vaccination intervention for young adult gay and bisexual men **Country:** USA **Funding:**	Protection-Motivation theory	**Design:** Randomized Pre-posttest with control group. **Purpose:** To report on a brief, web-based HPV intervention acceptability by YGBM and its short-term effects on HPV vaccination knowledge, attitudes, and beliefs.	N= 141 CG= 73 IG= 68 **Demographics:** M aged 18-25, gay or bisexual, various ethnicities **Setting:** Internet, residing within the U.S. **Inclusion:** M aged 18-25, resided in U.S., gay or bisexual **Exclusion**: Already received	**IV1:** CG – Standard HPV information from Vaccine Information Statement from CDC. **IV2:** IG – Outsmart HPV web-based content, targeted (YGBM) individually tailored content on HPV and HPV vaccination. **DV1:** HPV LOK	Pre- and posttest survey. LOK measured with 5 true/false statements, Likert-type responses measured severity and likelihood of getting HPV-related disease, perception of HPV vaccine effectiveness, perceived barriers, and HPV vaccine harms, HPV vaccine intention, self-	Stata version 14.0 Chi-square test, independent sample *t*-tests, linear regression, Cohen's *d*, two-tailed tests with α level of 0.05	**DV1:** No significant difference between CG and IG. Overall high LOK about HPV and HPV Vaccine. **DV2:** Greater intention to get vaccinated for IG (4.04 vs. 3.82, $b = 0.26$, $p<.10$, $d = 0.21$). **DV3:** IG lower perceived harms (3.75 vs. 4.05, $b = -0.34$, $p<.05$, d = -0.23). IG higher perceived risk of anal cancer among men who have sex with men (4.38 vs. 4.10, $b=0.34$, $p<.05$, $d=0.30$).	**LOE: II** **Strengths:** Rigorous randomized control design. National sample similar in demographic and health-related characteristics to YGBM in other studies. **Weaknesses:** Short-term effects, not know if they will be maintained over time, or if actual HPV uptake occurs. Recruiting only took place on one platform, Facebook. **Application:** First study to demonstrate the acceptability and short-term effects of a web-based HPV vaccination intervention for

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National Cancer Institute of the National Institutes of Health **Bias:** None recognized.			any dose of HPV Vaccine. **Attrition:** Began with 150 participants, 141 completed both surveys.	**DV2:** HPV Attitudes **DV3:** HPV Beliefs	efficacy, and social/community norms.			YGBM. Findings support continued efforts to pursue population-targeted, individually-tailored and web-based strategies to address the low levels of HPV vaccine uptake among YGBM and other priority populations at increased risk of either HPV-related disease or undervaccination.
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Mehta et al., (2013). Designing and Evaluating a Health Belief Model-Based Intervention to Increase Intent of HPV Vaccination among College Males **Country:** USA	Health Belief Model	**Design:** Randomized Pre-posttest with control group. **Purpose:** To develop and evaluate a Health Belief Model-based intervention to increase vaccination in college men.	N= 90 CG= 45 IG= 45 **Demographics:** M aged 18-25, various ethnicities, largely Caucasian. Majority heterosexual, various ages, majority single. **Setting:** Large Midwestern University **Inclusion:** M aged 18-25, English speaking,	**IV1:** CG – HPV education intervention regarding infection and vaccine. **IV2:** IG – Health Belief Model based educational approach and HPV education intervention **DV1:** HPV Perceptions **DV2:** Self-efficacy	Two hour educational sessions including PowerPoint, discussion, and videos were completed with a pre-test and post-test. A follow-up test was administered within 1 to 3 months. Due to attrition, data analysis did not include follow-up. For the information group, the survey based on Health Belief Model	IBM-SPSS 19.0. Descriptive statistics, repeated measures ANOVA, and regression analysis.	**DV1:** Significantly improved for IG, for perceived susceptibility (p=.000), benefits (p=.000), barriers (p=.000), and severity (p=.000). **DV2:** Significantly improved for IG, self-efficacy (p=.000). **DV3:** Significantly improved for IG, cues to action (p=.001). **DV4:** No significant results found. **DV5:** IG had higher intent to vaccinate (p=.002).	**LOE: II** **Strengths:** RCT. Intervention was effective and theory based. Intervention can be replicated on a large scale. **Weaknesses:** Attrition at follow-up, population only included one set of students at one university and may not be representative of other colleges, most participants were heterosexual, demographics between groups were different. **Application:** This study proved that is in important

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Funding: Merck Sharp & Dohme Corp. **Bias:** None recognized.			healthy, undergraduate and graduate students at large Midwestern university. **Exclusion**: Already received any dose of HPV Vaccine. **Attrition:** 16 out of 90 (17.8%) complete the follow-up test, 1 to 3 months after the study.	**DV3:** Cues to action **DV4:** HPV LOK **DV5:** HPV Vaccine Intention	was determined to be reliable and valid.			to not only education, but also engage participants with role plays, discussions, and brainstorming sessions using a theoretical model like the Health Belief model can help them grasp the concepts.
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Mora et al., (2018). Effectiveness of an Educational Intervention to Increase HPV Knowledge in High-Risk Minority Women	The Carolina HPV immunization attitudes and beliefs scale (CHIAS)	**Design:** Pre-post-test design. **Purpose:** To evaluate HPV and cervical cancer knowledge in a population at risk for cervical cancer and to determine whether	N= 122 **Demographics:** F aged 21-71, majority minority ethnicities, low socioeconomic status, and no college education. **Setting:** John H. Stroger Hospital of Cook	**IV1:** Participants – receiving 4-minute educational video. **DV1:** HPV LOK **DV2:** HPV acceptability	Prospective pre-post survey design consisting of baseline, immediate post, and final follow-up surveys. A 4 minute education video was used and created by PowerPoint. LOK was adapted and	SAS version 9.4 Summary statistics, paired *t* test, sensitivity analyses. *P* value of 0.05 or less considered significant.	**DV1:** Baseline score mean (SD) 9.6 (3.8). Postintervention score mean (SD) 14.1(3.7)(p<.001). Follow-up score mean (SD) 13.5(4.2). **DV2:** Baseline, 47% would receive HPV vaccine. Post-intervention, 76% (p<.0001). HPV	**LOE: III** **Strengths:** Sampling from an understudied diverse population, knowledge assessment at follow-up to assess knowledge retention over time. **Weaknesses:** Study was not randomized, education intervention required literacy, high attrition in

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Country: USA **Funding:** Women's Health Research & Quality Collaborative of Cook County **Bias:** None recognized.		knowledge and attitudes towards HPV vaccination improve after educational intervention.	County, Chicago, Illinois **Inclusion:** Abnormal pap test. F aged 18 and older, speak English or Spanish. **Exclusion**: Those that do not speak English or Spanish. **Attrition:** 104 out of 122 completed both pre- and posttest. 44 out of 104 participants completed the follow-up survey.		consisted of 20 multiple-choice questions. Participants were asked 10 unscored items about their attitudes, beliefs, and concerns about HPV, cervical cancer, and vaccination using a Likert scale. Medical history, demographic, and health literacy questions were asked.		acceptability for children of grandchildren, baseline, 30.8%, post-intervention, 71.2% (p<.001). Not statistically significant for follow-up.	follow-up. Vaccine acceptability was used as a surrogate marker for vaccination and study did not actually measure vaccination. **Application:** This study proved the need for widespread education programs for HPV and cervical cancer and that simple education interventions are effective in populations of low socioeconomic backgrounds and low level of education.
Citation	**Theory/ Conceptual Framework**	**Design/ Method/ Purpose**	**Sample/Setting**	**Major Variables Studied and Definitions**	**Measurement/ Instrumentation**	**Data Analysis**	**Findings/ Results**	**Level of evidence/ Decision for Use/Application to Practice**
Perez et al., (2016). A brief information – motivation – behavioral skills intervention to promote HPV	IMB Model	**Design:** Randomized Pre-post-test design, with follow-up. **Purpose:** To explore the utility of an IMB skills	N= 70 **Demographics:** F aged 18-26, two-thirds Caucasian, high family income, various years in school.	**IV1:** IMG IG – HPV specific information **IV2:** Attention Group (CG) – general women's health education **DV1:** Knowledge	Participants participated in a questionnaire (test) pre- and post-intervention as well as 4 weeks later. Both groups received material in a group setting.	SPSS Version 20.0 Descriptive statistics, chi-square test/Fisher's exact tests, sample *t*-test, ANCOVA,	**DV1:** No baseline difference between IG and CG. IG had significantly higher post-test (M=16.43 vs M=14.86; P=0.03) and 1 month (M=16.85 vs M=14.77; P<0.001).	**LOE: II** **Strengths:** Randomized control study. One of the first studies to explore potential impact of a theory-based model in effecting changes in vaccine uptake among a high-risk population. Findings are

Key: **ANCOVA-**analysis of covariance; **ANOVA-** analysis of variance; **CDC-**Center for Disease Control and Prevention; **CI-**confidence interval; **CG-**control group; **CS-**convenience sample; **CSS-**cross-sectional survey; **CR-**completion rate; **DV-**dependent variable; **F-** female; **GR-**geographic region; **HPV-** human papillomavirus; **IG-**intervention group; **IMB-**information-motivation-behavioral; **IV-**independent variable; **LOK-** level of knowledge; **M-** male; **MANCOVA-** multivariance analysis of covariance; **N-** number of participants; **n-**subset; **NP-**nurse practitioner; **RCT-**randomized control trial; **SD-**standard deviation; **SPSS-** Statistical Package for the Social Sciences; **VI-**vaccine initiation; **VR-**vaccination rate; **YGBM-** young gay and bisexual men; **YO-**year-old.

vaccination among college-aged women **Country:** USA **Funding:** Internal funds. **Bias:** None recognized.		intervention in promoting HPV vaccination knowledge, motivation, and intentions among college-aged women.	**Setting:** Major state university. **Inclusion:** F aged 18-26, enrolled in a Introductory Psychology course at a major state university. **Exclusion**: Student who received all 3 doses of HPV vaccine. **Attrition:** 70 women participated, 62 completed the 1 month survey.	**DV2:** Motivation **DV3:** Intentions	The IG group received specific material regarding HPV, and the CG received information on broad women's health topics.	MANCOVA, post hoc independent sample *t*-test, pairwise *t*-test.	**DV2:** IG had more increase in reported motivation from baseline to post-test (P=0.008) and from baseline to 1 month (P=0.04). IG and CG showed similar declines at 1 month. **DV3:** IG had greater increasing in vaccine intentions from baseline to post-test (P<0.001); however they showed greater decreases at 1 month (P=0.006). No significant difference vaccine uptake at 1 month (P=0.89).	consistent with current research. **Weaknesses:** Convenience sample, limited in generalizability and may not reflect views of other women. Excluded men. Small sample size **Application:** This study proved that an IMB-based model may provide universities with a powerful strategy to motivate women to get vaccinated.

Key: **ANCOVA-**analysis of covariance; **ANOVA-** analysis of variance; **CDC-**Center for Disease Control and Prevention; **CI-**confidence interval; **CG-**control group; **CS-**convenience sample; **CSS-**cross-sectional survey; **CR-**completion rate; **DV-**dependent variable; **F-** female; **GR-**geographic region; **HPV-** human papillomavirus; **IG-**intervention group; **IMB-**information-motivation-behavioral; **IV-**independent variable; **LOK-** level of knowledge; **M-** male; **MANCOVA-**multivariance analysis of covariance; **N-** number of participants; **n**-subset; **NP-**nurse practitioner; **RCT-**randomized control trial; **SD-**standard deviation; **SPSS-**Statistical Package for the Social Sciences; **VI-**vaccine initiation; **VR-**vaccination rate; **YGBM-** young gay and bisexual men; **YO-**year-old.

Appendix B

Table 2

Synthesis Table

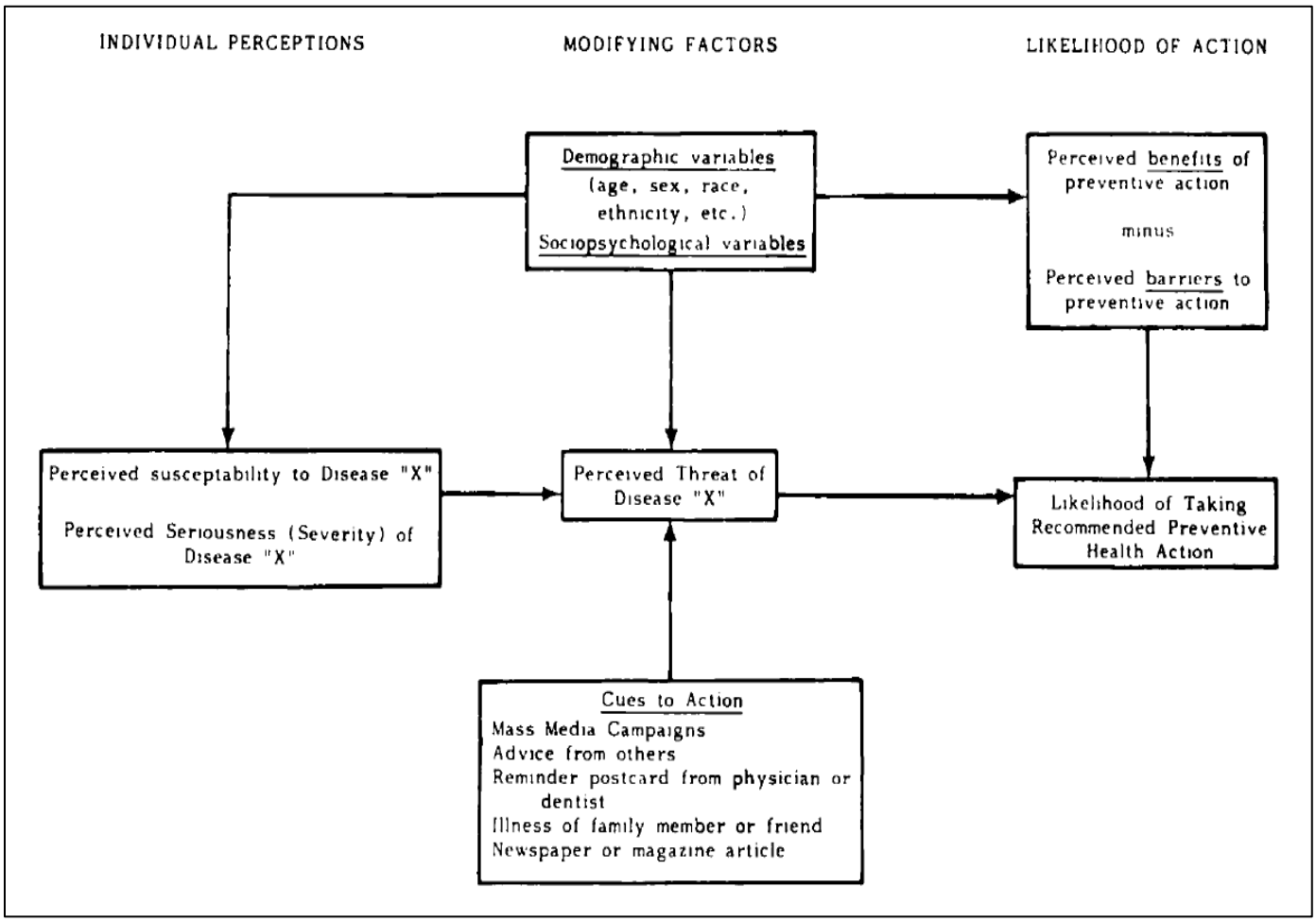
Studies		Chang et al.	Gerend et al.	Hopfer	Kester et al.	Krawczyk et al.	Li et al.	McRee et al.	Mehta et al.	Mora et al.	Perez et al.
Basics	Year	2013	2013	2012	2014	2012	2015	2018	2013	2018	2016
	LOE	III	II	II	II	II	III	II	II	III	II
	Design	QE	RCT	RCT	RCT	RCT	QE	RCT	RCT	QE	RCT
	Sample	1386	94	404	131	200	913	150	90	104	62
	Age	19-47	18-26	18-26	18-26	~20.4	25-64	18-25	18-25	21-71	18-26
	Gender	F	F	F	F, M	F, M	F	M	M	F	F
Education Interventions	Group Lecture	X			X		X		X		X
	Tailored Written Material		X								
	Written Material					X					
	Video			X		X				X	
	Tailored Web Base							X			
	Outcome Measurement	PPT	PPT	PPTFU	PT	PPT	PPT	PPT	PPTFU	PPTFU	PPTFU
Major findings	HPV Knowledge	↑	↑		↑	↑ both	↑	↑	↑	↑	↑
	Vaccine Intention		↑	↑	↑ for UV	↑ both	↑	↑	↑		↑
	Vaccine Acceptability	↑							↑	↑	
	Vaccine Initiation			↑							
	Vaccine Efficacy			↑							

Key: **F**-female; **HPV**- human papillomavirus; **M**-male; **PT**- post test; **PTT**- pre/post test; **PTTFU**- pre/post test, follow up; **QE**-quasi-experimental; **RCT**-randomized control trial; **UV**- unvaccinated; ↑-increase.

Appendix C

Figure C1

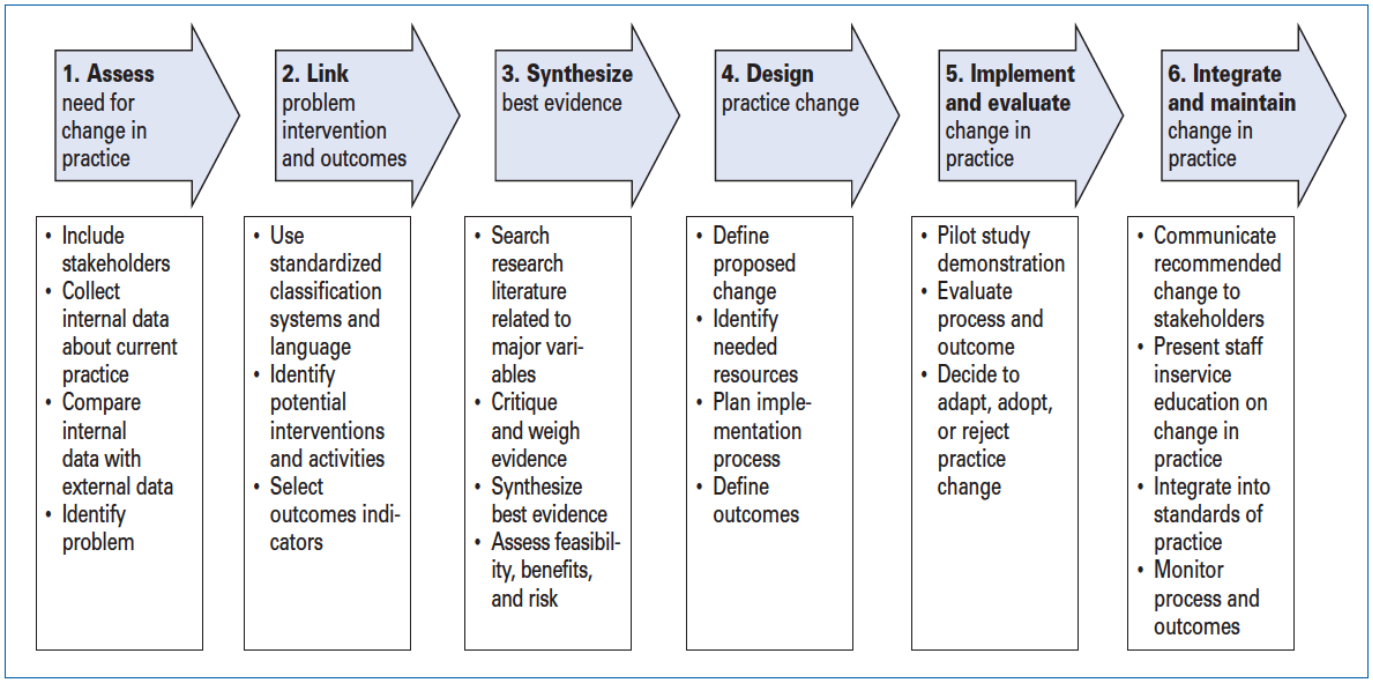
Health Belief Model



Appendix D

Figure D1

A Model for Evidence-Based Practice



Appendix E

Figure E1

Pre-test Questionnaire

Dear Participant,

This form was prepared to evaluate your knowledge about the Human Papillomavirus (HPV), health beliefs about HPV, and HPV vaccination. Your answers are very important and will help to improve HPV vaccination services to military service members and their families. Therefore, it is very important to answer honestly and to not change your answers to this pre-video questionnaire after watching the HPV video. Thank you for your participation in the project.

PRE-VIDEO QUESTIONNAIRE

1. Age:
   _____
2. Gender:
   a. Male
   b. Female
3. Ethnicity:
   a. Non-Hispanic White
   b. Non-Hispanic Black
   c. Hispanic
   d. Asian/ Pacific Islander
   e. Other/Unknown
4. Branch of Service:
   a. Air Force
   b. Army
   c. Navy
   d. Marine Corps
   e. Other: _____
5. Pay Grade/Rank:
   _____
6. HPV is related to the development of six types of cancer.
   a. True
   b. False
   c. I don't know
7. HPV can infect the oral cavity and genitals.
   a. True
   b. False
   c. I don't know
8. Condoms prevent HPV infection.
   a. True
   b. False
   c. I don't know
9. A person can be infected with HPV and have no symptoms.
   a. True
   b. False
   c. I don't know
10. The HPV vaccine will prevent 9 types of HPV.
    a. True
    b. False
    c. I don't know

PLEASE CIRCLE THE NUMBER THAT MATCHES YOUR AGREEMENT TO EACH STATEMENT	Disagree	Slightly Disagree	Slightly Agree	Agree
11. HPV vaccine can prevent genital warts.	1	2	3	4
12. HPV vaccine can prevent cancer in both men and women.	1	2	3	4
13. I trust the safety and efficacy of the HPV vaccine.	1	2	3	4
14. Likelihood of getting genital warts is high if I am not vaccinated against HPV.	1	2	3	4
15. Likelihood of getting HPV related cancer is high if I am not vaccinated against HPV.	1	2	3	4
16. HPV infection is a serious disease that can affect my military readiness.	1	2	3	4
17. HPV infection can cause death.	1	2	3	4
18. HPV infection would threaten a relationship with my partner.	1	2	3	4
19. The thought of HPV infection scares me.	1	2	3	4
20. I doubt that the HPV vaccine is safe and effective.	1	2	3	4
21. Possible side effects of HPV vaccination make me worry.	1	2	3	4

22. Have you had all three doses of your HPV vaccine?
    a. Yes
    b. No
    c. I don't know
23. Do you intend to get the HPV vaccine?
    a. Yes
    b. No
    c. I already have the HPV vaccine series
24. Will you recommend the HPV vaccine to other service members to improve their military readiness?
    a. Yes
    b. No
    c. I don't know

Appendix F

Figure F1

Post-test Questionnaire

DO NOT BEGIN UNTIL INSTRUCTED TO DO SO

POST-VIDEO QUESTIONNAIRE

1. HPV is related to the development of six types of cancer.
   a. True
   b. False
   c. I don't know
2. HPV can infect the oral cavity and genitals.
   a. True
   b. False
   c. I don't know
3. Condoms prevent HPV infection.
   a. True
   b. False
   c. I don't know
4. A person can be infected with HPV and have no symptoms.
   a. True
   b. False
   c. I don't know
5. The HPV vaccine will prevent 9 types of HPV.
   a. True
   b. False
   c. I don't know
6. Do you intend to get the HPV vaccine?
   a. Yes
   b. No
   c. I already have the HPV vaccine series
7. Will you recommend the HPV vaccine to other service members to improve their military readiness?
   a. Yes
   b. No
   c. I don't know

PLEASE CIRCLE THE NUMBER THAT MATCHES YOUR AGREEMENT TO EACH STATEMENT	Disagree	Slightly Disagree	Slightly Agree	Agree
8. HPV vaccine can prevent genital warts.	1	2	3	4
9. HPV vaccine can prevent cancer in both men and women.	1	2	3	4
10. I trust the safety and efficacy of the HPV vaccine.	1	2	3	4
11. Likelihood of getting genital warts is high if I am not vaccinated against HPV.	1	2	3	4
12. Likelihood of getting HPV related cancer is high if I am not vaccinated against HPV.	1	2	3	4
13. HPV infection is a serious disease that can affect my military readiness.	1	2	3	4
14. HPV infection can cause death.	1	2	3	4
15. HPV infection would threaten a relationship with my partner.	1	2	3	4
16. The thought of HPV infection scares me.	1	2	3	4
17. I doubt that the HPV vaccine is safe and effective.	1	2	3	4
18. Possible side effects of HPV vaccination make me worry.	1	2	3	4

Appendix G

Table 3

Budget

Category	Activities	Cost	Organization Expenses	In-Kind Expenses	Personal Expenses
Personnel	Project Director DNP Student June 2019 to May 2020	$40/hr 9hrs a week for 11 months		$15840	
	Project Mentor- Dr. Link	$65/hr 2hrs a week for 11 months		$5720	
	Project Site Champion	$42/hr 1hr a week for 6 months		$1092	
Materials & Supplies	Microsoft PowerPoint Software- To creating the HPV education video for service members	$129.99			*$0
	License for background music in video	$29 for 3 Songs			$29
	HPV Vaccine *Indirect Cost	$130 per vaccine ~52 vaccines	$6,750		
	Projector to present education video	$200	*$0		
	Room utilization for HPV education presented during “Medical Right Start”	$35 for 30min	*$0		
	Printed pre-test and post-test evaluation	$0.08 per side ~600x2	$96		
Introduction and Conclusion of Project to Staff	Project introduction meeting in 3 Departments (room utilization)	$35 for 30min per clinic	*$0		
	Project completion report, meeting in 3 Departments (room utilization)	$35 for 30min per clinic	*$0		
Evaluation	Web base military readiness tracking system-ASIMS	*Unable to determine	*$0		
	SPSS software	$99 per month			*$0
		Total Project Cost	**Organization $6,846**	**In-Kind $22,652**	**Personal $29**

Appendix H

Budget Justification

1. Personnel
    a. Project Director- The DNP student designs an evidence-based practice project, applies for IRB, implements the project, evaluates data, and provides recommendation for integrating and maintaining the intervention.
    b. Project Mentor- Provides guidance to project director.
    c. Project Site Champion- A leader within the organization that support the evidence-based practice project. They are available as a resource for staff and ensure compliance with the intervention.
2. Education Intervention: Materials & Supplies
    a. PowerPoint will be the method of creation and delivery for service member education. *Microsoft PowerPoint software is available free of charge to graduate student through Arizona State University.
    b. The HPV vaccine will be administered as a result of the service member education intervention. There are currently 1,376 active duty service members at project site's base that need at least one dose of the HPV vaccine. The estimated costs are an assumption that there will be a 10 percent increase (52 service members) in the amount of service members that receive the first dose of the vaccine series. This cost is subject to change based on uptake of the HPV vaccine.
    c. Presentation projector is already purchased and used for the "Medical Right Start" briefing and no additional cost will incur for using the projector to present the patient education.
    d. Pre-test and post-test questionnaires will be used to evaluate presented education. The pre-test, post-test questionnaire will consist one sheet of paper with double-sided printing. The pretest questionnaire will be printed on the front of the paper and post-test questionnaire on the back of the paper. An estimate of 50 service members attending medical right start, every Tuesday for three months approximates 600 copies of questionnaires required.
    e. Room utilization for patient education presentation. Patient education about HPV vaccination will be delivered at "Medical Right Start" briefing every Tuesday. *This briefing already occurs weekly and no additional cost will incur for delivering the education during this time.
3. Staff Education for Introduction and Conclusion to Project
    a. Room utilization for project introduction. The evidence-based practice project will be introduced in the following department staff meeting rooms: Public Health, Patient Education, and Immunizations. *The three clinics already have a room available for staff meetings and can be used at no cost.
    b. Room utilization for project conclusion. The evidence-based practice project will be introduced in the following department staff meeting rooms: Public Health, Patient Education, and Immunizations. *The three clinics already have a room available for staff meetings and can be used at no cost.
4. Evaluation
    a. Web base military readiness tracking system-ASIMS. ASIMS is a web-based application that provides the Air Force with the capability to track medical

readiness. ASIMS tracking system is paid for by the U.S Air Force and no addition costs will be incurred for using this system.

b. SPSS Software is necessary to run the data analysis. The latest is available at no cost to graduate students through Arizona State University.

5. Funding
    a. There is no external funding sources for this project
    b. The organization costs are estimated to be $6,846.
    c. Personal expenses for the projected director are estimated at $29.
    d. In-kind expenses for the project are estimated at $22,652.
6. Potential Benefits/Cost Savings
    a. Increased rates of HPV vaccination among military service members can promote military readiness because HPV related illnesses can impact a service member's ability to perform their military duties.
    b. The HPV vaccine could provide a preventive measure to reduce costs associated with treatment of genital warts and cancer caused from HPV.
    c. Long-term outcomes of the interventions would include a decrease in diagnosis of HPV of among service members, decrease in HPV related cancer in service members, decrease in costs associated with HPV treatment, and fewer healthcare appointments associated with HPV.

Appendix I

Table 4

Frequency Table for Demographic Characteristics (N=116)

Variable	*n*	*%*
Gender		
Female	25	21.55
Male	91	78.45
Ethnicity		
Asian/Pacific Islander	9	7.76
Hispanic	10	8.62
Non-Hispanic Black	15	12.93
Non-Hispanic White	72	62.07
Other/Unknown	10	8.62
Service		
Air Force	116	100
Rank		
E1	3	2.59
E2	8	6.90
E3	60	51.72
E4	14	12.07
E5	8	6.90
E6	9	7.76
E7	6	5.17
E8	1	0.86
O1	4	3.45
O2	2	1.72
O3	1	0.86
HPV Vaccine Status		
I don't know	65	57.52
No	24	21.24
Yes	24	21.24

Note. Due to rounding errors, percentages may not equal 100%.

Appendix J

Table 5

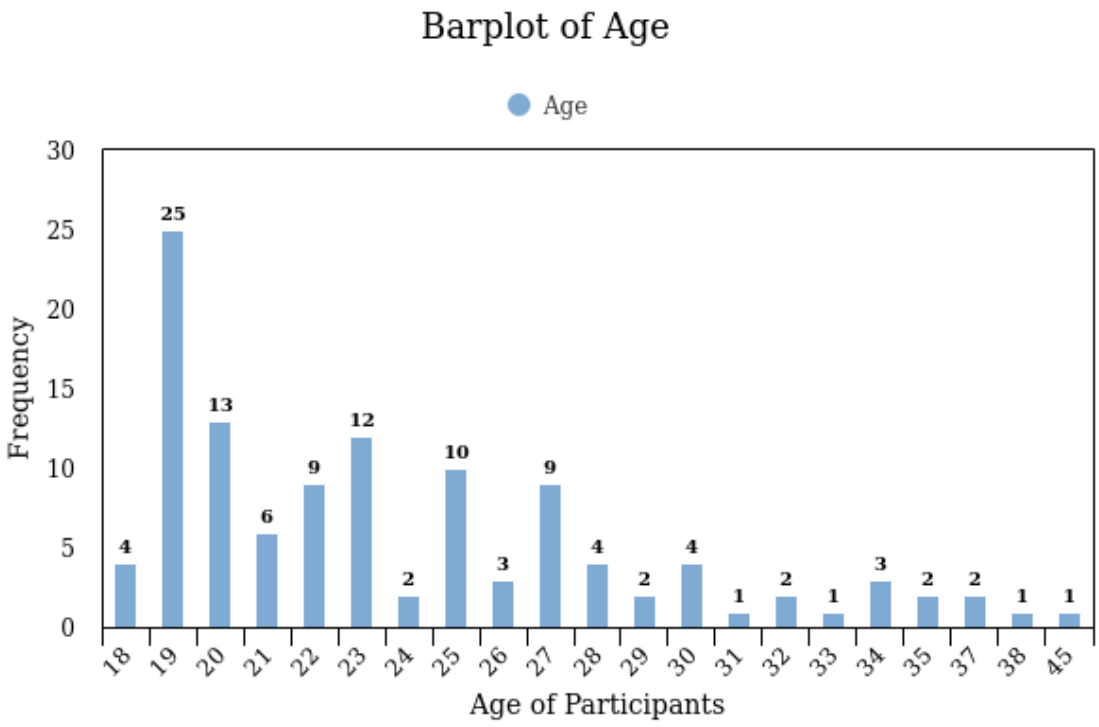
Summary Statistics Table for Age (N=116)

Variable	*M*	*SD*	*n*	Min	Max	*Mdn*	Mode
Age	23.91	5.29	116	18.00	45.00	23.00	19.00

Note. '-' denotes the sample size is too small to calculate statistic.

Figure J1

Barplot of Participants Age



Appendix K

Table 6

Two-Tailed Paired Samples t-Test for the Difference Between Pretest and Posttest HPV Knowledge Scores

PreTest		PostTest				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
3.00	1.44	4.39	0.77	-9.31	< .001	0.93

Note. n = 101. Degrees of Freedom for the *t*-statistic = 100. *d* represents Cohen's *d.*

Figure K1

Pretest and Posttest HPV Knowledge: Mean Scores

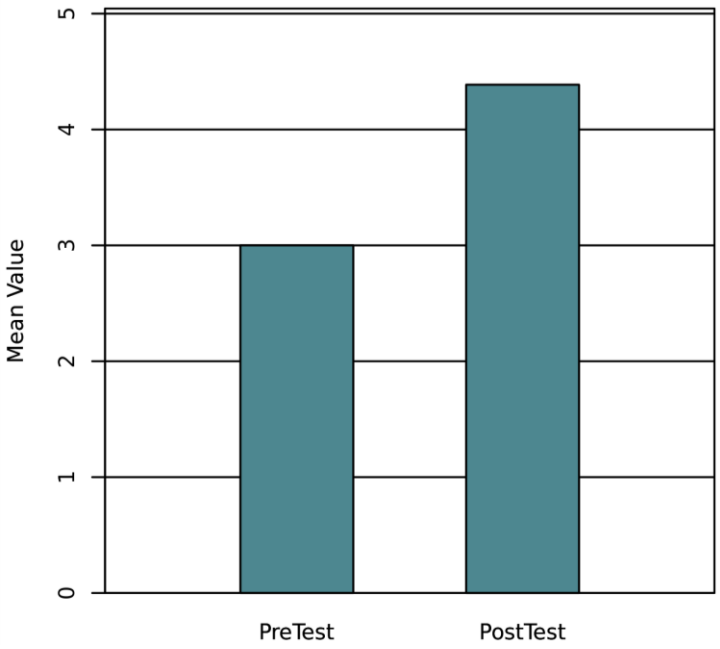


Table 7

Summary Statistics Table for HPV Knowledge Score

Variable	*M*	*SD*	*n*	Min	Max	*Mdn*	Mode
HPV Knowledge Score							
Pre	3.00	1.44	101	0.00	5.00	3.00	3.00
Post	4.39	0.77	101	0.00	5.00	4.00	5.00

Appendix L

Table 8

Pretest Posttest Analysis of Health Beliefs Regarding HPV and HPV Vaccination (n=101)

Health Beliefs	*Z* (*p*)
Perceived Benefits	
1. HPV vaccine can prevent genital warts	-5.95 (< .001)
2. HPV vaccine can prevent cancer in both men and women	-6.58 (< .001)
3. I trust the safety and efficacy of the HPV vaccine	-5.48 (< .001)
Perceived Susceptibility	
4. Likelihood of getting genital warts is high if I am not vaccinated against HPV	-4.36 (< .001)
5. Likelihood of getting HPV related cancer is high if I am not vaccinated against HPV	-4.28 (< .001)
Perceived Severity	
6. HPV infection is a serious disease that can affect my military readiness	-3.34 (< .001)
7. HPV infection can cause death	-2.13(.033)
8. HPV infection would threaten a relationship with my partner	-1.33 (.183)
9. The thought of HPV infection scares me	-0.57 (.571)
Perceived Barriers	
10. I doubt that the HPV vaccine is safe and effective	-0.80 (.426)
11. Possible side effects of HPV vaccination make me worry	-3.34 (< .001)

HPV: human papillomavirus; Z: Wilcoxon signed rank

Table 9

Frequency Table for Health Beliefs (n=101)

Variable	Pre	Post
Perceived Benefits		
1. HPV vaccine can prevent genital warts		
Disagree	20 (20%)	4 (4%)
Slightly Disagree	10 (10%)	1 (1%)
Slightly Agree	42 (42%)	21 (21%)
Agree	29 (29%)	75 (74%)
2. HPV vaccine can prevent cancer in both men and women		
Disagree	23 (23%)	2 (2%)
Slightly Disagree	13 (13%)	3 (3%)
Slightly Agree	34 (34%)	15 (15%)
Agree	29 (29%)	81 (80%)
3. I trust the safety and efficacy of the HPV vaccine		
Disagree	10 (10%)	2 (2%)
Slightly Disagree	11 (11%)	6 (6%)
Slightly Agree	37 (37%)	21 (21%)
Agree	43 (43%)	72 (71%)
Perceived Susceptibility		
4. Likelihood of getting genital warts is high if I am not vaccinated against HPV		
Disagree	9 (9%)	2 (2%)
Slightly Disagree	26 (26%)	14 (14%)
Slightly Agree	29 (29%)	19 (19%)
Agree	37 (37%)	66 (65%)
5. Likelihood of getting HPV related cancer is high if I am not vaccinated against HPV		
Disagree	8 (8%)	5 (5%)
Slightly Disagree	22 (22%)	7 (7%)
Slightly Agree	36 (36%)	28 (28%)
Agree	35 (35%)	61 (60%)

Table continues on next page.

Variable	Pre	Post
Perceived Severity		
6. HPV infection is a serious disease that can affect my military readiness		
Disagree	4 (4%)	2 (2%)
Slightly Disagree	7 (7%)	4 (4%)
Slightly Agree	28 (28%)	15 (15%)
Agree	62 (61%)	80 (79%)
7. HPV infection can cause death		
Disagree	6 (6%)	6 (6%)
Slightly Disagree	12 (12%)	6 (6%)
Slightly Agree	32 (32%)	21 (21%)
Agree	51 (50%)	68 (67%)
8. HPV infection would threaten a relationship with my partner		
Disagree	5 (5%)	4 (4%)
Slightly Disagree	6 (6%)	4 (4%)
Slightly Agree	18 (18%)	16 (16%)
Agree	72 (71%)	77 (76%)
9. The thought of HPV infection scares me		
Disagree	9 (9%)	13 (13%)
Slightly Disagree	17 (17%)	8 (8%)
Slightly Agree	22 (22%)	23 (23%)
Agree	53 (52%)	57 (56%)
Perceived Barriers		
10. I doubt that the HPV vaccine is safe and effective		
Disagree	47 (47%)	60 (59%)
Slightly Disagree	33 (33%)	18 (18%)
Slightly Agree	11 (11%)	10 (10%)
Agree	10 (10%)	13 (13%)
11. Possible side effects of HPV vaccination make me worry		
Disagree	22 (22%)	48 (48%)
Slightly Disagree	29 (29%)	13 (13%)
Slightly Agree	24 (24%)	19 (19%)
Agree	26 (26%)	21 (21%)

Appendix M

Table 10

Significance Table for HPV Vaccine Intention (n = 76)

HPV Vaccine Intention	*Z*(*p*)
Do you intend to get the HPV vaccine?	-0.33 (.739)

HPV: human papillomavirus; Z: Wilcoxon signed rank

Table 11

Frequency Table for HPV Vaccine Intention (n=101)

Variable	Pre	Post
HPV Vaccine Intention		
Yes	63 (62%)	67 (66%)
No	17 (17%)	15 (15%)
I already have the HPV vaccine	21 (21%)	19 (19%)

Table 12

Significance Table for HPV Vaccine Recommendation (n = 101)

Vaccine Recommendation	*Z*(*p*)
Will you recommend the HPV vaccine to other service members to improve their military readiness?	-4.49 (< .001)

HPV: human papillomavirus; Z: Wilcoxon signed rank

Table13

Frequency Table for HPV Vaccine Recommendation (n=101)

Variable	Pre	Post
HPV Vaccine Recommendation		
Yes	63 (62%)	82 (81%)
No	5 (5%)	2 (2%)
I don't know	33 (33%)	17 (17%)

Appendix N

Table 14

Frequency Table for MTF HPV Vaccine Uptake

Variable	Pre-Intervention	Post-Intervention
Branch of Service		
Air Force	1974 (95%)	1994 (96%)
Army	54 (3%)	45 (2%)
Navy	45 (2%)	42 (2%)
HPV Vaccine Status		
Current	552 (27%)	667 (32%)
Due	731 (35%)	669 (32%)
Unknown	723 (35%)	680 (33%)
Exempt	67 (3%)	65 (3%)
HPV Vaccine Dose Series		
0	790 (38%)	745 (36%)
1	588 (28%)	551 (26%)
2	302 (15%)	352 (17%)
3	393 (19%)	433 (21%)

Table 15

Summary Statistics Table for Pre/Post Intervention Age

Variable	*M*	*SD*	*n*	Min	Max	*Mdn*	Mode
Age							
Pre-Intervention	22.29	1.85	2073	17.00	25.00	22.00	21.00
Post-Intervention	22.27	1.86	2081	18.00	25.00	22.00	21.00

Figure N1

MTF HPV Vaccine Status for Active Duty Service Members