

HPV IMMUNIZATION: REDUCING MISSED OPPORTUNITIES THROUGH ENHANCED
PROVIDER KNOWLEDGE AND COMMUNICATION STRATEGIES

A Dissertation
Submitted to the Graduate Faculty
of the
North Dakota State University
of Agriculture and Applied Science

By

Carly Joy Hanson

In Partial Fulfillment of the Requirements
for the Degree of
DOCTOR OF NURSING PRACTICE

Major Department:
Nursing

April 2019

Fargo, North Dakota

North Dakota State University
Graduate School

Title

HPV IMMUNIZATION: REDUCING MISSED OPPORTUNITIES
THROUGH ENHANCED PROVIDER KNOWLEDGE AND
COMMUNICATION STRATEGIES

By

Carly Joy Hanson

The Supervisory Committee certifies that this *disquisition* complies with North Dakota
State University's regulations and meets the accepted standards for the degree of

DOCTOR OF NURSING PRACTICE

SUPERVISORY COMMITTEE:

Dr. Allison Peltier, DNP, FNP-C

Chair

Dr. Dean Gross, PhD, FNP-C

Dr. Lisa Montplaisir, PhD

Dr. David Muhs, MD

Approved:

April 8, 2019

Date

Dr. Carla Gross, PhD, RN

Department Chair

ABSTRACT

The purpose of the project was to increase healthcare professionals' knowledge regarding HPV, the vaccine, and communication strategies to improve vaccine acceptance. In addition, the purpose was to increase healthcare professionals' level of comfort in using the communication strategies discussed. The project was also designed to reduce HPV vaccination rates of missed opportunities and increase overall HPV vaccination coverage. The rates of HPV vaccination coverage are significantly lower than other adolescent vaccines. There has been minimal research on the impact of an educational intervention in rural areas. A literature review was performed prior to project design and implementation, which revealed the significance of providing healthcare professional education.

An educational intervention was performed in two rural family practice clinics in North Dakota. Post-test questionnaires were collected to evaluate healthcare professional knowledge and comfort using a 5-point Likert scale. HPV vaccination and missed opportunity rates were monitored for two months before and after the intervention. The results of the questionnaire revealed an average Likert score of 3.97 for increased understanding of HPV, the vaccine, and communication strategies. The average Likert score for increased comfort with the new communication strategies was 4.06. The number of missed opportunities at routine exams, including well child and physical exams, was reduced from 32 in the two months prior to implementation of the educational intervention to only 17 in the two months after implementation at one of the rural clinics. No change was noted in overall HPV vaccination rates or missed opportunities. In conclusion, further research is needed to understand the type of education required for reduced HPV vaccination rates and sustainability. Continued research should also evaluate the impact of a multifaceted approach to improve HPV vaccination rates.

ACKNOWLEDGEMENTS

This clinical dissertation and entire process would not have been possible without the help and support from several important people and organizations. First, I would like to recognize the contributions, guidance, and support of my committee chairperson, Dr. Allison Peltier. She has dedicated countless hours toward this project and its success. Her encouragement and passion for healthcare and teaching have been truly inspiring. None of this would have been possible without her. The example she set as a researcher, mentor, and teacher will impact me as a future nurse practitioner always.

Next, I would like to thank my clinical dissertation committee members: Dr. Dean Gross, Dr. Lisa Montplaisir, and Dr. David Muhs. Your time, feedback, and support have been greatly appreciated. It was a pleasure working with such a wonderful committee. I would also like to thank Ms. Loretta Askew for her support and helping me navigate the clinical dissertation process.

I would also like to thank Sanford Health Jamestown Clinic and Sanford Health Valley City Clinic for allowing me to conduct my practice improvement project with you. It was a pleasure working with each of these facilities. I especially want to thank Ms. Yvonne McGregor, Dr. Sarah Schatz, Ms. Wendy Hager, Ms. Andrea Polkinghorn, Ms. Kate Steinke, Ms. Damaris Qual, Ms. Valarie Storbeck, Ms. Sarah Tulp, Ms. Melodi Krank, and all of those who participated in this research. Each one of you made so many contributions to my work. Thank you for helping to make this project possible. In addition to Sanford Health staff, I would like to thank the North Dakota Department of Health for their encouragement, support, and statistics.

Fourth, I would like to thank my classmates and professors at NDSU. It takes a village to successfully navigate the journey of a clinical dissertation project. Thank you to each of my

classmates for the care and smiles along the way, especially my Bismarck classmates who were there every week and in between. I would also like to thank my Advisor, Adam Hohman for encouraging me to pursue my passion on HPV vaccination and education, as well as the incredible clinical experience in Haiti, which further inspired my passion for HPV research. I would like to thank my clinical preceptors, as well. I would especially like to thank Taryn Boom, APRN for all of the support, guidance, and encouragement during these last three years.

I would like to thank my family: my husband, children, parents, siblings, in-laws, and grandmothers. Each of you have been monumental in my ability to complete this clinical dissertation project. I would also like to thank my friends for your continued support, smiles, and insights along the way. Kim and Ashley, thank you for believing in me through it all. What is life without a little balance and spice? I would like to thank my coworkers at the Sanford Health Jamestown Clinic. I appreciate the encouragement these last three years.

Lastly, I would like to thank God for giving me the strength to survive this project and the faith to see it through to the end. Completing this Doctor of Nursing Practice clinical dissertation project was not an easy task but was possible due to this strength. Thank you to everyone.

“At times, our own light goes out and is rekindled by a spark from another person. Each of us has cause to think with deep gratitude of those who have lighted the flame within us.”

– Albert Schweitzer

DEDICATION

I dedicate this dissertation to my family, Jeremy, Vianne, and Henry.

“Family isn’t defined only by last names or by blood; it’s defined by commitment and by love. It means showing up when they need it most. It means having each other’s backs. It means choosing to love each other even on those days when you struggle to like each other. It means never giving up on each other.” – Dave Willis

TABLE OF CONTENTS

ABSTRACT	iii
ACKNOWLEDGEMENTS	iv
DEDICATION	vi
LIST OF TABLES	xi
LIST OF FIGURES	xii
CHAPTER 1. INTRODUCTION	1
Background and Significance	1
CHAPTER 2. REVIEW OF LITERATURE	4
HPV Epidemiology	4
Pathophysiology	5
Complications	5
HPV Vaccine	8
Vaccine History	9
Vaccine Recommendations	9
Efficacy	10
Safety and Adverse Events	11
Vaccination Coverage	13
National Vaccination Coverage	13
State Vaccination Coverage	14
County Vaccination Coverage	15
Coverage Variables	17
Required Vaccination Comparison Data	17
Barriers of HPV Vaccination Coverage	18
HPV Vaccination Myths & Parental Concerns	19

Lack of Parental Knowledge.....	22
Lack of Provider Support.....	24
Missed Opportunities	28
Lack of Follow-Up.....	29
Improving HPV Immunization Acceptance	30
Communication Strategies	30
Appointment Scheduling	33
Education	34
Theoretical Framework.....	34
Theory for Practice	35
Model	37
Conclusion	40
CHAPTER 3. PROJECT DESCRIPTION	41
Congruence with the Organization’s Strategic Plan	41
Project Objectives	42
Project Design.....	42
Resources	45
Protection of Human Subjects	46
CHAPTER 4. EVALUATION	48
Evaluation Methods	48
Objective One	49
Objective Two.....	50
Objective Three.....	50
CHAPTER 5. RESULTS	54
Presentation of Results.....	54

Demographics	54
Objective 1	55
Objective 2	57
Objective 3	66
CHAPTER 6. DISCUSSION & RECOMMENDATIONS	68
Interpretation of Results.....	68
Post-test Results	68
Missed Opportunity Results.....	69
State & County Rate Comparison.....	70
Limitations	71
Recommendations.....	73
Implications for Practice.....	74
Implications for Future Research.....	76
Application to Other DNP Roles	78
REFERENCES	79
APPENDIX A. IRB EXEMPT APPROVAL LETTER	94
APPENDIX B. EDUCATIONAL PRESENTATION.....	95
APPENDIX C. CONDENSED EDUCATIONAL PRESENTATION	101
APPENDIX D. TRANSCRIPTION OF HPV RECOMMENDATION VIDEOS	107
Video Clip 1: Dr. Alix Casler describes how she recommends HPV vaccine	107
Video Clip 2: Dr. Wolynn discusses how his office routinely recommends HPV vaccine	108
Video Clip 3: Talking with parents who decline HPV vaccine.....	108
APPENDIX E. HEALTHCARE PROFESSIONAL INVITATION EMAIL	110
APPENDIX F. POST-TEST QUESTIONNAIRE.....	112
APPENDIX G. HANDOUTS PROVIDED AT EDUCATIONAL INTERVENTION	113

APPENDIX H. EXECUTIVE SUMMARY..... 118

 Background..... 118

 Project Summary..... 119

 Results..... 119

 Recommendations..... 120

APPENDIX I. CENTER FOR DISEASE CONTROL AND PREVENTION —
PERMISSION TO USE..... 122

APPENDIX J. NORTH DAKOTA DEPARTMENT OF HEALTH — PERMISSION TO
USE..... 123

APPENDIX K. WOLTERS KLUWER HEALTH LICENSE — PERMISSION TO USE..... 124

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Practice Improvement Project Objectives and Assessment Questions	52
2. Sanford Jamestown Missed Opportunities for HPV Vaccination.....	59

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. Human papillomavirus (HPV) vaccination coverage among adolescents 13-17 years by state, HHS region, and the United States, National Immunization Survey-Teen (NIS-Teen), 2008 through 2016. Reproduced from CDC, 2018b.	15
2. Adolescent HPV Immunization Rates Years 13-17. Reproduced from the North Dakota Department of Health and the North Dakota Immunization Information System (2018).	16
3. Healthcare professionals' level of experience.	55
4. Responses to post-test questions 1-4. Evaluation of objective 1.	57
5. Percentage of missed opportunities for HPV vaccination at the Sanford Jamestown Clinic.	58
6. Percentage of missed opportunities before and after at Sanford Jamestown.	60
7. Sanford Jamestown HPV vaccination monthly coverage percentages.	63
8. Sanford Valley City HPV vaccination monthly coverage percentages.	64
9. Percentage of attributed patients seen at Sanford Jamestown and Sanford Valley City.	65
10. Percentages of increased understanding from healthcare professionals post-intervention.	66
11. Percentage of increased comfort for healthcare professionals post-intervention.	67

CHAPTER 1. INTRODUCTION

Background and Significance

Every year in the United States (U.S.), over 30,000 people are diagnosed with human papillomavirus (HPV)-related cancers (Center for Disease Control and Prevention [CDC], 2016a). HPV is a sexually transmitted infection with over 150 different serotypes of the virus, which is estimated to infect 14 million people each year in the U.S. This adds to the growing number of almost 80 million people who are currently infected with at least one strain of HPV.

With these statistics in mind, it is vital to understand the complications of an HPV infection. Most HPV infections clear without the need for treatment; however, some infections last longer and are linked with serious complications. Cervical, vaginal, vulvar, penile, anal, and oropharyngeal cancers are all associated with HPV infections (CDC, 2016a). Additionally, a person infected with HPV often does not show any signs or symptoms and continues to pass the virus on to others without even knowing the danger exists until complications arise.

Since HPV infections are quite common and complication rates are rising due to the increasing number of infections, the question of what can be done arises. Fortunately, there is a vaccination against HPV that provides protection against nine serotypes. The first quadrivalent HPV vaccine was released over ten years ago in 2006. The 9-valent HPV vaccine was licensed in 2014 for use in both females and males and is now the only available HPV vaccine approved by the Food and Drug Administration (FDA) (CDC, 2016b). There are currently no recommendations for revaccination with the 9-valent HPV vaccine if a person completed the HPV vaccine series with quadrivalent or bivalent HPV vaccines.

The Advisory Committee on Immunization Practices (ACIP) recommends the vaccine be administered to females and males between the ages of 11 to 12 years; however, the vaccine is

approved for ages 9 through 26 years (Meites, Kempe, & Markowitz, 2016). There are two separate dosing schedules depending upon when the vaccine is initiated. If initiated before 15 years of age, only two doses are required to be given six months apart. If the vaccine is initiated after 15 years, a three-dose scheduled is required.

While the HPV vaccine has been in existence for over ten years, vaccination uptake continues to lag. One of the objectives of *Healthy People 2020* is to increase vaccination coverage to a target of 80 % for the HPV vaccine, along with all others (Office of Disease Prevention and Health Promotion [ODPHP], 2018). According to the CDC (2018a), roughly 60 % of teens in the United States, both male and female, ages 13 to 17 years received at least one dose of the HPV vaccine. The number of adolescents and young adults who received at least one dose of the HPV vaccine ranged from 41.9 to 88.9 among various states with the percentage in North Dakota being 67.6% (CDC, 2017a). In comparison to HPV rates, other adolescent vaccine coverage rates are much higher. For example, the tetanus-diphtheria-pertussis (Tdap) vaccine coverage range in the United States was 77.5% to 96.7% with North Dakota at 92 % (CDC, 2017b). Tdap is a required vaccine for teens to receive, while the HPV vaccine is a recommended vaccine in North Dakota.

The current coverage rates can be broken down further to evaluate specific counties in North Dakota (North Dakota Immunization Information System [NDIIS], 2018). In Stutsman County, 73% of adolescents and young adults have received one dose of the HPV vaccine, and there is a 93.2% completion rate for the Tdap vaccine. The up-to-date percentage for the HPV vaccine, or the percentage of those who are receiving the vaccination series on schedule, drops to 56.88% for Stutsman County. Barnes County reports a 64.44% coverage rate for one dose and 54.81% up-to-date for the HPV vaccine. Tdap coverage is 89.23% in Barnes County.

The difference in coverage rates between HPV vaccination and the other recommended adolescent vaccinations exposes the existence of missed opportunities. A missed opportunity is an adolescent visit during which Tdap and MenACWY were administered while the HPV vaccine was not (Espinosa et al., 2017). Missed opportunities include well-child visits, as well as any other visit in which the adolescent sees a primary care provider. Missed opportunities are an ongoing problem according to the CDC and a commonly cited reason for the significantly low rates of HPV vaccination coverage (Javaid et al., 2017; Reagan-Steiner et al., 2016).

HPV vaccination is a significant intervention that can reduced HPV-related complications; however, acceptance and HPV vaccination coverage rates continue to lag behind other recommended adolescent vaccinations, including Tdap and MenACWY. The existence of missed opportunities and barriers require action. Interventions need to be done to improve provider knowledge of effective communication strategies regarding the HPV vaccine, reducing missed opportunities, eliminating misperceptions of the vaccine, and decreasing barriers to vaccination.

CHAPTER 2. REVIEW OF LITERATURE

With the knowledge of the current problem with low HPV vaccination coverage, a practice improvement project is indicated. The first step in creating a project is to ensure it is evidence-based. A systematic search was performed using the following databases: The Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Database of Systematic Reviews (CDSR), PubMed, Medline, and Health Source: Nursing/Academic Education. A keyword search was performed and included: *human papillomavirus, HPV, education, communication strategies, vaccine, vaccination, complications, cancer, barriers, andragogy, parent, knowledge, safety, efficacy, adverse events*. Various word combinations were used in the database searches with numerous articles found. The articles were critically appraised for applicability and reliability. After appraisal, key topics were developed and will be discussed further, including HPV epidemiology, complications, the HPV vaccine, vaccination coverage data, barriers to vaccination coverage, missed opportunities, and strategies to improve HPV vaccination coverage.

HPV Epidemiology

Human papillomavirus is a virus specific to humans, which attacks epithelial cells and mucous membranes (Dunphy, Winland-Brown, Porter, & Thomas, 2015). There are over 150 serotypes of HPV. There are two main categories of HPV serotypes: low-risk and high-risk. Low-risk serotypes can cause plantar or genital warts. Type 1 is known to cause plantar warts, whereas types 6 and 11 cause anogenital warts. High-risk serotypes are linked with progressive neoplasms and include Type 16 and 18. The serotypes causing genital warts and cancer are transmitted through intimate contact, including oral, anal, and vaginal sex (CDC, 2016c). HPV infections are extremely common with an estimated 80% of Americans being infected in their

lifetime. Many of the 150 serotypes can be cleared without concern; however, approximately 10% of HPV infections will not be cleared by the immune system, leading to persistent infection and serious consequences.

Pathophysiology

Persistent HPV infections are a known cause of cervical, anal, vaginal, vulvar, penile, and oropharyngeal carcinomas (Viens et al., 2016). Serotypes 16 and 18 are linked with over 73% of HPV-related cancers (de Martel, Plummer, Vignat, & Franceschi, 2017). These serotypes, along with other high-risk serotypes, infect the basal cells of squamous epithelia through microabrasions or wounds (Maxwell, Grandis, & Ferris, 2016). Once the infection occurs, the virus replicates and differentiates. HPV can survive in a latent state for decades before undergoing any malignant transformation allowing it to evade immune system defenses. Oncoproteins E6 and E7 are key factors related to the malignant transformation by inactivating tumor suppressor proteins in the body.

Complications

When considering the epidemiology of HPV infections, it is essential to look at each of the associated complications. Both genital warts and cancer are associated complications of persistent HPV infection. There are now several known cancers associated with HPV infection, including cervical, oropharyngeal, anal, vaginal, vulvar, and penile. The associated annual medical costs for HPV-related complications in the United States are estimated to be \$8 billion (Dahlstrom et al., 2018). The direct medical costs in the United States for treating HPV-related genital warts, a low-risk complication, for two years after diagnosis is approximately \$6,700.

Genital warts. HPV 6 and 11 are both serotypes linked with causing approximately 85% of anogenital warts (Joura & Pils, 2016). Both sexes are affected by anogenital warts, with a

lifetime risk of 10%. Warts are considered to be low-risk HPV complications (Daughtery & Byler, 2018). Qi et al. (2014) reported a negative impact on quality of life for patients with genital warts, specifically noting increased concerns about self-image and a great psychosocial burden. Anogenital warts do require large amounts of patient education about their cause and treatment. Aggressive partner follow-up is encouraged to reduce the spread of HPV, as it can become resistant to treatment and have a lifetime impact (Dunphy et al., 2015).

Cervical cancer. The link between cervical cancer and HPV infection has been established for several years, yet the worldwide rates of cervical cancer remain high. According to de Martel et al. (2017), cervical cancer accounts for a staggering 83% of the new HPV-related cancer cases each year with a majority of those cases in less developed countries. Females under the age of 50 years are impacted the most by cervical cancer with an estimated 250,000 cases diagnosed globally each year. North America accounts for 14,000 of the worldwide cases of cervical cancer each year.

The age of the female during infection with HPV is also a key factor of cervical cancer epidemiology (Hacker, Gambone, & Hobel, 2016). The adolescent cervix is at a higher risk of carcinogenic stimuli from frequent infections due to the active process of squamous metaplasia. Mirabello et al. (2018) found HPV 16 to be the most carcinogenic but noted variants of HPV 16 create different risks of persistence and progression of the infection. Continued genomics and epidemiology research is being done to better understand the subvariants and associated risk levels.

Oropharyngeal cancer. A newer HPV-related cancer on the rise is oropharyngeal cancer (Selcuk, 2016). The overall incidence of head and neck squamous cell cancer is declining in developed countries; however, HPV-related oropharyngeal squamous cell carcinoma (OPSCC)

continues to increase. The impact of HPV-related OPSCC is predicted to increase and be larger than that of HPV-related cervical cancer by the year 2020. HPV prevalence has increased from 16.3% between 1984 and 1989 up to an overwhelming 71.7% between 2000 and 2004 (Maxwell, Grandis, & Ferris, 2016). De Martel et al. (2017) report a higher burden of HPV-related head and neck cancers in developed countries than less developed countries, which is opposite that of HPV-related anogenital cancers. Alcohol and tobacco use are known risk factors for HPV-negative OPSCC, but they are no longer the leading cause of OPSCC (Maxwell et al., 2016). The leading cause is now HPV infection.

With the predicted impact of HPV-related OPSCC in mind and increased burden in developed countries, it is important to note the prognosis. Maxwell et al. (2016) describe a superior three-year survival rate with HPV-negative OPSCC. The tumors respond better to all types of treatment being used. Better local and regional control of the cancer is seen; however, distant metastatic control was similar for both HPV positive and negative OPSCC.

Anal cancer. Another known complication of HPV infection is anogenital cancers, one of which is anal cancer. An estimated 88% of invasive anal cancer cases are attributable to HPV infection worldwide (Serrano et al., 2015). According to de Sanjosé, Bruni, and Alemany (2014), roughly 91.1% of invasive anal cancers in the United States were positive for HPV. A higher incidence is seen in women than men, as there are approximately 18,000 new female cases and 17,000 new male cases annually (de Martel et al., 2017). Serrano et al. (2015) report 87% of the HPV positive anal cancers to be positive for HPV 16 and 18, which are two of the known high-risk serotypes. HPV 16- and 18-related tumors tend to be more aggressive in comparison to other HPV positive tumors and are seen to develop at earlier ages.

Vulvar and vaginal cancers. Vulvar and vaginal cancers are also attributable to HPV infection with 8,500 and 12,000 new cases worldwide annually (de Martel et al., 2017). North America accounts for 3,300 of these new cases, as both vulvar and vaginal HPV-related cancers have a higher incidence in less developed countries. Serrano et al. (2015) detected HPV 16 and 18 in 63.7% of vaginal and 72.6% of vulvar cancers. The next highest serotypes detected were HPV 31 in 5.3% of vaginal lesions and HPV 33 in 6.9% of vulvar lesions respectively. Vaginal and vulvar cancers account for 4% of all gynecology malignancies, and the majority of these cases are consistently related to HPV infection (de Sanjosé et al., 2014).

Penile cancer. The final anogenital HPV-related cancer is penile cancer. Penile cancer is very rare, representing less than 1% of cancers among men in the United States (de Sousa et al., 2015). However, the incidence of penile cancer is as high as 10% in some parts of the world. Approximately 63.5% of penile lesions were positive for HPV infection with HPV 16 being the most common strain, and the glans has been found to be the most common location.

HPV infection is a known risk factor for causing penile cancer. The prevalence of HPV infection is known to vary based on geographic location according to Alemany et al. (2015). The variation is believed to be attributed to circumcision practices and their impact with developing persistent HPV infections. Additionally, D'Hauwers et al. (2012) note a correlation between the incidence of cervical cancer and penile cancer worldwide.

HPV Vaccine

The existence of HPV in cervical cancer samples was discovered in the 1980s (Lockett & Feldman, 2016). By 1999, scientists had discovered how persistent HPV infections are linked with causing cervical cancer, and later the connection with several other complications was made (Joura & Pils, 2016). With the expanding knowledge of the role of HPV and its known

complications came the idea to create a vaccine and allow for the implementation of primary prevention. The purpose of vaccines is to stimulate the immune system and cause it to produce a reaction against the specific infectious agent, which creates protection from the disease without having to have it first, which is also known as humoral immunity (Bonanni et al., 2017; Angioli et al., 2016).

Vaccine History

The first HPV vaccine became available in 2006, a quadrivalent HPV vaccine (Joura & Pils, 2016). Marketed by Merck, it was designed to provide protection against HPV 6, 11, 16, and 18 and is also known as Gardasil. In 2007, GlaxoSmithKline released the Cervarix HPV vaccine. Cervarix is a bivalent vaccine designed to provide protection against HPV 16 and 18. The quadrivalent and bivalent vaccines were the only available options for several years. In 2014, Gardasil 9 was approved by the FDA as the only nine-valent HPV vaccine (9vHPV). The nine-valent vaccine targets HPV 6, 11, 16, 18, 31, 33, 45, 52, and 58. All three of the vaccines are available internationally. Due to recommendations from the CDC and ACIP, the nine-valent HPV vaccine is the only available HPV vaccine in the United States as of late 2016 (Meites, Kempe, & Markowitz, 2016).

Vaccine Recommendations

The nine-valent vaccine is recommended for females and males ages 9 to 26 years with an emphasis for initiating the vaccine at 11 to 12 years. Since the approval in 2014, there has been one recommended change to the dosing schedule for the nine-valent vaccine. The change to the only 9vHPV vaccine occurred with a change in the dosing schedule. Originally, all of the vaccines required a 3-dose series. In 2016, a new 2-dose schedule was approved by the ACIP (Meites et al., 2016). The 2-dose schedule applies to males and females ages 9 to 14 years. The

second dose is given 6 to 12 months after the first. Males and females ages 15 to 26 years and those who are immunocompromised are to receive the 3-dose series with the second dose given 1 to 2 months after the first and the third dose 6 months after the first. The CDC approved the change in schedule after an FDA trial. Immune responses to the HPV vaccine after four weeks were noninferior for the adolescents ages 9-14 years who received two doses of the vaccine when compared to adolescent girls and young women who received the three-dose series of the HPV vaccine (Iverson et al., 2016). The trial had over 1500 participants, both males and females. The results also demonstrated how immune responses are typically better in young children and young adolescents than in adults.

Efficacy

The efficacy of the bivalent and quadrivalent HPV vaccines is established; however, it is significant to note it takes several years post recurrent HPV infections for cancer to develop (Luckett & Feldman, 2016). All three vaccines have demonstrated high efficacy in HPV-naïve females. The bivalent vaccine revealed 92.6% efficacy in preventing HPV16 and 18 cervical intraepithelial neoplasia (CIN) 2 lesions or worse in HPV-naïve females in the PATRICIA trial. The PATRICIA trial also established 52.8% efficacy in CIN2 lesions in females with a history of previous HPV infections. The quadrivalent vaccine's efficacy was evaluated in the Future II trial and demonstrated 98% efficacy in CIN2 or worse lesions in HPV-naïve females and 42% and 79% efficacy against HPV 16 and 18 in women with a history of previous infections. Additionally, the Future I and II trials demonstrated greater than 96% efficacy against HPV-related vulvar and vaginal cancers as well (Angioli et al., 2016). Ninety percent efficacy was established against penile, perianal, and perineal diseases in males after receiving the quadrivalent vaccine.

The 9vHPV vaccine demonstrated 96% efficacy against HPV 31, 33, 45, 52, and 58 and 96% against HPV 6, 11, 16, and 18 (Lockett & Feldman, 2016). The efficacy against HPV 6, 11, 16, and 18 was shown to be noninferior to the quadrivalent vaccine; however, the additional serotypes provides increased protection. Currently the bivalent and quadrivalent vaccines provide protection against 70% of cervical cancer worldwide (Joura et al., 2015). With the added serotypes included in the 9vHPV vaccine, the amount of protection against cervical cancer is estimated to increase to 90%.

Safety and Adverse Events

The safety of vaccinations is an ever-present concern for parents and patients. Chandler (2017) explains how there are three stages of vaccine pharmacovigilance: signal detection, development of a causality hypothesis, and testing of the hypothesis. Rigorous testing and surveillance is used with all vaccinations, including HPV vaccines. The FDA also requires a three phase process for the development of vaccines, with a fourth phase occurring once the vaccine is on the market and available for public use (FDA, 2018). The first phase of vaccine trials evaluates the safety and immunogenicity of the vaccine. Phase two assesses the necessary dosing for the vaccine. The third phase further evaluates vaccine effectiveness. The process to receive FDA vaccine approval for marketing takes several years. Extensive safety evaluations and control group trials are done prior to approval and with any changes to recommendations (Gonçalves et al., 2014). Angioli et al. (2016) explain how the 9vHPV vaccine is not 100% risk free, which is similar to all other medications and vaccinations. FDA monitoring and approval is required in the United States.

As with other vaccines, adverse events are reported and monitored. The Vaccine Adverse Event Reporting System (VAERS) is a database used for reporting unverified adverse events

following immunization administration in the United States. The most common adverse event reported after receiving the HPV vaccine is pain at the injection site (Angioli et al., 2016). The nine-valent vaccine is associated with a slightly higher rate of adverse events in comparison to the quadrivalent vaccine. Less than 10% of girls who received the HPV vaccine reported pain, which is less than that of other vaccines (Nicol et al., 2015). Gonçalves et al. (2014) found local reactions of pain, swelling, and erythema at injection site to be the most common adverse events reported in a systematic quantitative review. Systemic adverse events reported were fever, nausea, and dizziness. General adverse events were discovered to be not related to receiving the HPV vaccine. Furthermore, no absolute contraindications to receiving the vaccine were identified. The vaccine is not recommended to be given during pregnancy but is not absolutely contraindicated.

Serious adverse events are rare according to Lockett and Feldman (2016). Most adverse events after receiving any of the HPV vaccines are mild and self-limited. Concerns of autoimmune, neurological, and venous thromboembolic (VTE) events have circulated and caused resistance to increased vaccination rates (Gonçalves et al., 2014). No safety signals related to any of these events were found.

Multiple studies have been conducted to further evaluate any link between VTE and the HPV vaccine. Lui et al. (2016) investigated HPV vaccine adverse events in Alberta, Canada. Over 528,000 doses of HPV vaccine were given during their research, with 192 reports of adverse events found or 37.4 per 100,000 doses. None of the reported adverse events were consistent with VTE. An additional study conducted by Yih et al. (2016) evaluated the risk of VTE after HPV vaccine administration in the United States. Between 2006-2013, 279 potential cases of VTE were identified within the defined post-HPV vaccine administration time. After

further chart evaluations, the number of definite first VTE cases was narrowed down to 53. Additional known VTE risk factors were identified within the cases, including oral contraceptive use, blood coagulation disorders, recent surgery, and immobility. Yih et al. (2016) found a lack of evidence to indicate any increased risk for VTE after HPV vaccine administration. The lack of association found corresponds with the results of other studies as well. Naleway et al. (2015) discovered the number of VTE cases after HPV administration to be small and not linked with any significant risk increase.

Autoimmune and neurologic adverse events have also been researched further to have a better understanding of any link between vaccination and diagnosis. According to Bonanni et al. (2017), there are no research findings to support any link between HPV vaccination and demyelinating disease, complex regional pain syndrome, or postural orthostatic tachycardia syndrome. Arnheim-Dahlström et al. (2013) conducted an evaluation of over 690,000 doses of HPV vaccine administered to over 290,000 girls in Denmark and Sweden. Their results detected a slight increased risk for Behcet's syndrome, Raynaud's disease, and type I diabetes; however, further analysis revealed a lack of consistent evidence to support a claim for causal association between the vaccine and the autoimmune conditions. The rates for epilepsy and paralysis were noted to be decreased after vaccine administration. No safety signals were identified in the study. The evidence suggests the benefits far outweigh the risks for receiving the vaccine series.

Vaccination Coverage

National Vaccination Coverage

Despite the recommendations and benefits of receiving the HPV vaccine, vaccination coverage remains low in the United States. The 2015 National Immunization Survey-Teen report revealed that among adolescents between 13-17 years of age, HPV vaccination coverage with ≥ 1

dose was 56.1% (Reagen-Steiner et al., 2016). The coverage drops significantly with each dose of the vaccination given with ≥ 2 doses at 45.4% and ≥ 3 doses at 34.9% for males and females combined. When the national coverage rates are divided based on gender, the coverage for males receiving ≥ 1 dose is 49.8% and 62.8% for females.

The National Immunization Survey-Teen also found differences in coverage between Hispanics, non-Hispanic whites, and non-Hispanic blacks (Reagen-Steiner et al., 2016). Coverage with ≥ 1 dose was higher among both Hispanic and non-Hispanic black adolescents than non-Hispanic white adolescents. Another characteristic with noted differences in coverage rates was living below the federal poverty level. Adolescents living below the federal poverty level had increased ≥ 1 dose coverage in comparison to those living at or above the federal poverty level with coverage rates for females below the poverty level at 70.0% in comparison to females at or above the poverty level at 60.4%. Male coverage rates for receiving ≥ 1 dose coverage at the poverty level was 61.1% versus the 46.0% at or above the poverty level.

State Vaccination Coverage

There is great variation in HPV vaccination coverage among states. For example, HPV vaccination coverage varies greatly between the states with Rhode Island reporting ≥ 1 dose all adolescent coverage of 88.9%, yet Wyoming reporting 43.4% for the same population (CDC, 2018b). North Dakota is in the top twenty for ≥ 1 dose coverage for both male and female adolescents ages 13-17 years with a percentage of 67.6; however, this is still below the *HealthyPeople 2020* goal of over 80% coverage. Figure 1 demonstrates the coverage of ≥ 1 dose of HPV vaccine in the United States. There are areas with consistently increased uptake, including California. A factor impacting the uptake rates in California is the strict state

immunization policy, which does not allow for personal or religious belief exemptions for receiving required vaccinations (National Vaccine Information Center [NVIC], 2018).

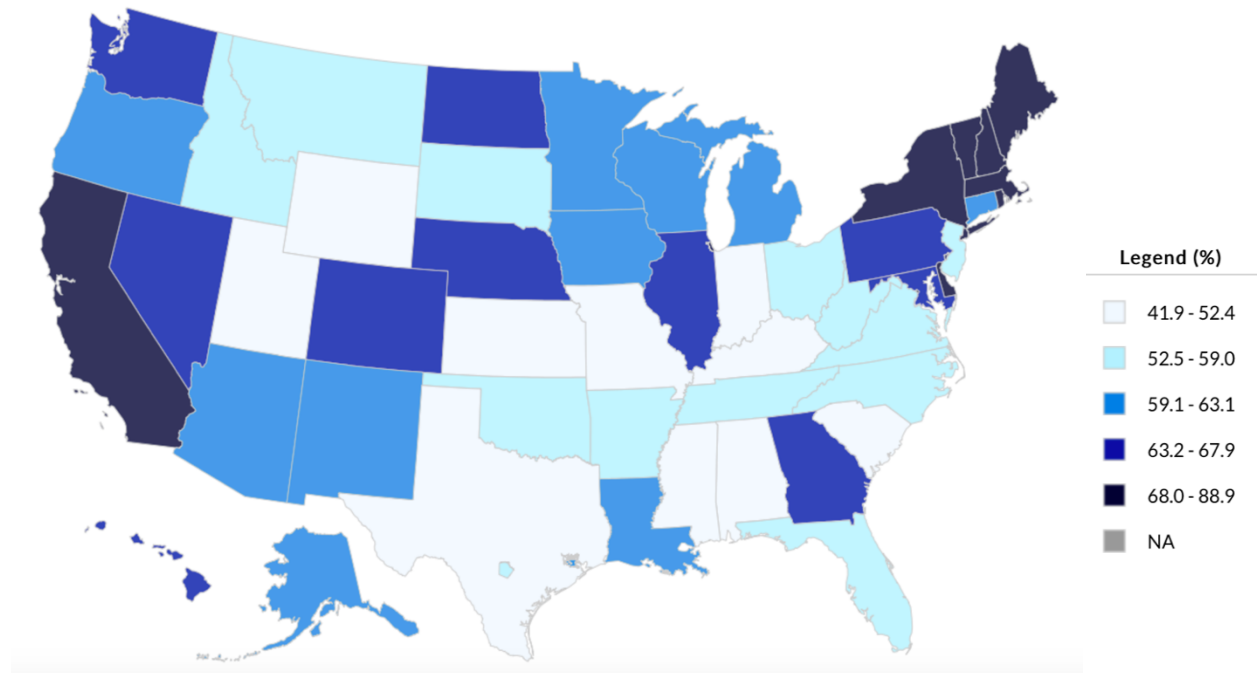


Figure 1. Human papillomavirus (HPV) vaccination coverage among adolescents 13-17 years by state, HHS region, and the United States, National Immunization Survey-Teen (NIS-Teen), 2008 through 2016. Reproduced from CDC, 2018b.

Specifically looking at North Dakota, more information can be obtained about the current vaccination rates statewide. The statewide coverage for up-to-date HPV vaccination among adolescents ages 13-17 is 52.7%, with 60.2% of that being females and 45.5% males (CDC, 2018b). The up-to-date coverage rates are almost 15% lower in comparison to the rates for ≥ 1 dose of HPV vaccine with a greater gap between genders.

County Vaccination Coverage

After evaluating both national and state coverage, additional information can be obtained from the North Dakota State Department of Health regarding county coverage rates (NDIIS, 2018). Further evaluating Stutsman and Barnes Counties disseminates more information about

the current coverage rates for Jamestown and Valley City, North Dakota. The rate of ≥ 1 dose of HPV vaccine in Stutsman County for both males and females ages 13- 17 years is 73.07%, while the up-to-date coverage is at 59.43%. The percentages differ when evaluating males and females separately with 79.09% of females and 68.07% of males receiving ≥ 1 dose and 63.01% of females and 48.02% of males being up-to-date.

The coverage for Barnes County is within the same category as Stutsman; however, the percentages are lower (NDIIS, 2018). Sixty-five percent of males and females together have received ≥ 1 dose while only 55.64% are up-to-date. The gender differences, although small, continue to exist with 65.92% of females and 64.40% of males receiving ≥ 1 dose and 57.46% of females and 53.87% of males being up-to-date. Figure 2 represents the current HPV vaccination coverage in North Dakota counties.

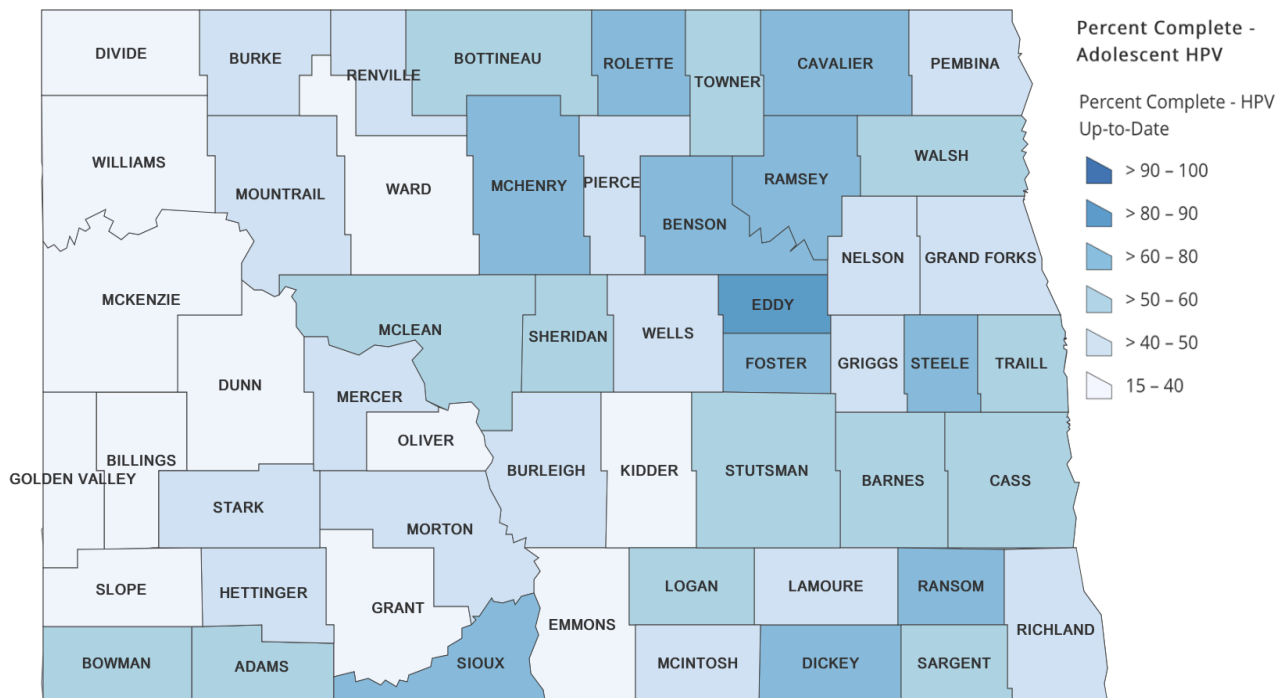


Figure 2. Adolescent HPV Immunization Rates Years 13-17. Reproduced from the North Dakota Department of Health and the North Dakota Immunization Information System (2018).

Coverage Variables

Research has found key variables impacting HPV vaccination coverage (Reagan-Steiner et al., 2016; Simons, Unger, Lopez, & Kohn, 2015). Gender differences can be seen at the national, state, and county levels with females more often receiving the HPV vaccination and being up-to-date. The type of insurance whether private, public, or no insurance is another key variable. Simons et al. (2015) found more patients with private insurance were receiving the HPV vaccinations than those with public insurance.

Confounding evidence suggests that race may also influence coverage rates. According to Reagan-Steiner et al. (2016), HPV coverage was higher among Hispanics and non-Hispanic blacks than white adolescents. Simons et al. (2015) reported white adolescents with higher coverage rates within family planning centers; however, Asian-Pacific islanders had the highest coverage rates. A fourth variable is living below the poverty level. Adolescents living below the federal poverty level were found to have higher vaccination coverage rates in comparison to those living at or above the poverty level (Reagan-Steiner et al., 2016). Each of these variables must be kept in mind when evaluating current coverage rates, as well as devising HPV vaccination coverage improvement strategies.

Required Vaccination Comparison Data

With the current HPV vaccination coverage data in mind, a comparison with the required school vaccinations provides further details about the status and room for improvement. Currently, the tetanus, diphtheria, and acellular pertussis (Tdap) vaccine and quadrivalent meningococcal vaccine (MenACWY) are the two required vaccines vaccinations for school-aged adolescents. The Tdap vaccine is a one dose vaccine recommended to be given at ages 11-12 years with a booster Td given every 10 years, unless otherwise recommended (CDC, 2015). The

MenACWY vaccine is a 2-dose series with the first dose recommended at ages 11-12 years and a booster dose at age 16 years (CDC, 2018c). The CDC (2018d) recommends the Tdap, MenACWY, and HPV vaccines be given between ages 11 to 12 years. The recommendation allows for a direct comparison of vaccination rates to be done.

In 2015, the national coverage of ≥ 1 dose of Tdap was 86.4% for all adolescents ages 13-17 years (Reagan-Steiner et al., 2016). The coverage of ≥ 1 dose of MenACWY for all adolescents was 81.3%. Both required vaccines are above the *Healthy People 2020* goal of $> 80\%$ coverage. The lowest coverage rate nationally for Tdap is in South Carolina with a percentage of 77.5 for receiving ≥ 1 dose of Tdap (CDC, 2018e). The highest coverage is found in Massachusetts with a staggering 96.7%. When considering North Dakota alone, the Tdap coverage is 92% for males and females combined ages 13-17 years. Stutsman and Barnes counties have a Tdap rate of 94.25% and 87.99% respectively (NDIIS, 2018).

The national coverage for MenACWY has a wider range with Wyoming having a rate of 54.2% of all adolescents receiving ≥ 1 dose of MenACWY and Rhode Island at the top with 96.4% (CDC, 2018f). The MenACWY coverage is 92% in North Dakota. These rates are almost 40% higher than that of HPV vaccination with ≥ 1 dose. Stutsman and Barnes counties in North Dakota have coverage rates for ≥ 1 dose of MenACWY of 92.55% and 87.41% respectively, which are notably higher in comparison with ≥ 1 dose of HPV vaccination for the same adolescent population. Despite the progress of HPV vaccination programs, the coverage rates are still far behind, indicating the existence of HPV vaccination barriers and need for improvement.

Barriers of HPV Vaccination Coverage

Since the recommendation for HPV vaccination in 2006, barriers for vaccination coverage have been identified (Brown, Hopfer, & Chan, 2015; Tom et al., 2015). HPV

vaccination myths, parental concerns, parental knowledge, provider beliefs, missed opportunities, and lack of follow-up for vaccination completion are all known barriers. Parental concerns include safety issues, beliefs about promoting sexual promiscuity, questions of the necessity of the vaccine, and lack of provider recommendations for the vaccine. A better understanding of HPV vaccination barriers can lead to the development of quality improvement projects and educational programs to improve coverage rates and remove the barriers.

HPV Vaccination Myths & Parental Concerns

HPV vaccination myths and parental concerns are closely linked and often found to overlap. Common myths and concerns noted in research are a risk for increased sexual activity after receipt of the HPV vaccine, promotion of unsafe sexual practices, lack of vaccine necessity due to abstinence, cost and financial concerns, and safety concerns related to the vaccine (Farmar et al., 2015). Each myth impacts the provider-parent-adolescent visit and conversation in a unique, yet connected way.

Increased risk of sexual activity and unsafe sexual practices. The concern for an increased risk of sexual activity and promiscuity has been raised by both parents of male and female adolescents (Oldach & Katz, 2012). Parents of females noted increased concern in comparison to parents of males with reports of the concern roughly 17% of the time when discussing the concern with healthcare staff. Farmar et al. (2016) support the existence of the barrier as well, noting parental fear that receiving the vaccine will cause their children to become sexually promiscuous.

The link between the myth and parental concern of increased sexual promiscuity is related to parental knowledge about HPV infection (Zimmerman et al., 2016). Parents understand that transmission of HPV infections is related to sexual activity and believe

immunization will cause children to believe the vaccine decreases the risks associated with sexual activity, thereby leading to promiscuity. Many parents believe that increased risk of promiscuity leads to the practice of unsafe sex practices and additional increased risks.

The myth and parental concerns related to increased risk for promiscuity and unsafe sexual practices have not been proven through research. Brown et al. (2015) reported no significant correlation between receipt of the HPV vaccine and increased risk for sexual activity or unsafe practices. Despite the lack of evidence, the myth continues to exist, creating a barrier for vaccination coverage and improvement.

Lack of Vaccine Necessity due to Abstinence. The parental belief in the lack of HPV vaccination due to necessity relates closely to parental knowledge about HPV and the vaccination. Hansen, Credle, Shapiro, and Niccolai (2016) explained how parents often underestimate the sexual experience of their children. Parents may rely on cues, adolescent characteristics, and common age beliefs when considering their adolescents' sexual experience and activity. A father was noted to express a lack of purpose for the vaccine in a 12-year-old girl unless she was sexually active, which he considered to be highly unlikely. According to the Youth Risk Behavior Survey (YRBS) in 2017, 3.4% of high school students in the United States initiated sex before 13 years old (Kann et al., 2018). Approximately 9.7% of high school students reported having sex with more than four persons, and 28.7% reported being currently sexually active. Only 53.8% of those who reported being sexually active used a condom during sexual activity. The YRBS statistics reveal that despite the fact that many parents believe their adolescent children are not sexually active, a large majority of adolescents are engaging in sexual activity.

Most parents believe their children are remaining abstinent at ages 11 to 12 years, which is when the HPV vaccine is recommended to be administered (Perkins et al., 2014). Parents voice concern about their children being too young or are convinced of their abstinence and therefore delay the vaccine. With the belief of a lack of necessity also comes a parental knowledge gap regarding the importance of vaccine initiation and completion prior to sexual debut. Additionally, parents have noted a reason for delaying HPV vaccination until the adolescent starts to become sexually active, as they believe the adolescent has a low risk for infection with their perceived abstinence (Moore, Fankhauser, & Hull, 2016; Zimmerman et al., 2016). According to Mollers et al. (2015), the level of effectiveness provided by the HPV vaccine decreases if the adolescent has been exposed to HPV prior to vaccination. The vaccine is only 36% effective against persistent HPV 16 and 18 infections if there are positive HPV results at baseline, meaning prior HPV exposure. The vaccine is over 76% effective if there is no prior exposure at baseline. Adolescents ages 11 to 12 years also have a more robust immune response in comparison to older adolescents (Moore et al., 2016). The prior exposure rate to HPV is also lower at these ages; therefore, increasing vaccine effectiveness.

Cost and Financial Concerns. In addition to concerns and beliefs regarding the relationship of the HPV vaccine with sexual activity, parents express concerns related to the cost of the vaccine. The cost of the vaccine and availability at the local healthcare office are barriers reported by parents (Espinosa et al., 2017). The majority of children and adolescents are covered by public or private health insurance, which does cover the vaccine, but this does not include all adolescents who are recommended to receive the HPV vaccination series (North & Niccolai, 2016). The Vaccines For Children (VFC) program is available to cover the vaccination for majority of adolescents who are uninsured and meet the eligibility criteria (Oldach & Katz,

2012). Concerns of cost occur among both parents of adolescent females and males (Javid et al., 2016).

Healthcare providers also note financial concerns regarding the vaccine and possible lack of reimbursement being a reason for decreased support and encouragement at adolescent appointments (Tom et al., 2016). The financial concerns for providers are system-related and include stocking cost and lack of insurance coverage. Depending on the VFC population, the perceived financial concerns are not as prominent of a barrier for providers and parents (Farmar et al., 2016).

Safety Concerns. Safety concerns among parents are one of the most common barriers for receiving the HPV vaccine. According to Javid et al. (2016), 49% of parents of adolescent girls and 42% of parents of adolescent boys reported “a great deal” of concern regarding the safety of the HPV vaccine. An additional 31% and 30% of parents of adolescent girls and boys respectively expressed “somewhat” concern related to the safety of the HPV vaccine. Less than 10% were not concerned at all about the safety of the vaccine series.

Lack of Parental Knowledge

Another barrier that can interfere with HPV vaccination uptake is lack of parent knowledge regarding the vaccine. Several studies have evaluated parental knowledge through surveys and interviews (Hansen et al., 2016; Javid et al., 2017; Oldach & Katz, 2012; Rendle & Leskinen, 2017; Tan & Gerbie, 2017). The lack of parental knowledge concerning the HPV vaccine includes a lack of knowledge about HPV infection, the vaccine series, and vaccine safety and efficacy information, as well as commonly believed myths. One factor that contributes to lack of parental knowledge of the HPV vaccine is they may not receive a recommendation or education about the vaccine by their healthcare providers during appointments (Javid et al.,

2017). Improved provider-parent communication is strongly recommended, as it can reduce this barrier and improve overall HPV vaccine coverage.

Beliefs concerning a parental lack of knowledge are voiced by nursing staff, as well as providers (Oldach & Katz, 2012). Lack of parental knowledge about HPV vaccines was the most commonly reported barrier by nursing staff and was reported to be an important barrier 55.6% of the time. The knowledge deficit extends to both parents of female and male adolescents. HPV knowledge is impacted by various sociodemographic characteristics, including gender, income, and race. Upon surveying U.S. adults, McBride and Singh (2018) found only 31% of males and 28% of females believed HPV caused oral cancer. Female gender, college degree, and an annual income over \$50,000 were all associated with increased knowledge regarding the HPV vaccine.

Variations in parental knowledge have also been noted between parents bringing their male children and adolescents to pediatric and public health clinics (Tan & Gerbie, 2017). Tan and Gerbie (2017) found 91% of parents at pediatric clinics versus 65% of parents at public health clinics were aware of HPV. Further questioning demonstrated a disparity between the two populations with 86% of parents at pediatric clinics knowing of the existence of the HPV vaccine but only 55% of parents at public health clinics. Furthermore, only 16% of pediatric clinic parents and 18% of public health clinic parents of boys were aware of HPV causing cancers in males, demonstrating a continued overall lack of HPV knowledge among parents.

Parental knowledge deficits are interrelated with HPV myths and concerns as well. Parents are unaware of accurate information and hear stories from friends or family members, thus influencing their level of knowledge. The amount of time a provider spends with parents discussing their concerns and providing education also influences overall levels of knowledge and can therefore impact vaccination rates and completion rates. Kornides, Fontenot, McRee,

Panozzo, and Gilkey (2018) discovered only 47% of parents believed the provider spent enough time discussing HPV and the vaccine with them and providing education. Parents who reported greater satisfaction with the provider encounter and time spent were far more likely to initiate the vaccine series.

Lack of Provider Support

The awareness of provider support and recommendation for HPV vaccination is one of the most important and influential factors that increase HPV vaccination uptake; however, lack of provider support for the vaccine has been noted by parents, including provider ambivalence, lack of time spent discussing HPV at the visit, lack of provider knowledge, and lack of strong recommendation (Brown et al., 2015). Lack of provider support and recommendation is also linked with missed opportunities for HPV vaccination. Despite a lack of parental knowledge regarding HPV and the vaccine, receiving a provider's strong recommendation for HPV vaccination has a positive impact on vaccine uptake and coverage and is reported to be one of the top five reasons for vaccination according to the CDC (McBride & Singh, 2018).

Provider ambivalence. Healthcare providers have a tendency to be ambivalent about recommending the HPV vaccine to all adolescents in the target age group, which can contribute to missed opportunities (Brown et al., 2015). One reason for provider ambivalence is concern regarding insurance coverage and cost for both the patient and clinic. Most patients should qualify to receive the HPV vaccine, yet not 100% will be fully covered. A second reason healthcare providers may not make a strong recommendation for the HPV vaccine is a lack of time and desire to explain why males should also receive the vaccine (Oldach & Katz, 2012). Many parents of males require additional time and education concerning the need for male HPV vaccination. Providers can be dissuaded by the additional needs and complexity of the situation.

Oldach and Katz (2012) further discuss how parents then may interpret a lack of education and time spent discussing the importance of male vaccination as a reason to delay or refuse vaccination, believing in a decreased risk for males.

Provider beliefs about parental perceptions of HPV vaccination and an overestimation of parental concerns about safety also contribute to provider ambivalence (Clark et al., 2016). Providers may misinterpret the safety concerns of parents and feel that they are unable to change parents' minds about vaccination. Therefore, they may not discuss the HPV vaccination in detail. Misinterpretation and misinformation can manifest as provider uncertainty about the importance of HPV vaccination and further dissuade parents and adolescents of the importance.

Lack of time. Numerous studies have shown a lack of time with the patient impacts the amount of support parents perceive healthcare providers to have with HPV vaccination (Brown et al., 2015; Gowda et al., 2012; Kornides et al., 2018). Many adolescent healthcare visits are 30 minutes or less, placing a time constraint on the appointment (Brown et al., 2015). The shortened visit impacts the amount of time providers are able to spend providing education about the importance of HPV vaccination. As with provider ambivalence, the time constraint causes providers to have to rush or feel pressured about the educational topics stressed during the visit, causing uncertainty for both patients and parents about vaccine importance.

Gowda et al. (2012) discovered providers generally recognize the importance of discussing the vaccine, safety, and efficacy with parents and adolescents; however, the amount of time required to effectively educate does not exist during most visits. Many of the parental concerns voiced take time to comprehensively discuss. Parental satisfaction with providers and initiation of HPV vaccination is linked with a belief that the correct amount of time was spent during the visit discussing HPV (Kornides et al., 2018). The more time spent discussing the

importance, safety, and efficacy of HPV vaccination is directly linked with improved vaccination acceptance, yet providers express a lack of available time for this.

Lack of provider knowledge. A third factor that may interfere with HPV vaccination uptake is a lack of provider knowledge and information. A survey of providers done by Tom et al. (2016) revealed around 80% of providers have good knowledge about HPV; however, nearly 17% were unsure of any connection between HPV and head and neck cancer. Additionally, healthcare providers were also unsure of when HPV is most commonly found and if it can be cleared without any treatment. The results demonstrate a lack of provider knowledge and a level of uncertainty. On the other hand, vaccine knowledge scores were higher with over 94% of providers answering correctly. Ultimately, an overall lack of provider knowledge regarding HPV may contribute to reduced HPV acceptance rates among parents and adolescents.

Lack of strong recommendation. Another factor that may be a barrier to HPV vaccination is lack of a strong recommendation for the vaccine by healthcare providers. Receiving a provider's recommendation for HPV vaccination has been found to be critical for vaccination uptake and coverage (Hansen et al., 2016). Unfortunately, provider ambivalence and a lack of time can interfere with healthcare providers' ability to make a strong recommendation for vaccination. Therefore, a lack of provider recommendation continues to be a fundamental barrier (Farmar et al., 2016).

A majority of providers report supporting HPV vaccination fully; however, the approach to recommendation and advocating for HPV vaccination varies greatly (Javaid et al., 2017). Approximately 57% of providers use a bundling approach and list the HPV vaccine between the additional adolescent vaccinations, while 29% of providers explain the HPV vaccine as being an optional vaccine and set it apart from other adolescent vaccinations. The manner of presenting

the HPV vaccine is believed to impact the strength of the recommendation. Offering the vaccine as optional may contribute to not effectively advocating for the vaccine. Javaid et al. (2017) found that 69% of healthcare providers feel a lack of provider recommendation impacts HPV vaccine uptake for girls “a great deal.”

Receiving a provider recommendation at every adolescent visit demonstrates the importance of HPV vaccination and can increase initiation and completion rates (Zimmerman et al., 2016). The recommendation for initiation and completion of vaccination should be strong and clear as to not cause parental uncertainty (Brown et al., 2015). Krantz et al. (2017) found a direct correlation between the level of provider recommendation and missed vaccination opportunities with a higher number of missed opportunities occurring with weaker recommendations. Between 35% and 58% of families were unable to recall any sort of provider recommendation for HPV vaccination.

Moore et al. (2016) noted parents will commonly follow a healthcare provider’s recommendations, including those for HPV vaccination, when they believe the recommendation is strong. A strong recommendation consists of a clear and straightforward message for parents. The ambivalence of the message and recommendation from the provider can be perceived to decrease its strength and significance (Kulczycki, Qu, & Shewchuk, 2016). A lack of strength in the provider recommendation or lack of recommendation overall are linked with a negative impact on HPV vaccination rates. Provider recommendation for HPV vaccination is key as parental HPV awareness and understanding without recommendation do not automatically result in HPV vaccination (Pierre-Victor et al., 2017a).

Missed Opportunities

As previously defined, missed opportunities are adolescent visits when HPV vaccination is not provided but Tdap and MenACWY are administered and may include well-child adolescent visits or any visit with the primary care provider in which the HPV vaccination was due but not administered (Espinosa et al., 2017). Missed opportunities were commonly seen at well-child visits and vaccine-related visits. Espinosa et al. (2017) found the HPV vaccine was given 37% of the time with other adolescent vaccines, demonstrating a missed opportunity occurs more than 60% of the time. Pediatricians were noted to have lower rates of missed opportunities in comparison to non-pediatricians, which may contribute to lower HPV vaccination rates in more rural settings where pediatricians may not be readily available. Although HPV vaccination coverage has made progress, the progress is limited with coverage rates significantly lower than those for Tdap and MenACWY (Reagan-Steiner et al., 2016). The comparison of coverage between the recommended adolescent vaccinations demonstrates continued missed opportunities specifically for the HPV vaccination itself.

Brown et al. (2015) discuss the significance of missed opportunities at problem-focused visits. Over 90% of problem-focused adolescent visits, including visits while adolescents were ill or seen for medication changes, were missed opportunities for HPV vaccination. In order to continue to improve vaccination coverage, every visit with adolescents should be viewed as an opportunity to provide education and HPV vaccination (Farrar et al., 2016). The frequency and strength of the provider education and recommendation provided at the visits has the potential to increase vaccination coverage (Krantz et al., 2017). Sussman et al. (2015) interviewed primary care providers and found it common for them to struggle with advocating for vaccination at

every visit, especially the acute care visits. The providers noted this struggle as a contributing factor for a missed opportunity for HPV vaccination.

Missed opportunities also arise when parents and adolescents are not provided the education about the vaccination series recommendations and the need for additional appointments and follow-up (Moore et al., 2016). Missed opportunities are reported to be the most common reason for the significantly lower HPV vaccination rates in the United States (Javaid et al., 2017). Providers may not be aware of the current impact of missed opportunities or do not have the skills to reduce them. Additional education and communication skills are needed for healthcare providers to reduce the number of missed opportunities and positively impact HPV vaccination coverage.

Provider-parent communication may also contribute to missed opportunities. Provider beliefs about parental concerns and the lack of additional time required to discuss HPV vaccination in detail may cause delay of discussion and therefore vaccination (Clark et al., 2016). The barrier of HPV myths also becomes a factor in missed opportunities. The myths about the risk for increased sexual activity and timing of vaccination are linked with both parent and provider delay for the recommendation of the HPV vaccine (Perkins et al., 2014). Conversational awkwardness for providers, parents, and adolescents is also a factor for a delay in conversation and subsequent missed opportunities (Daley, 2011).

Lack of Follow-Up

Lack of follow-up for HPV vaccination for the completion of the two or three-dose series also contributes to lower HPV completion rates. Missed opportunities to provide education to adolescents at each visit cause decreased awareness of the significance of series completion, which may contribute to lower rates of follow-up (Zimmerman et al., 2016). Provider

ambivalence and lack of recommendation and support also contribute to a lack of follow-up due to parental perceptions (Brown et al., 2015).

Improving HPV Immunization Acceptance

Communication Strategies

With research demonstrating multiple barriers for improved HPV vaccination coverage, it is essential to evaluate the possible solutions that can reduce the barriers and increase coverage. Provider-parent communication is a vital component during adolescent visits. Communication consists of the education provided, as well as recommendations for vaccination. Research has found several successful communication strategies for improving HPV vaccination rates, including framing, normalizing, bundling, providing a clear recommendation, implementing provider-initiated discussion, and using presumptive communication (CDC, 2018g; Opel et al., 2013; Perkins et al., 2014).

Framing. Framing is the manner in which the provider discusses the HPV vaccine and how it is compared to the other recommended adolescent vaccinations. The HPV vaccine is sometimes listed separately from other recommended or required adolescent vaccinations (Gilkey & McRee, 2016). Higher levels of parental hesitancy are associated with using an optional approach of HPV vaccination. Parents may also interpret the message and recommendations as being weaker when the vaccination is framed in an optional way, causing it to sound less important (Gilkey et al., 2016).

Additionally, framing is used when providing education specifically about HPV vaccination. Gain-framing and loss-framing are two techniques available to providers to use (Gilkey & McRee, 2016). Gain-framing focuses on the positive effects, while loss-framing focuses on the negative consequences associated with lack of action, such as HPV vaccination

(Lee & Cho, 2017). Loss-framed messages tend to be more effective on influencing vaccination behavior and willingness.

Bundling. Bundling is a communication technique in which the HPV vaccine is sandwiched between Tdap and MenACWY (Espinosa et al., 2017). The three recommended adolescent vaccines are grouped together instead of HPV being listed as optional. Bundling corresponds with the provider's framing method. This is a successful technique according to research by Farmer et al. (2016). The use of bundling the HPV vaccination with other required vaccinations is supported by the CDC (CDC, 2018g). CDC provider resources and handouts contain the recommendation to bundle adolescent vaccinations, including the HPV vaccine, to improve coverage rates.

Normalizing. A third successful communication strategy for providers to use during parent and adolescent HPV vaccination conversations is to normalize the HPV vaccine. Normalizing is done by not singling the vaccine out as distinctly separate from the other vaccinations (Perkins et al., 2014). Normalizing causes the HPV vaccine to appear to be of equal importance to parents when compared to Tdap and MenACWY. The concept of normalizing HPV vaccination is demonstrated when using a bundling approach to vaccination discussion (Espinosa et al., 2017).

Providing a clear recommendation. According to the CDC (2018g), the number one reason for HPV vaccination is attributed to a strong provider recommendation. The concept is simple, yet still a significant barrier as previously discussed. Providing education about HPV and the complications is not enough to cause vaccine initiation and series completion (Pierre Joseph et al., 2016; Pierre-Victor et al., 2017b). HPV knowledge alone does not cause increased HPV vaccination rates. Knowledge plus a healthcare professional's recommendation together make a

difference. It is important for providers to consistently recommend HPV vaccination and view every visit as an opportunity to vaccinate and educate (Farmer et al., 2016). Consistent recommendations are believed to be stronger recommendations and are therefore followed more often. Providing a clear and strong recommendation for HPV vaccination is a successful communication technique.

The strength of a recommendation is influenced by the framing used, education provided following the recommendation, and the clarity of the recommendation. Pierre-Victor et al. (2017a) found providers should focus on the HPV vaccine being used for cancer prevention, providing a clear message about the benefits of receiving the vaccine. The provider recommendation also must be clear about when the vaccine is to be given (Kornides et al., 2018). A strong recommendation advocates for same day administration.

Provider initiated discussion. Failure to communicate with parents and discuss HPV vaccination is linked with a lack of series initiation and completion (Kulczycki et al., 2016). Providers are encouraged to initiate the conversation by recommending the vaccination and then further discussing the indication, safety, and efficacy. Kulczycki et al. (2016) found that providers who initiated the conversation regarding HPV vaccination and perceived minimal barriers to dialogue had better coverage rates for both initiation and continuation of HPV vaccination. Discussion is to continue at every visit, which correlates to strong provider recommendations and parents staying informed.

Using presumptive communication. Presumptive communication is a technique in which the result is presupposed in the statement and can be used to frame and recommend HPV vaccination (Opel et al., 2013). Presumptive HPV vaccination states in the recommendation that the vaccination will be given at the visit with the other recommended vaccinations. Presumptive

communication is recommended to be used instead of participatory communication, which is more open-ended and allows for a greater amount of parental input and decision-making.

Participatory communication questions whether or not HPV vaccination will be provided at the visit and is associated with a perceived weaker recommendation for HPV vaccination.

Participatory communication strategies are linked with higher amounts of parental hesitancy and resistance.

Opel et al. (2013) discovered it is common for providers to use participatory communication with known vaccine hesitant parents in comparison to known non-vaccine hesitant parents. Approximately 83% of the sampled population expressed greater resistance to vaccination when participatory vaccination communication was used in comparison to 26% with presumptive vaccination communication. Additionally, Opel et al. (2013) noted if providers continue to pursue the topic of vaccination after encountering parental resistance, roughly half of parents will change their minds and opt to have children receive the recommended vaccinations. Presumptive communication and continued recommendations, even after resistance, are positive and successful communication techniques.

Appointment Scheduling

Scheduling follow-up appointments for adolescents or bundling HPV vaccination with other follow-up visits is one solution to improve the known barrier of a lack of follow-up for HPV vaccination alone (Simons et al., 2015). Conflicting expectations between parents and healthcare providers about who is the responsible party for ensuring series completion exist (Sussman et al., 2015). Sussman et al. (2015) found that 65% of parents expect the clinic to remind parents and adolescents about scheduling and completing the vaccine series; however, 52% of providers reported it is their responsibility to explain the HPV vaccination schedule but

the parents' responsibility to make the appointments. Improved vaccination rates and series completion rates are seen with scheduled appointments (Williams et al., 2017).

Education

Healthcare professionals' education provided to parents and adolescents is a critical piece of HPV vaccination uptake in addition to the recommendation for vaccination. Kulczycki et al. (2016) found that providers who discuss HPV vaccination in addition to providing a recommendation have higher rates of vaccination administration than those who do not. The focus of the education should be on the cancer prevention aspects of the HPV vaccination and not the route of HPV transmission (Pierre-Victor et al., 2017a). The framing of the education provided to parents and adolescents has a strong impact on their perception of the vaccine. Educational focus on STI prevention in comparison to cancer prevention is not as beneficial. STI prevention focused education typically has a negative impact on HPV vaccination initiation. Pierre-Victor et al. (2017b) recommend providers prioritize HPV recommendation and education efforts in order to improve vaccination coverage. Cancer prevention focus and framing are key when providing education (Espinosa et al., 2017).

Theoretical Framework

In order to properly implement a performance improvement project and conduct evidence-based practice (EBP), it is essential to use both a theory and a model for project development. Both the theory and model guide project development and encourage the success of project implementation. A theory for practice and model are essential factors utilized in this project to create an educational intervention for healthcare providers.

Theory for Practice

In 1968, Malcolm Knowles developed an adult learning theory known as andragogy (Merriam, 2001). Andragogy was created to better explain how adults learn in comparison to children and the distinct differences between the two. The definition of andragogy is “the art and science of helping adults learn” (Daily & Landis, 2014, p.2066). Adult learning theory is pertinent to the proposed performance improvement project because the project incorporates providing education specifically to adult healthcare workers. In order to provide the most appropriate forms of education, it is important to apply a theory created to explain how adults learn best.

Knowles identified five key assumptions within adult learning theory. The first assumption is that each adult uses self-directed learning and has an independent self-concept (Merriam, 2001). In comparison, children are dependent learners and must rely on other to teach them. Daily and Landis (2014) further explain the self-concept of learning for healthcare providers as a professional responsibility. Healthcare providers must take time after their education is complete to continue to learn and grow with the ever-changing healthcare industry. The performance improvement project provides an educational session about the HPV vaccine and communication strategies for providers to use to improve HPV vaccination coverage and reduce missed opportunities. Various educational resources and communication strategies were included for the healthcare providers to take away and review further. The project also offered healthcare professionals the opportunity to further self-direct their learning and future implementation of new communication techniques for parent-provider HPV vaccination discussions.

The second assumption is that adults accumulate an abundance of knowledge through their life experiences and can use the knowledge as a resource to further their learning (Merriam, 2001; Daily & Landis, 2014). Adults are able to look back on their experiences and use this knowledge to determine future decisions. Example scenarios were included in the educational presentation to allow for providers to draw on their past experiences and knowledge to determine their actions and responses. Each provider has a unique reservoir of knowledge and therefore, was able to provide unique feedback to others, as well as about the possible outcomes for each situation and how to improve the outcome to result in HPV vaccination.

Knowles' third assumption explains how the learning needs of adults are dependent upon social roles and any changes occurring (Merriam, 2001). Adults are goal-oriented learners and have a readiness to learn in relation to developmental tasks and social roles (Cercone, 2008). In order to apply Knowles' third assumption within the educational project, the objectives were presented at the beginning of the presentation and were targeted towards HPV vaccination missed opportunities and communication strategies. The reason for learning the new strategies was emphasized throughout the presentation and specifically highlighted at the beginning for providers to understand the project's impact on their specific learning goals.

The fourth assumption of andragogy factors in the change in perspective that occurs with maturation (Cercone, 2008). As adults age, their reason for learning and focus change from concerns for future application to the immediacy of application. The change from future application to immediacy of application encompasses the adult's reason for why they need to learn the new information and why it is important to them. A brief focus on the current HPV vaccination statistics, as well as current barriers, assisted the healthcare professionals to better

understand why the presented information was important and necessary to learn. The participants were able to implement the communication strategies immediately into their practice.

The fifth and final assumption of Knowles' adult learning theory is that adults are motivated to learn through internal factors, such as self-esteem and job satisfaction, instead of external factors (Cercone, 2008). The project evaluated each providers' HPV vaccination statistics prior to and after the educational intervention by accessing aggregate data from the EHR. The results may have influenced job satisfaction and improved healthcare professional's self-esteem. Improved knowledge and resources for HPV vaccination, as well as parent-provider communication, may also have increased self-esteem. Additionally, each provider's experience with HPV vaccination was respected during the presentation with feedback provided in a constructive and respectful manner. The post-test survey done at the end of the education session included a space for self-reflection and feedback for improvement as well.

With creation and implementation of the HPV vaccination educational presentation, the assumptions of andragogy were incorporated. Objectives, provider needs, and goals were equally integrated throughout the project (Daily & Landis, 2014). The theory is learner-centered and emphasizes the importance of feedback for both the learners and educators (Taylor & Hamdy, 2013). Consistent and constructive feedback are essential for provider learning and project success.

Model

The use of a model to guide a performance improvement project and practice change is fundamental (Melnyk & Fineout-Overholt, 2015). For the purpose of the HPV vaccination performance improvement project, the Promoting Action on Research Implementation in Health Services (PARIHS) framework was used. The PARIHS framework was developed originally in

1998 and then adapted over time to the current version in 2004. It was created from an examination of practice development, quality improvement, and research. The framework guided implementation and sustainability for the evidence-based project. The model fit seamlessly because it demonstrated the various interdependent relationships and intricacies of factors within a performance improvement project.

The model consists of three main elements: evidence, context, and facilitation (Melnyk & Fineout-Overholt, 2015). Each of the three main elements consist of subelements. The subelements for each section are explained by examples of low and high characteristics to guide implementation and sustainability. The first element to consider is evidence. Evidence is a comprehensive sense of the knowledge found within the framework and project itself. The knowledge is both real and academic. There are four subelements: research, clinical experience, patient experience, and local data. The subelements of evidence are used to guide the review of literature regarding the topic of HPV vaccination and were used throughout the project during the educational sessions. All of the subelements of evidence have a high level of value within the framework and project. Thorough research of HPV vaccination and communication strategies was necessary for a comprehensive level of knowledge. The research also included patient experiences with an emphasis on parental opinions and beliefs about HPV vaccination and interactions with providers. Local data regarding current HPV vaccination coverage rates in comparison to national rates were additional key pieces of evidence within the project. The clinical experience subelement corresponded nicely with the adult learning theory as well because it allowed the providers to draw on their wealth of knowledge and experiences to further their learning.

The second element is context, which consists of culture, leadership, and evaluation (Melnyk & Fineout-Overholt, 2015). The project focused on promoting learning within the organization by including both providers and nursing staff at the educational session. The culture subelement was also used through ensuring the project implemented staff values and the culture of caring found at the facility. Improving HPV immunization coverage and decreasing associated cancer rates fits with the *HealthyPeople 2020* goal for HPV vaccination coverage of >80% and is a key practice issue. The subelement of leadership is integrated teamwork, and this was achieved during the project by having both nursing staff and providers present for the education and receiving input from past experiences from everyone in attendance. Clear roles and an empowering approach to teaching the session and future impact were also be used. The evaluation of the project occurred throughout the project with feedback during the education presentation about past experiences and sample scenarios, as well as at the end on a post-test. Additional evaluation of any changes in HPV vaccination rates was also performed to better understand the impact of the project and any needed changes in the future.

The final element of facilitation consists of two subelements: purpose role and skills and attributes (Melnyk & Fineout-Overholt, 2015). The purpose role for the HPV vaccination project was to enable others to improve their practice through adult learning methods of education and a holistic approach involving both providers and nursing staff. The skills and attributes subelement varied depending upon the stage of implementation and the roles involved. The facilitation element helped to create sustainability and better implementation of the evidence-based recommendations for HPV vaccination practice and communication changes.

Conclusion

In conclusion, persistent HPV infection is linked with several serious complications, including anogenital and oropharyngeal cancers (CDC, 2016a). The HPV vaccine has been approved by the FDA since 2006 and available to reduce the rates of HPV and the complications. Despite the vaccines' existence, HPV vaccination coverage rates remain below the *Healthy People 2020* goal of greater than 80%. Several barriers of vaccination coverage have been identified, including lack of parental knowledge, lack of provider support, and missed opportunities. Options exist to reduce the barriers and enhance HPV vaccination uptake. Interventions for healthcare professionals are needed to provide knowledge about the current problem with low HPV vaccination coverage and methods to enhance knowledge and communication strategies.

CHAPTER 3. PROJECT DESCRIPTION

Congruence with the Organization's Strategic Plan

The practice improvement project was created in congruence with the strategic plan developed by the College of Health Professionals at North Dakota State University (NDSU). One approach included within the strategic plan was to improve relationships with outside organizations and partnerships to support research (NDSU, 2017). The project required partnership with a local healthcare facility, Sanford Health. A meeting with Sanford Health was held in the Spring of 2018 and permission was granted for the project to be done at two rural clinics in Jamestown, North Dakota and Valley City, North Dakota. All parties involved in the research relationship were supportive of the project and the potential to improve current HPV vaccination knowledge. A follow-up meeting is planned to discuss the results of the practice improvement project and the implications for future research, including options to increase sustainability. Additionally, NDSU Institutional Review Board (IRB) approval was received on October 4, 2018. Please see Appendix A for further information.

The second strategic plan aspect incorporated within the practice improvement project was a goal for “health professions training, research, and service activities of the College support the needs of North Dakota” (NDSU, 2017, p.7). The research and health professions training in this project was North Dakota-based. The current HPV vaccination coverage rate for receiving ≥ 1 dose for male and female adolescents age 13-17 in North Dakota was 67.7%; however, this rate was still significantly below the *Healthy People 2020* goal of greater than 80% (CDC, 2018b). HPV vaccination coverage demonstrates an area of need in North Dakota. One objective within the project focused on reducing the number of missed vaccination opportunities, which may help improve coverage rates.

Finally, the project corresponded with the goal of improved professionalism and increased interprofessional education (NDSU, 2017). The practice improvement project involved several members of the healthcare team including medical doctors, nurse practitioners, and nurses. The educational intervention was provided to the entire group together with encouraged discussion among all parties in attendance. Interprofessional relations were also promoted within the clinical dissertation committee. The committee was formed with members from nursing, biological sciences, and community healthcare.

Project Objectives

Healthcare professionals are key to improving HPV vaccination coverage. The professionals must be aware of the current data, barriers for vaccination coverage, their role, missed opportunities, and strategies for improvement in order to influence positive change and increased HPV vaccination coverage. A clinic education program was developed for the purpose of achieving the project objectives, which included the following: 1) to improve the healthcare professionals' level of knowledge of the HPV vaccine, safety, and efficacy, 2) to reduce the number of missed opportunities of HPV vaccination at the clinics, and 3) to improve the level of healthcare professionals' comfort in the communication strategies used to improve HPV vaccination coverage rates.

Project Design

The practice improvement project was an evidence-based educational intervention, which was built on results from numerous research studies revealing the need for further provider education and interventions to reduce the number of missed HPV vaccination opportunities and improve HPV vaccination coverage rates (Farrar et al., 2016). Healthcare professionals' level of knowledge and strong recommendation for HPV vaccination are key factors in adolescent HPV

vaccination coverage (Hansen et al., 2016). Parents rely on the knowledge and beliefs of the healthcare professionals (Kornides et al., 2018). The more satisfied parents are with the recommendation and education they received from the professionals, the more likely they are to agree to adolescent HPV vaccination.

Healthcare professionals face several barriers when trying to improve HPV vaccination coverage, including a lack of parental knowledge, HPV myths, and a lack of provider support leading to missed opportunities (Brown, Hopfer, & Chan, 2015; Tom et al., 2015). Strategies to reduce the amount of provider barriers and reduce the overall barriers for HPV vaccination exist. The focus of the practice improvement project was the various available strategies for improvement, including communication strategies, scheduling HPV vaccination appointments for series completion, and the importance of the healthcare professionals' recommendation. Additional information included for enhanced understanding of the topic of HPV vaccination was as follows: background on HPV infection and the related complications, the HPV vaccine, current coverage rates, barriers for HPV vaccination, and missed opportunities. Research has demonstrated improved HPV vaccination coverage after the successful implementation of an educational intervention for healthcare professionals (McLean et al., 2017).

The education was provided in a 50 to 60-minute presentation. The presentation was held three times in Jamestown and one time in Valley City due to clinic size and the patient populations. The third presentation in Jamestown was during the weekly provider meeting per the request of the physician director. The presentation was shortened to a condensed version per manager request during the meeting to allow for the necessary information to be provided in a timely manner. The condensed presentation was 30 minutes in length due to time constraints and

covered the same topics with more emphasis placed on the communication strategies and methods to reduce missed opportunities for HPV vaccination.

Additional examples including framing of the HPV vaccine and addressing parental concerns were presented during the educational intervention. Training in communication strategies and patient education is recommended by research to potentially reduce the number of missed opportunities and increase vaccination uptake (Javaid et al., 2017). Decreasing the number of missed opportunities and HPV vaccination coverage improvement should encompass provider training and education (Brown et al., 2015). Healthcare provider educational sessions have been shown to improve coverage rates, with an added benefit of recurrent educational opportunities for sustainability (Krantz et al., 2017).

The educational information was presented using a PowerPoint format with handouts provided for further review. Please see Appendix B and Appendix C for the educational presentation and condensed presentation format. Visual data was encompassed within the presentation, including graphs and coverage maps. Training videos from the Center for Disease Control and Prevention were shown during the presentation. The training videos discussed sample scenarios for presenting HPV vaccination using the communication strategies examined. One training video also discussed the topic of parental refusal and an evidence-based approach to address the situation. Please see Appendix D for the transcription of the training videos. After completing the educational seminar, the participants were given a post-test questionnaire to complete. A section for feedback was also available at the end of the post-test questionnaire. Please see Appendix F for the post-test questionnaire.

Data regarding missed opportunities for HPV vaccination and clinic HPV vaccine statistics were collected. A retrospective analysis for 2 months prior to project implementation

and for 2 months after implementation was done to allow for comparison. The HPV vaccination statistics were compared with those on the county and state level. Additional statistical data collected included common primary diagnoses for missed opportunity visits and patient gender.

Resources

Several various resources were utilized throughout the planning, implementation, and evaluation of the practice improvement project. Technology, time commitments, and personnel were required for the successful completion of the project. The personnel include the members of the clinical dissertation committee that was formed and a contact person at Sanford Health. The committee members had a variety of backgrounds and offered unique expertise. The investigator and clinical dissertation committee were required to spend a significant amount of time researching, planning, implementing, and evaluating the educational intervention. All healthcare professionals who agreed to participate in the proposed project were also required to spend approximately 60 minutes of their time completing the educational seminar and post-test questionnaire.

The technology used for the purpose of the project was essential for its successful completion. PowerPoint was vital for the educational seminar, as well as the presentation of the final project and results. Technology was used to assess data and determine the results of the project. The data assessed include responses to the post-test questionnaires and clinic statistics of missed opportunities and HPV vaccines given during the proposed time frame. Sanford Health technology support, nurse managers, and vaccine champions aided in the collection of vaccination and missed opportunity data.

Protection of Human Subjects

The human subjects who were involved in the project were healthcare professionals only. There was no direct patient contact during the project. The healthcare professionals did include women and minorities; however, no children were included in the practice improvement project. The statistics obtained were in an aggregate format with no personal identifiers included.

Protection of the human subjects involved in the study was ensured by the North Dakota State University Institutional Review Board. The project was reviewed and approved by the board and by school administration on October 4, 2018. Approval was obtained from Sanford Health through a proposal process on February 28, 2018. Participants were recruited through facility emails, flyers, and word of mouth communication. Please see Appendix E for the invitation e-mail that was sent to health professionals. Voluntary informed consent was obtained prior to the start of the education seminar with verbal permission from participants received. Healthcare professionals in attendance were reminded the project was voluntary, and personal information was kept confidential. Treats and refreshments were offered during each of the educational presentations. As an added incentive, a drawing for a \$10 gift card was done at the sessions for those who attended.

The project had several benefits. The benefits included the knowledge gained by healthcare providers regarding HPV, the HPV vaccine, current barriers for vaccination, missed opportunities, and strategies to enhance vaccination uptake. However, the project did not reduce the number of missed opportunities or increase HPV vaccination coverage. Healthcare professionals also gained increased levels of comfort with new communication techniques and strategies for HPV vaccination improvement. New communication techniques for providers are

essential, as parents' level of satisfaction with the healthcare provider's recommendation for HPV vaccination can influence vaccination behavior and coverage (Kornides et al., 2018).

The knowledge gained through the project is critical because it can impact future healthcare professionals' practice and patient interactions. The knowledge gained also has the potential to reduce the number of missed opportunities and improve HPV vaccination coverage. Improved vaccination coverage will impact future rates of HPV infections and related complications. The knowledge can also impact future research regarding the impact of a healthcare professional educational intervention, as well as methods to improve vaccination coverage and reduced missed opportunities. A meeting will be held with Sanford Health to discuss the results of the practice improvement project, along with possible plans for sustainability. Potential plans for sustainability include the use of an online learning module or Sanford Learn and quarterly staff questions.

CHAPTER 4. EVALUATION

Evaluation Methods

Two forms of evaluation were used for the practice improvement project. The first was a post-test questionnaire. The post-test questionnaires were used to gain a better understanding of the healthcare professionals' level of HPV knowledge, as well as level of comfort with new communication strategies and methods for HPV vaccination coverage improvement. Questionnaires provide valuable information and have been used to collect data regarding provider knowledge about HPV (Kulczycki et al., 2016). Roussos-Ross, Foster, Peterson, and Decesare (2017) reported an increase in vaccine knowledge using a post-seminar survey to evaluate participants after an educational intervention. The post-test questionnaire incorporated the PARIHS framework by including clinical experience demographic information and questions. The demographic data collected, including current position and years of practice, was used to determine level of clinical experience for each of the participants. The post-test questions were designed to evaluate project objectives one and three using evidence-based information gathered during the literature review and presented during the educational session. Two or more questions were created per objective.

The second form of evaluation was the statistical data regarding the number of HPV vaccinations administered at each clinic two months prior to the educational session and two months after the session. The number of missed opportunities from each facility during the same time frame was also collected. The literature supports the effectiveness of education sessions in reducing missed HPV opportunities, as Javaid et al. (2017) noted how targeted interventions could be used to reduce the number of missed opportunities for HPV vaccination. Additionally, provider and staff education has been shown to impact HPV vaccination uptake (McLean et al.,

2017). The statistical data was used to evaluate objective two. Aggregate data was obtained as per the IRB approval. The statistical data aligned with the subelement of local data from the PARIHS framework.

Objective One

The first project objective was to improve healthcare professionals' level of understanding and knowledge of the HPV vaccine, safety, and efficacy. Approximately one-third of the education materials and PowerPoint presentation, both original and condensed format, focused on objective one. Four post-test questions were used to evaluate the presentation and assess if the objective was met. The first question was as follows: "For both males and females ages 9-14 years, what is the correct HPV vaccine dose regimen?" Response options were: a) 2-dose regimen: now and three months, b) 2-dose regimen: now and six months, c) 3-dose regimen: now, one-two months, and six months, d) 3-dose regimen: now, one month, and three months. The second question was as follows: "The HPV vaccine is associated with which of the following adverse events (select all that apply)." The response options were: a) venous thromboembolism (VTE), b) neurologic events, c) autoimmune events, d) localized injection site pain, e) none of the above. The third post-test question evaluating objective one was as follows: "The nine-valent HPV vaccine has demonstrated _____ efficacy if given prior to the initiation of sexual activity." The responses were: a) 92%, b) 87%, c) 96%, d) 78%. The final question was as follows: "Which of the following has been found to be the most significant factor in determining HPV vaccine acceptance and initiation among parents and adolescents?" The response options were: a) provider recommendation, b) amount of education provided, c) increased time for appointment, d) advertisement recommendation. Please see Table 1 for further information.

Objective Two

The second project and learning objective was to reduce the number of missed opportunities for HPV vaccination at each of the facilities. Statistical data was used to evaluate the project and verify if the objective was met post-implementation. The statistical data included the number of missed opportunities at both the Sanford Health clinics in Jamestown and Valley City. The missed opportunity data originally looked at children and adolescents ages 11-17 years but was later expanded to ages 11-4 years and 15-26 years due to the data received from Sanford Health. Missed HPV opportunities were compared to missed opportunities for the other adolescent vaccines as well. The reason for the patient visit when the vaccine was missed was also included in the data. Additional statistical data used to evaluate the project objective were the total number of HPV vaccines given during the project time and HPV up-to-date rates for patients ages 11-14 and 15-26. The total number of adolescent visits were calculated for each month. The Sanford Health immunization strategy leader collected and supplied the aggregate data for the objective, as well as the project coordinator for the Department of Public Health.

Objective Three

The third objective was to improve healthcare professionals' level of comfort in communication strategies that can be used to improve HPV vaccination coverage rates. The objective was evaluated with two post-test questions. The two questions used a Likert scale to assess healthcare professionals' opinions. The first question was as follows: "Following the education presentation, I have an increased understanding of HPV, the HPV vaccine, and communication strategies used to reduce missed opportunities and improve vaccine coverage." The response options included: 1) strongly disagree, 2) disagree, 3) neutral, 4) agree, 5) strongly agree. The second question was as follows: "Following the educational presentation, I am more

comfortable discussing HPV and the HPV vaccine with parents and adolescents.” The response options were the same for the second statement as the first. Additionally, the post-test included a section for comments and feedback regarding the presentation and educational information provided. Please see Table 1 for additional information.

Several participants reported positive feedback after attending the educational intervention. Feedback and comments during the educational intervention included discussing the current HPV-positive cervical cancer rates in Australia and the impact of their vaccination program. One comment provided in the comments section stated, “Good job!” Other staff stated they found the information very helpful and planned to use it later the same day. Additional staff who were unable to attend requested to know if more opportunities would be available because of what they were hearing from participants.

Table 1

Practice Improvement Project Objectives and Assessment Questions

Question	Response Options	Method of Instruction	Length of Instruction
Objective 1: Improve healthcare professionals' level of knowledge of the HPV vaccine, safety, and efficacy			
For both males and females ages 9-14 years, what is the correct HPV vaccine dose regimen?	<ul style="list-style-type: none"> a) 2 dose-regimen: now & 3 months b) 2-dose regimen: now & 6 months c) 3-dose regimen: now, 1-2 months, & 6 months d) 3-dose regimen: now, 1 month, & 3 months 		
The HPV vaccine is associated with which of the following adverse events? (select all that apply)	<ul style="list-style-type: none"> a) Venous thromboembolism (VTE) b) Neurologic events c) Autoimmune events d) Localized injection site pain e) None of the above 	Lecture, PowerPoint presentation, and videos	<p>~ 20 minutes of original presentation</p> <p>~ 10 minutes of condensed presentation</p>
The nine-valent HPV vaccine has demonstrated _____ efficacy if given prior to the initiation of sexual activity.	<ul style="list-style-type: none"> a) 92% b) 87% c) 96% d) 78% 		
Which of the following has been found to be the most significant factor in determining HPV vaccine acceptance and initiation among parents and adolescents?	<ul style="list-style-type: none"> a) Provider recommendation b) Amount of education provided c) Increased time for appointment d) Advertisement recommendation 		

Table 1. *Practice Improvement Project Objectives and Assessment Questions* (continued)

Question	Response Options	Method of Instruction	Length of Instruction
Objective 3: Improve healthcare professionals' level of comfort in the communication strategies used to improve HPV vaccination coverage rates			
Following the educational presentation, I have an increased understanding of HPV, the HPV vaccine, and communication strategies used to reduce missed opportunities and improve vaccine coverage.	1) Strongly disagree 2) Disagree 3) Neutral 4) Agree 5) Strongly agree	Lecture, PowerPoint presentation, and videos	~ 40 minutes of the original presentation ~ 20 minutes of the condensed presentation
Following the educational presentation, I am more comfortable discussing HPV and the HPV vaccine with parents and adolescents.	1) Strongly disagree 2) Disagree 3) Neutral 4) Agree 5) Strongly agree		

CHAPTER 5. RESULTS¹

Presentation of Results

Data were collected through the use of post-test questionnaires completed by healthcare providers, and HPV vaccination data was obtained from Sanford Health. The post-test questionnaires were collected immediately after completing the presentation. The Jamestown questionnaires were collected on the following dates: November 5, 2018, November 8, 2018, and November 20, 2018. The Valley City questionnaires were collected November 27, 2018. The Sanford Health data were collected in January 2019 from both Jamestown and Valley City clinics, as well as from the immunization strategy leader for Sanford Health in Sioux Falls, SD.

Demographics

The demographic data was collected on the post-test questionnaires. The total number of participants between the two sites was 36. Three of the 36 participants were unable to stay for the complete presentation and were not able to complete the post-test questionnaire. Nearly half (n=15) of the participants were primary care providers, including physicians, nurse practitioners, and physician assistants. The remainder of the participants (n=18) were nursing staff, including registered nurses (n=10) and licensed practicing nurses (n=6), as well as other support staff working at the clinics. The level of experience for the participants ranged from less than one year to over 20 years. Please see Figure 3 for additional information.

¹ The material in this chapter was co-authored by Carly Hanson and Dr. Allison Peltier. Carly Hanson had primary responsibility for collecting samples in the field and for interviewing users of the test system. Carly Hanson was the primary developer of the conclusions that are advanced here. Carly Hanson also drafted and revised all versions of this chapter. Dr. Allison Peltier served as proofreader and checked the math in the statistical analysis conducted by Carly Hanson.

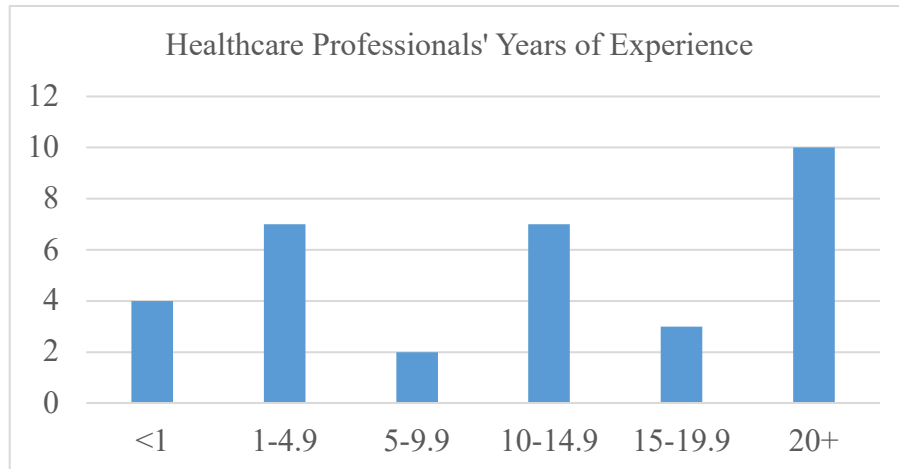


Figure 3. Healthcare professionals' level of experience.

Objective 1

The first objective of the project was to improve the level of knowledge of the HPV vaccine, safety, and efficacy for healthcare professionals. As previously discussed, there were four questions on the post-test questionnaire pertaining to objective one. The first question evaluated healthcare professionals' level of knowledge of the current HPV vaccine dose-regimen for adolescents ages nine through fourteen years. The correct answer was option b. 2-dose regimen: now and six months (Meites, Kempe, & Markowitz, 2016). Of the 33 healthcare professionals who completed the post-test questionnaire, 93.9% (n = 31) chose the correct answer for the current dose-regimen recommendation for the age range.

The second question evaluated healthcare professionals' knowledge of associated adverse events with receiving the HPV vaccine. Multiple answers were allowed for the question, as it was a select all that apply. Although the question was a select all that apply, there was only one correct answer. The correct answer was option d. localized injection site pain. VTE, neurologic events, and autoimmune events were additional options; however, they were not supported by research and not positively associated with the HPV vaccine (Arnheim-Dahlström et al., 2013; Bonanni et al., 2017; Lui et al., 2016). The correct answer was chosen 76.9% of the time. Of the

33 participants, 90.9% (n = 30) chose the correct answer but not necessary the correct combination since it was a select all that apply question.

The third question was used to evaluate healthcare professionals' knowledge of vaccine efficacy. The correct answer was option c. 96% (Luckett & Feldman, 2016). The results for the answer were split; however, only 42.4% (n = 14) of the healthcare professionals chose the correct answer. The other similar, yet incorrect answer (92%) was chosen by 54.5% (n = 18) of the healthcare professionals.

The final question used to evaluate objective one assessed healthcare professionals' knowledge of the most significant factor for HPV vaccination among adolescents. The correct answer was option a. provider recommendation (CDC, 2018g). Provider recommendation is the number one reason for HPV vaccination in the United States. It is considered to be key in parental acceptance and HPV vaccination uptake among the adolescent population (Perkins et al., 2014). Of the 33 healthcare professionals, 97% (n = 32) selected the correct answer. See figure 4 for additional information.

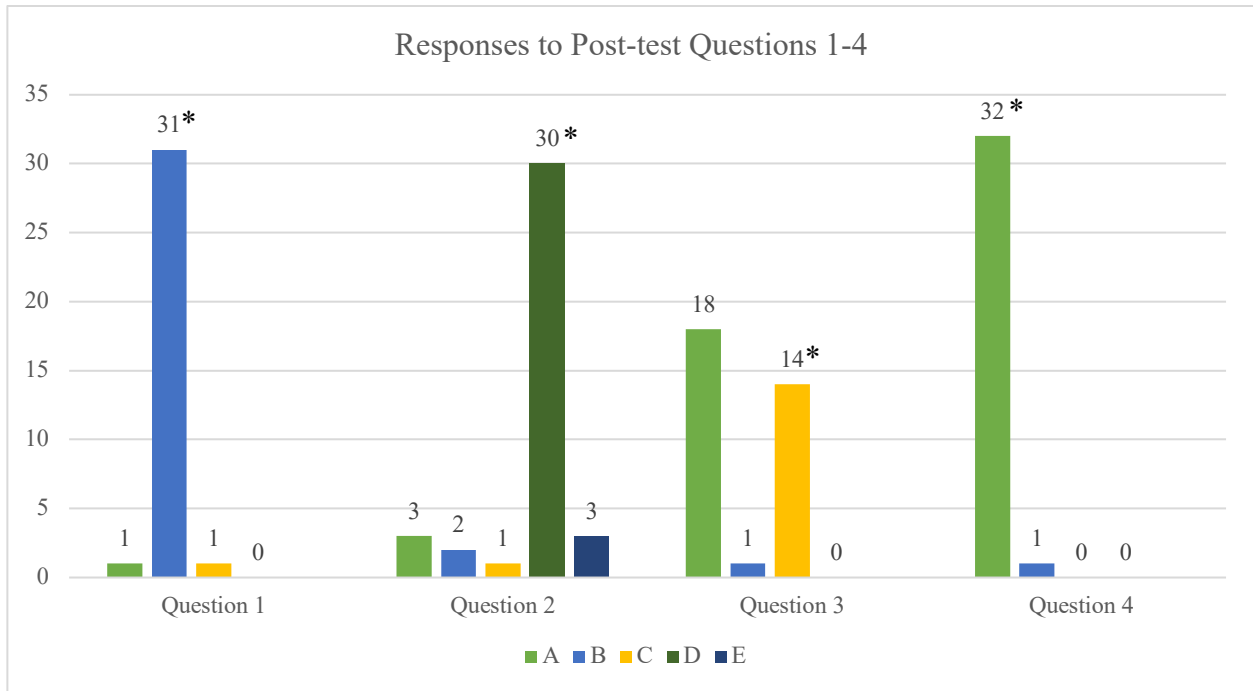


Figure 4. Responses to post-test questions 1-4. Evaluation of objective 1. * represents the correct answer.

Objective 2

The second objective of the project was to reduce the number of missed opportunities for HPV vaccination among adolescents at each of the clinic sites. HPV vaccination and missed opportunity rates were monitored for 2 months prior to the practice improvement project and compared to HPV vaccination and missed opportunity rates at each of the clinic sites post-intervention. The original age range was adolescents ages 11-17 years; however, due to data received from Sanford Health, the age range was expanded to include up to 26 years. Additional data regarding diagnoses at the missed opportunity visits and total number of HPV vaccines administered were collected for further evaluation. The total number of patient visits for ages 11-14 years and 15-26 years for September 2018 through January 2019 were calculated for both Jamestown and Valley City clinics.

Missed opportunities. The overall total for each interval included ages 11-14 years and 15-26 years. The overall total number of missed opportunities for HPV vaccination at the Sanford Jamestown Clinic was 322 in the two months prior to the educational intervention (September 20 – November 19, 2018), which is 30.3% of the total patient visits during the same time. Approximately 38.8% of patient visits ages 11-14 years and 28.9% of patient visits ages 15-26 years were missed opportunities for HPV vaccination prior to educational intervention. The overall total number of missed opportunities was 294 for the two months following the intervention (November 20, 2018 – January 19, 2019), which is 31.5% of the total patient visits. Approximately 45.1% of patient visits ages 11-14 years and 29.2% of patient visits ages 15-26 years were missed opportunities in the 2 months after the intervention. For a detailed breakdown of the missed opportunities for each age group and month below, please see Figure 5 and Table 2.

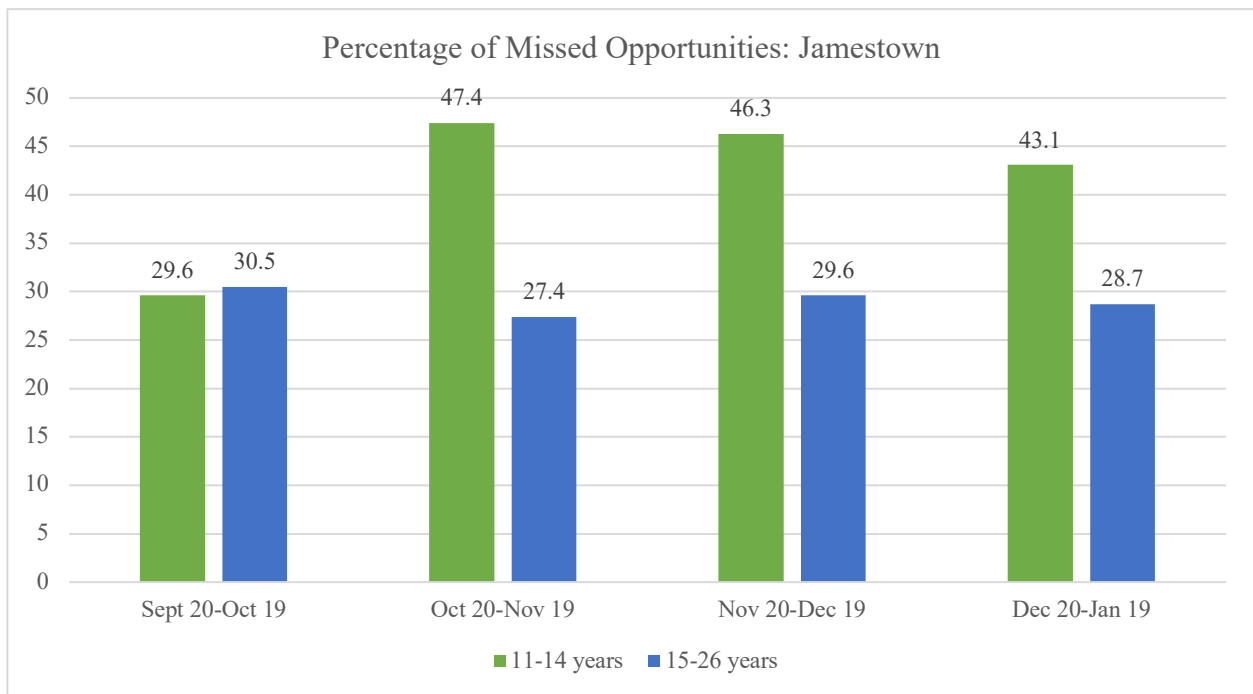


Figure 5. Percentage of missed opportunities for HPV vaccination at the Sanford Jamestown Clinic.

Table 2

Sanford Jamestown Missed Opportunities for HPV Vaccination

	Sept 20- Oct 19	Oct 20- Nov 19	Nov 20- Dec 19	Dec 20- Jan 19
11-14 years	71	76	82	51
15-26 years	459	457	446	355

The Valley City clinic reported zero missed opportunities before and after the practice improvement project, which included all vaccinations for ages 11-26 years. The Valley City clinic checked their rates using two different methods to verify the results, EPIC data and NDIIS data. During the two months prior to the educational intervention in Valley City (September 27 – November 26, 2018), the clinic saw 314 patients ages 11-26 years. In the two months after the intervention (November 27, 2018 – January 26, 2019), 330 patients ages 11-26 years were seen.

Non-HPV missed opportunities. At the Sanford Clinic in Jamestown, there were missed opportunities for TDaP and meningococcal vaccination as well. From September 20, 2018 through November 19, 2018, there were 82 missed opportunities for TDaP and meningococcal vaccination for ages 11-26 years. The percentage of missed opportunities for TDaP and meningococcal vaccination was 7.7% for the two months prior to intervention. The number of missed opportunities for TDaP and meningococcal vaccination from November 20, 2018 through January 19, 2019 was 86 for ages 11-26 years. The percentage of missed opportunities for TDaP and meningococcal vaccination was 9.2% for the two months post-intervention. See Figure 6 for more information regarding a comparison of HPV missed opportunities to TDaP and meningococcal missed opportunities. As previously stated, Valley City Sanford did not have any missed opportunities for adolescent vaccinations, including TDaP, meningococcal, and HPV.

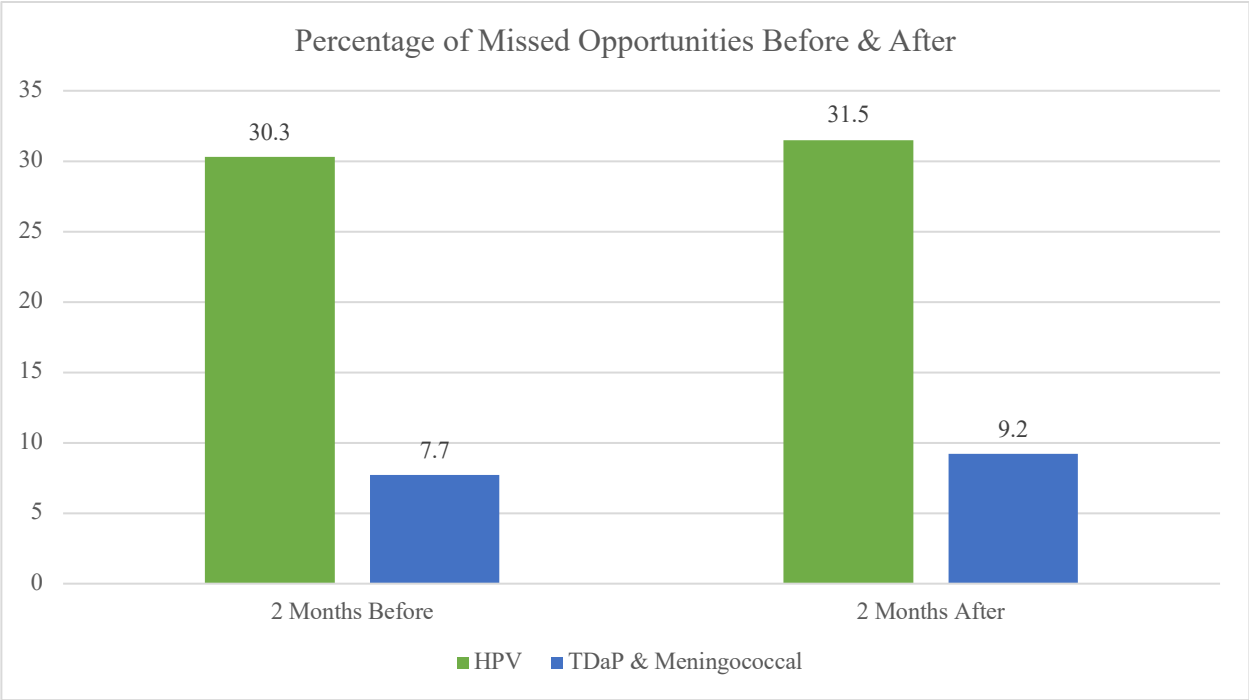


Figure 6. Percentage of missed opportunities before and after at Sanford Jamestown.

Frequent diagnoses associated with missed opportunities. Frequent diagnoses used during missed HPV opportunities include the following: encounter for routine exam, sore throat, upper respiratory infection, sinusitis, attention deficit disorder (ADD), and immunizations due. At the Jamestown clinic, there were 16 visits with the diagnosis of ‘immunization due’ before the educational intervention, and there were 17 visits with this diagnosis after. There were 32 visits with diagnoses for routine exam or well child exam before the intervention, and this was reduced to 17 visits with these diagnoses after the intervention. Missed opportunities during visits for upper respiratory infection (URI), sinusitis, and sore throat were commonly noted during the evaluation time. Twenty-six visits for URI, sinusitis, or sore throat occurred pre-intervention, while 31 visits for URI, sinusitis, or sore throat occurred post-intervention.

HPV vaccines given. The total number of HPV vaccines given for two months prior to the intervention (September 20, 2018 to November 20, 2018) was 47 at the Jamestown Sanford Clinic, which includes both clinic and state vaccine. The 47 doses of HPV vaccination account

for only 4.4% of the patient visits ages 11-26 years. This number is comparable to the total number of HPV vaccines given at the Jamestown Sanford Clinic for two months after the intervention (November 21, 2018 to January 20, 2019), which was 46. The 46 doses account for 4.9% of the patient population seen. Twelve HPV vaccines were administered at the Valley City Sanford Clinic two months prior to the intervention (September 27, 2018 to November 26, 2018), which was given at 3.8% of visits. Sixteen HPV vaccines were administered in the two months after the intervention (November 27, 2018 to January 27, 2019) at the Valley City Sanford Clinic, which accounts for 4.8% of the visits.

HPV status for attributed patients. Sanford Health provided additional data regarding the HPV status for patients during each month. The data is separated into two groups based on age of the patient for each of the clinics. The age ranges are 11-14 years and 15-26 years. The number of patients with zero HPV doses, one dose, and completed were collected. The patients were also assigned to an active primary care provider and clinic through a process called attribution (Ambulatory Attribution Workgroup, 2019). The assignment to an active primary care provider is based on eligible encounters. Eligible encounters include an office visit, well child, OB office visit, nursing home visit, and pediatric visit. The encounter must be a face-to-face encounter and a completed appointment. The patients are assigned to the active provider seen most frequently in the past 27 months. Once the patient is assigned to a provider, they are then assigned to the provider's clinic. Patient attribution is updated monthly and can change based on the patient's attributed primary care provider.

The percentage of patients with one dose and who completed the HPV vaccine series did not change significantly from before the practice improvement to after the project. The number of patients attributed to each clinic did vary slightly due to the attribution process. See figures 7

and 8 for additional information. It is important to note, not all attributed patients are seen each month at the clinic. Less than 15% of the attributed population ages 11-14 years is seen each month and less than 35% of the attributed population ages 15-26 years is seen each month at the Sanford Jamestown Clinic. Roughly 14% or less of the attributed population ages 11-14 years is seen each month at the Sanford Valley City Clinic and less than 25% of the attributed population ages 15-26 years is seen monthly. See figure 9 for additional information about the percentage of attributed patients who were seen each month.

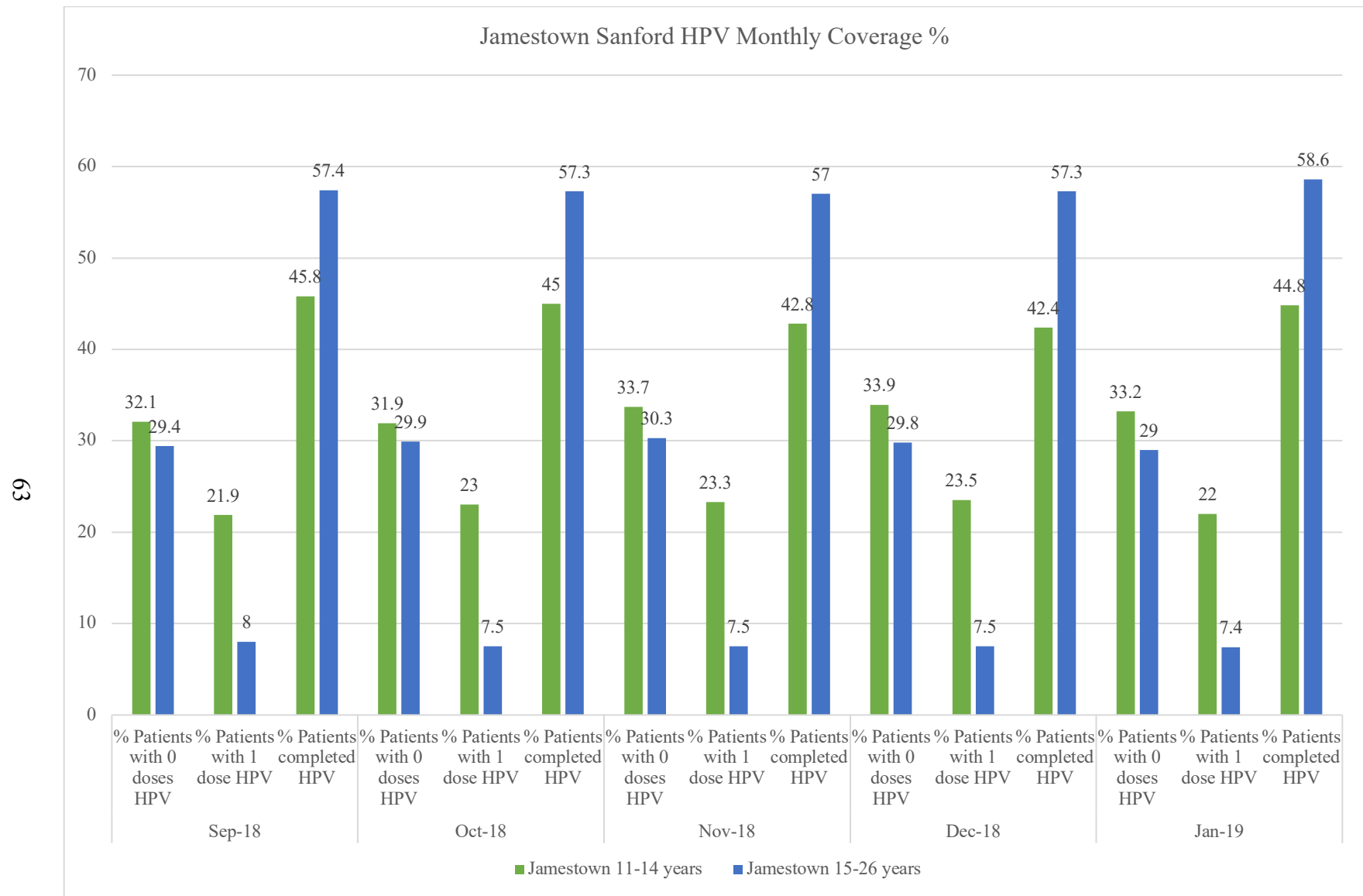


Figure 7. Sanford Jamestown HPV vaccination monthly coverage percentages.

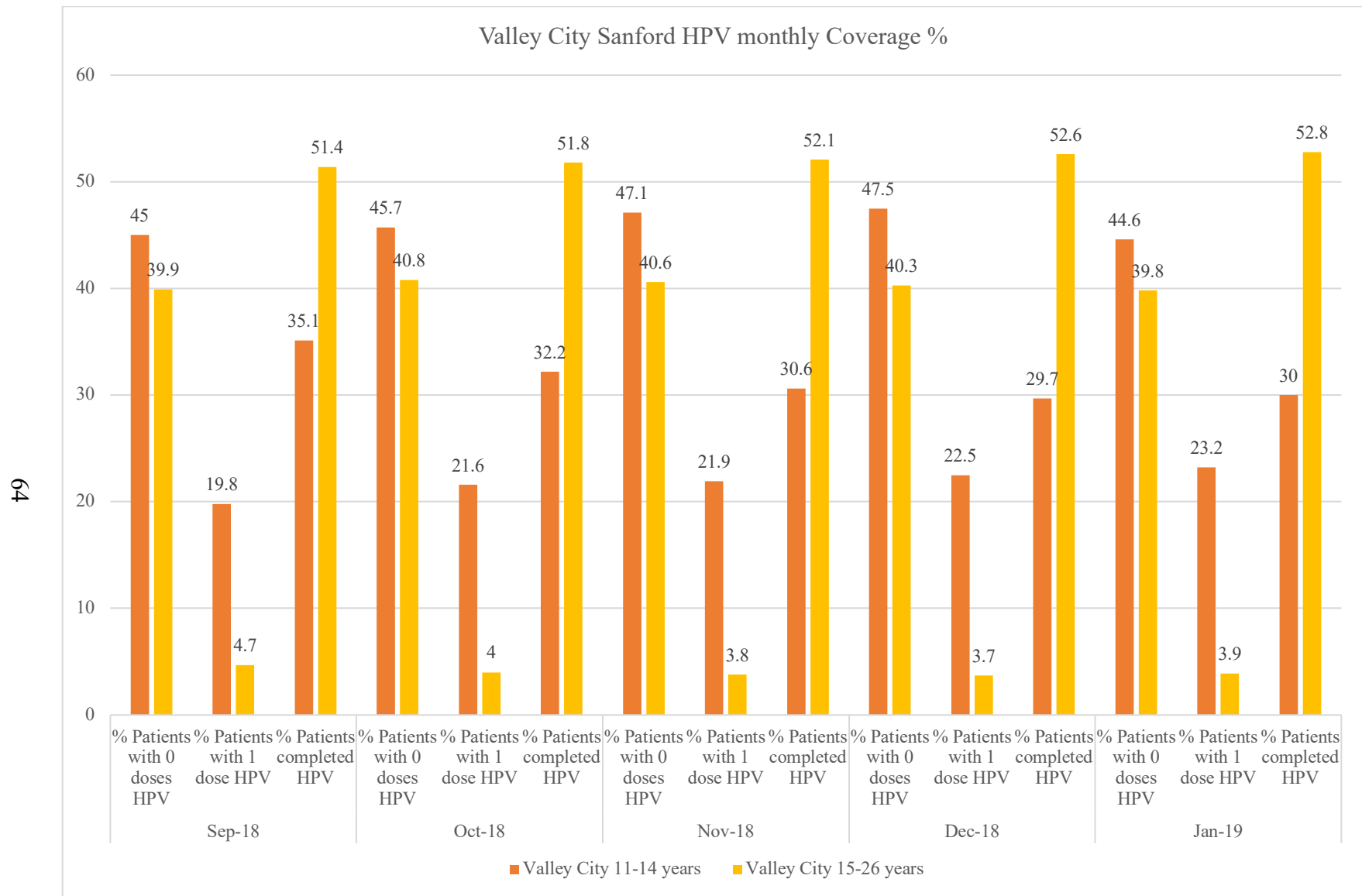


Figure 8. Sanford Valley City HPV vaccination monthly coverage percentages.

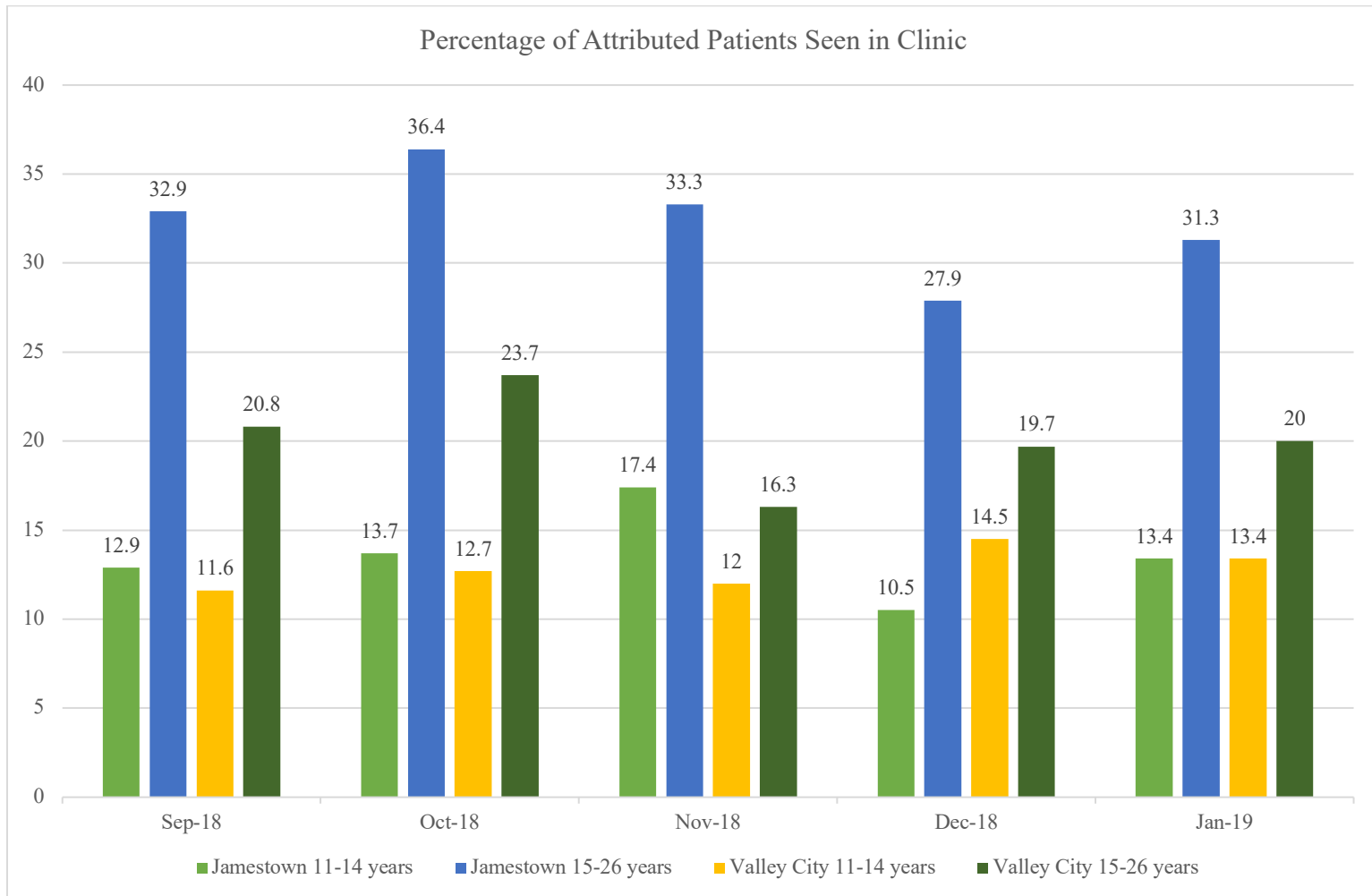


Figure 9. Percentage of attributed patients seen at Sanford Jamestown and Sanford Valley City.

Objective 3

The third objective was to improve the healthcare professionals' level of comfort in the new communication strategies discussed during the educational presentation. Two questions on the post-test questionnaire were used for the evaluation and scored on a 5-point Likert scale from strongly disagree to strongly agree. The first question evaluated healthcare professionals' beliefs about their level of understanding of HPV, the vaccine, and communication strategies and if they felt their understanding and comfort of these topics increased after attending the educational intervention. The average score was 3.97. Of the 33 healthcare professionals who completed the questionnaire, 75.8% (n = 25) either agreed or strongly agreed with the statement. There were 18.2% (n = 6) of those who attended who strongly disagreed with the statement. Please see figure 8 for additional information.

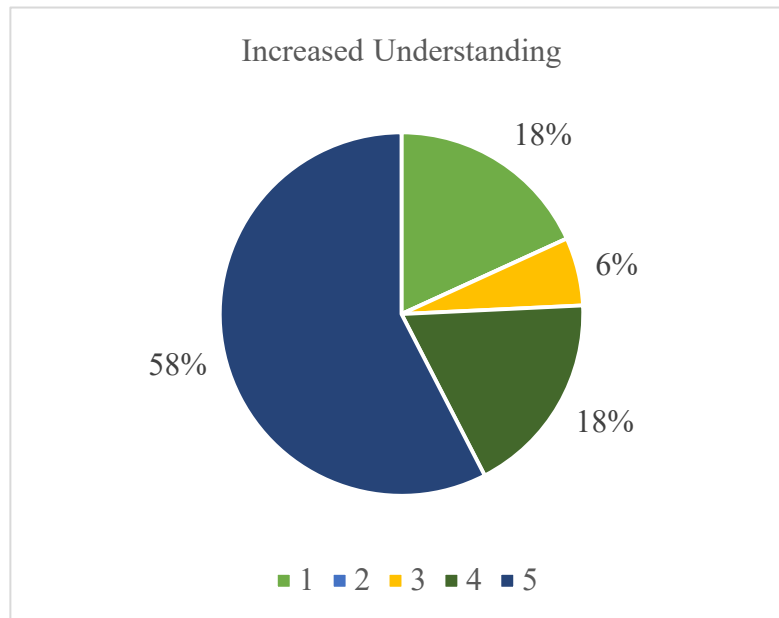


Figure 10. Percentages of increased understanding from healthcare professionals post-intervention.

The second statement used to evaluate objective three appraised healthcare professionals' level of comfort in using the new communication techniques for discussing HPV with parents

and adolescents after attending the educational session. The average score was 4.06. Of those in attendance, 78.8% (n = 26) positively responded to the statement by either agreeing or strongly agreeing. The number who disagreed was the same for the second question at 18.2% (n = 6). Please see figure 9 for additional information.

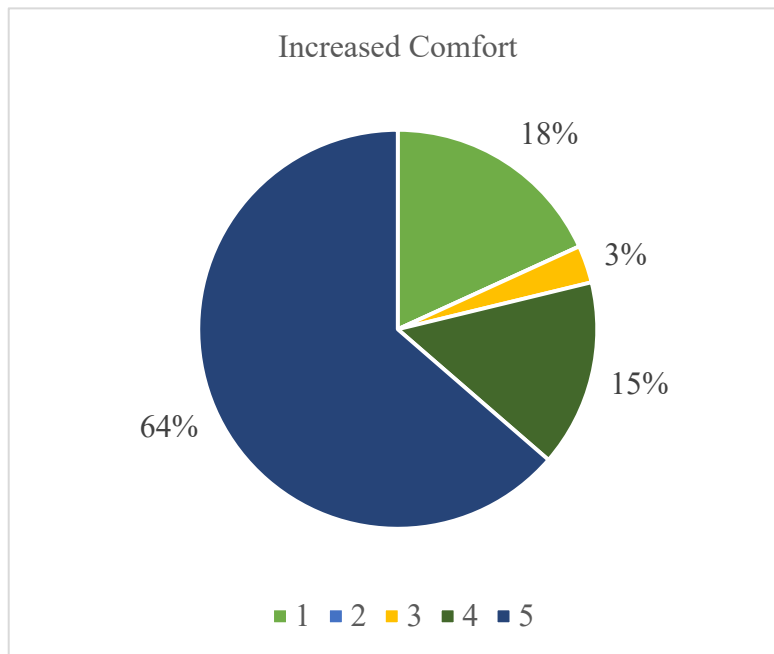


Figure 11. Percentage of increased comfort for healthcare professionals post-intervention.

CHAPTER 6. DISCUSSION & RECOMMENDATIONS

Interpretation of Results

Post-test Results

Overall, a majority (n=25) of the healthcare professional participants reported an increase in level of understanding of HPV, the HPV vaccine, and communication strategies to reduce missed opportunities for vaccination and improve coverage. The correct answer was selected on the post-test a majority of the time for questions one through four, which were used to evaluate objective one. The post-test results indicate an increase in participants' knowledge; however, there is no baseline pre-test for comparison. It is critical to prioritize efforts to facilitate healthcare professionals understanding and recommendations for HPV vaccination (Pierre-Victor et al., 2017b). Interventions, such as educational sessions, that increase healthcare professionals' understanding can increase HPV vaccination coverage according to Fu et al. (2014).

The results for question three about the efficacy of the HPV vaccine in the HPV-naïve population did vary with an incorrect answer being chosen a majority of the time; however, the most common answer chosen was only four percent different than the correct answer of 96%. Both answers were greater than 90%. Gaps in healthcare professionals' knowledge and lack of strong recommendation are known factors for the lag in HPV vaccination uptake in comparison to the required adolescent vaccines (Farrar et al., 2016; Tom et al., 2016). Research has shown how essential it is to increase provider knowledge and strengthen the recommendation for HPV vaccination in order to improve vaccination uptake and completion rates (Rand et al., 2018).

The average rating for increased level of understanding after attending the practice improvement intervention was 3.97 on a 5-point Likert scale, demonstrating a positive response from the healthcare professionals in attendance. The average rating for increased level of comfort

with new communication strategies to reduce missed opportunities for HPV vaccination was 4.06 on a 5-point Likert scale, which also demonstrated positive results from many of the health professionals. The positive results support the available evidence about the importance of provider knowledge and subsequent recommendation for HPV vaccination in the adolescent population (Brown et al., 2015). The results also indicate project objective three was met. Provider recommendation is critical and remains to be a key area for HPV vaccination uptake research (Hansen et al., 2016).

Missed Opportunity Results

When further evaluating objective two and the rate of missed opportunities for HPV vaccination, it is noted there was no change from before project implementation to after. The rate of missed opportunities at both Jamestown Sanford and Valley City Sanford did not change. However, the rate of missed opportunities at routine physical exams and immunization due visits did decrease at the Jamestown clinic after the educational intervention. Routine exam missed opportunities was 32 in the two months prior to intervention and decreased to 17 in the two months after the intervention. The immunization due visit rate of missed opportunities did not decrease following implementation of the educational sessions.

The overall lack of change in rate of missed opportunities is supported by evidence stating educational interventions alone are not enough to significantly decrease the rates of missed opportunities (McLean et al., 2017). A multifaceted approach including provider and staff education has been shown to significantly impact the rate of missed opportunities (Rand et al., 2018). Additional evidence suggests implementation of recall systems to increase HPV vaccination uptake may help to reduce the number of missed opportunities (McLean et al., 2017).

State & County Rate Comparison

Comparison of Sanford Jamestown and Valley City rates to state and county rates is important to gain an understanding of the effectiveness of the educational intervention; however, it is difficult due to the difference in the age groups. State and county level statistics are for ages 11-17 years, while Sanford statistics are for ages 11-14 years and 15-26 years. For the comparison, up-to-date rates for county and state are compared with completed rates at each of the intervention clinics. In January 2019, Sanford Jamestown HPV vaccination coverage for ages 11-14 years was 22% for 1-dose and 44.8% for completed HPV vaccination series. The coverage for ages 15-26 years was 7.4% with 1-dose and 58.6% completed. The Stutsman County completed rate was 73.07% for adolescents ages 11-17 years in 2018 (NDIIS, 2018). Therefore, Sanford Jamestown remained below the county rates after educational implementation.

Sanford Valley City HPV coverage for ages 11-14 years was 23.2% with 1-dose and 30% completed in January 2019. The coverage for ages 15-26 years was 3.9% with 1-dose and 52.8% completed. Barnes County coverage for ages 11-17 years is 65% for 1-dose and 55.64% for up-to-date (NDIIS, 2018). In comparison to Barnes County, Sanford Valley City remains significantly below the county coverage rates for 1-dose. The coverage for ages 15-26 being completed is closer to county levels but remains behind after the educational intervention, as discussed in the following paragraph.

The coverage rate for completed HPV vaccination in Jamestown for ages 15-26 is above state levels at 57.3% completed, whereas the North Dakota coverage rates for ages 11-17 years is 67.6%. Sanford Valley City is slightly behind the completed rates for ages 15-26 at 52.6%. The rates for 1-dose completion at each of the intervention clinics were significantly behind the state

rates for all ages. The state rate for 1-dose is 67.6% for ages 11-17 years. Sanford Jamestown had a 1-dose rate of 7.5%, and Sanford Valley City has a 1-dose rate of 3.7%.

Limitations

The practice improvement project was associated with several limitations. The first limitation was a small sample size. Overall, 33 participants were able to complete the entire educational session and post-test questionnaire. A small sample size negatively impacts the accuracy of the results and does not allow the results to be generalized (McClave & Sincich, 2017). The total participants were split between the two healthcare locations as well.

A second limitation was the limited number of implementations of the practice improvement project educational sessions. The project was implemented four times: three in Jamestown and one in Valley City. There is a larger number of employees at the Jamestown Sanford location, which is why the project was implemented in this location additional times. The third time in Jamestown was a condensed version of the presentation due to implementing during the weekly provider meeting. Increased amounts of implementation sessions may have increased the sample size.

An additional limitation was the type of data collected. The HPV statistics were collected in aggregate form. Aggregate form was used to protect patient and provider identities; however, it does not allow for the results to be tailored to the individual providers. The aggregate data also does not allow details to be known about the missed opportunity visits. Additional helpful details about the reasoning for a missed opportunity, such as an acute illness, parental/patient refusal, or inaccurate immunization records, would be helpful in learning more about the various causes of missed opportunities at each facility. Knowledge regarding the healthcare providers associated

with each missed opportunity visit would also help to know if certain providers at the facilities have higher rates of HPV missed opportunities and may benefit from further education.

A fourth limitation is the varying age ranges for the aggregate data regarding HPV coverage rates for each clinic. The data were only available in set ages from 11-14 years and 15-26 years. The target ages for the practice improvement project were ages 11-17 years; however, the ages of 18-26 years were included in the results and comparison. Including the additional ages possibly skewed the data for coverage rates and the comparison to state and county level statistics.

A fifth limitation is the amount of time spent monitoring the data. The data were monitored for 2 months prior to and after the educational intervention at each facility. The amount of time spent monitoring the HPV statistics may not have been adequate to fully see the changes after implementation. Fewer patients ages 11-14 years and 15-26 years were seen in the clinic after the educational intervention than before the intervention. Rand et al. (2018) recorded data for a 12-month period. Additionally, the limited timeframe for implementation did not allow for the presentation to be recorded and made available to additional healthcare professionals, which may have increased the number of participants and access to the intervention. A recording of the PowerPoint presentation with a voiceover could have enhanced sustainability as well.

Another limitation may be the reliability of the data. The Valley City Sanford Clinic reported zero missed opportunities for vaccination; however, the rates of HPV vaccination coverage in January 2019 were only 30% for ages 11-14 years and 52% for ages 15-26 years. The percentage of adolescents who had not received any HPV vaccination was high.

The final limitation is found within the missed opportunity data and patient visit numbers. Not all patients ages 15-26 years were eligible to receive the HPV vaccine due to pregnancy or

other contraindications. The patients were still noted on the missed opportunity data, as well as the total visit numbers for each month because according to health maintenance data from Sanford, the patients were due for the vaccine. Further exclusion parameters could have resolved this issue and lead to more accurate data and statistics.

Recommendations

Due to the positive response from healthcare professional participants, it is reasonable to recommend continued research into the impact of educational seminars on the rates of missed opportunities for HPV vaccination. Brief educational seminars and updates could be instituted quarterly or an annual seminar is another option. Despite the lack of a significant decrease in the rate of missed opportunities for vaccination and overall HPV vaccination rates, continued healthcare professional education is warranted. Educational intervention regarding the significance of accurate and consistent provider recommendation for HPV vaccination can increase coverage rates (Krantz et al., 2017).

One recommendation is to expand the research and implementation opportunity to include an online module. Since the practice improvement project was implemented at Sanford Health facilities, the expanded research could include implementing a Sanford Success Center online module or Sanford Learn. The online module would contain the same information and details, yet be more easily accessible. Expanding the research to include online modalities increases the sample size and demographics. The online module also allows for participants to access it at a time that works best for them and could be available for a certain length of time. The expanded research would focus on family practice healthcare professionals. The Sanford Learn module could be assigned to certain staff on an annual basis and updated as needed.

An additional option for Sanford Health is to implement quarterly staff questions pertaining to HPV vaccination. Nursing staff are required to participate in staff questions on a monthly basis to verify knowledge of specific topics. HPV vaccination could be implemented as one of the key topics. Additional healthcare professionals, including providers, could also participate in the questions. Rand et al. (2018) reported including all staff in multifaceted interventions to increase HPV vaccination to be significant in improved facility rates. Quarterly questions would be a method of continued reinforcement of the information previously learned through educational sessions. Consistent questions and staff education, along with system level changes, are more sustainable and can increase HPV vaccination rates (McLean et al., 2017).

The long-term recommendation for the project is to continue implementation through an online module and expand the participant pool. The expanded pool would include the health professionals within the pediatric specialty. The overall goal is for HPV vaccination rates to increase to the *Healthy People 2020* goal of over 80% and reduce the rate of missed opportunities (ODPHP, 2018).

Implications for Practice

The practice improvement project impacted 33 healthcare professionals, including physicians, advanced practice providers, and nursing staff. The research and data collected adds to the available literature regarding the impact of healthcare professional-focused educational interventions. The significance of providing education to all staff can create a group culture that encourages HPV vaccination (Wolynn, 2018). Rand et al. (2018) support HPV vaccination interventions that involve all staff as well, noting it can have a larger impact on the results.

New information was provided during the practice improvement project to increase healthcare professional knowledge about the significance of rising HPV-associated cancers, such

as oropharyngeal cancer. The rates of oropharyngeal HPV-positive cancer are increasing and predicted to surpass the rates of HPV-associated cervical cancer by 2020 (Selcuk, 2016). The significance of protecting against rising cancers is known, but additional healthcare professional education is important to continue to recommend vaccination.

With the implementation and recommendation of a 2-dose series by the ACIP and CDC, it is critical to provide education to all staff (Meites, Kempe, & Markowitz, 2016). HPV-9 vaccination rates continue to lag behind the other adolescent vaccinations required. The 2-dose series has the potential to improve vaccination rates and increase coverage. In addition to the 2-dose schedule for ages 11-14 years, the ACIP is also investigating an extended schedule for ages 27-45 years (Markowitz, 2018). The extended ages were approved by the FDA in 2018 in hopes to increase protection against HPV-associated complications (FDA, 2018b). With the new extended ages, coverage rates will continue to be below the *Healthy People 2020* goal of 80% unless interventions are used to increase provider recommendations and coverage rates (ODPHP, 2018).

The impact of a successful HPV vaccination program is noted by the current rates of HPV-associated complications in Australia (Hall et al., 2018). Australia was one of the first countries to start a national HPV vaccination program in 2007 for girls that expanded in 2013 for boys (Patel et al., 2018). The program originally administered the quadrivalent HPV vaccine and only recently changed from the 2-dose series to the nine-valent HPV vaccine in January 2018. A substantial decline in the rates of genital warts and cervical disease were reported and directly linked with the national vaccination program. Australia reports HPV-associated diseases could be potentially eliminated if the vaccination program continues, along with screening for disease.

Currently in Australia, the HPV vaccine coverage for girls is greater than 78% and greater than 72% for boys (Patel et al., 2018). The coverage rates are below the *Healthy People 2020* goal of 80% but are significantly higher than current coverage rates in the United States (CDC, 2018a; ODPHP, 2018). According to Patel et al. (2018), mortality rates for cervical cancer are predicted to continue to decrease and reach one new case per 100,000 annually by the year 2034. Due to the HPV vaccination program and cervical cancer screening in Australia, the rate of new cervical cancer diagnoses is estimated to decrease to less than six per 100,000 annually by 2020. If boys were not included in the vaccination program, a delay of at least 2 years in cervical cancer elimination is anticipated. The findings from Australia demonstrate the need for improved vaccination rates in the U.S. to reduce the rates of HPV-related complications, which is why this practice improvement project and future projects are needed.

Implications for Future Research

The findings from the practice improvement project revealed a continued need for intervention to reduce missed opportunities for HPV vaccination and increase vaccination coverage, especially in rural areas. The project intervention did increase healthcare professional understanding of HPV and confidence in communication strategies. Despite the increased knowledge, the rate of missed opportunities and HPV vaccination coverage did not improve significantly after project implementation. Of importance to note is the rate of missed opportunities at routine exams, including well child and physicals, did decrease from 32 before implementation to 17 after implementation at the Sanford Jamestown Clinic. The rates of missed opportunities at problem focused and immunization due visits remained unchanged. Further research is needed to understand the best methods to increase HPV vaccination coverage in rural areas and reduce the number of missed opportunities.

One area of focus for future research is the idea of implementing a multifaceted approach. The new approach could use alternative options for educational sessions, including online modules. The multifaceted approach would also incorporate provider feedback, as other studies have shown feedback as a key element for improving vaccination coverage (Moore et al., 2017; Rand et al., 2018). It is beneficial to include all staff in the approach to increasing HPV vaccination coverage, including the option of a standard process that allows for nursing support staff to begin the vaccine discussion (Farmer, 2016; Rand, 2018).

Research is needed to focus on the creation of a catch-up program and recall system for the expanded ages of the HPV vaccine. Pending ACIP approval, the nine-valent HPV vaccine will be needed for the additional ages of 27-45 years (Markowitz, 2018). Research evaluating the best methods for catch-up notification and recall after series initiation is needed. Limited data is available regarding methods with positive outcomes.

Another area of focus for future research is the rural population. Limited research is available regarding the rural population in the Midwest. A large portion of available research regarding HPV vaccination coverage is in rural Appalachia (Oldach & Katz, 2012). Further investigation into the barriers for vaccination uptake and interventions to reduce missed opportunities in the rural Midwest is needed. The future research could evaluate the differences in coverage among the American Indian population in the area as well.

A final topic for consideration is the expansion of HPV intervention research to include new partners. Future research could consider partnering with student health at local universities, such as North Dakota State University. New partners allow for increased populations with varying demographics to be reached. With the expanded population and ages, research could

evaluate the barriers to vaccination coverage, as well as types of interventions that would work best for the population.

Application to Other DNP Roles

The rates of missed opportunities for HPV vaccination and coverage lag behind other adolescent vaccines is well documented. Nurse practitioners working in primary care and family practice are on the front lines. Primary care is a key setting for vaccination and education regarding HPV. Increased understanding of barriers to vaccination and to working with the rural adolescent population can help nurse practitioners to provide a higher-level quality of care. The communication strategies provided can be used to discuss additional adolescent topics, such as sexual health or health hygiene. The significance of a recommendation from a healthcare professional is well-known, no matter the topic of conversation.

Healthy People 2020 (ODPHP, 2018) goals include increased immunization rates, which coordinates with the goal of nurse practitioners to ensure appropriate primary prevention is being provided. Immunizations are a foundation piece of primary prevention. Nurse practitioners strive to improve the health of the population and provide education to patients. Increased immunization and use of primary prevention has the potential to improve health and reduce the rates of HPV-related complications.

REFERENCES

- Alemaný, L., Cubilla, A., Halec, G., Kasamatsu, E., Quirós, B., Masferrer, E., ... de Sanjosé, S. (2015). Role of human papillomavirus in penile carcinomas worldwide. *European Urology*. 69. 953-961. DOI: 10.1016/j.eururo.2015.12.007
- Ambulatory Attribution Workgroup. (2019). Ambulatory patient attribution process: Frequently asked questions. Retrieved from Sanford Health Quality Department.
- Angioli, R., Lopez, S., Aloisi, A., Terranova, C., de Cicco, C., Scaletta, G., ... Plotti, F. (2016). Ten years of HPV vaccines: State of art and controversies. *Critical Reviews in Oncology/Hematology*. 102. 65-72. DOI: 10.1016/j.critrevonc.2016.03.020
- Arnheim-Dahlström, L., Pasternak, B., Svanström, H., Sparén, P., & Hviid, A. (2013). Autoimmune, neurological, and venous thromboembolic adverse events after immunization of adolescent girls with quadrivalent human papillomavirus vaccine in Denmark and Sweden: cohort study. *BMJ*. 1-11. DOI: 10.1136/bmj.f5906
- Bonanni, P., Zanella, B., Santomauro, F., Lorini, C., Bechini, A., & Boccalini, S. (2017). Safety and perception: What are the greatest enemies of HPV vaccination programmes? *Vaccine*. DOI: 10.1016/j.vaccine.2017.05.071
- Brown, B., Hopfer, S., & Chan, A. (2015). Improving human papillomavirus vaccine uptake: Barriers and potential solutions. *California Journal of Health Promotion*. 13(2). iv-x. Retrieved from www.cjhp.org/volume12issue2_2015/documents/iv-x_EditorialBrown_CJHP2012_Issue2.pdf
- Center for Disease Control and Prevention [CDC]. (2015). Tdap vaccine: What you need to know. *Vaccine Information Statement*. Retrieved from <https://www.cdc.gov/vaccines/hcp/vis/vis-statements/tdap.pdf>

Center for Disease Control and Prevention [CDC]. (2016a). Human Papillomavirus: Questions and answers. Retrieved from <https://www.cdc.gov/hpv/parents/questions-answers.html>

Center for Disease Control and Prevention [CDC]. (2016b). Supplemental information and guidance for vaccination providers regarding use of 9-valent HPV. Retrieved from <https://www.cdc.gov/hpv/downloads/9vhpv-guidance.pdf>

Center for Disease Control and Prevention [CDC]. (2016c). What is HPV? Retrieved from <https://www.cdc.gov/hpv/parents/whatishpv.html>

Center for Disease Control and Prevention [CDC]. (2017a). 2016 Adolescent human papillomavirus (HPV) vaccination coverage report. Retrieved from <https://www.cdc.gov/vaccines/imz-managers/coverage/teenvaxview/data-reports/hpv/reports/2016.html>

Center for Disease Control and Prevention [CDC]. (2017b). 2016 Adolescent tetanus and diphtheria toxoids (Td) or tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccination coverage report. Retrieved from <https://www.cdc.gov/vaccines/imz-managers/coverage/teenvaxview/data-reports/td-Tdap/reports/2016.html>

Center for Disease Control and Prevention [CDC]. (2018a). HPV vaccination coverage data. retrieved from <https://www.cdc.gov/hpv/hcp/vacc-coverage/index.html>

Center for Disease Control and Prevention [CDC]. (2018b). 2008 through 2016 adolescent human papillomavirus (HPV) vaccination coverage trend report. Retrieved from <https://www.cdc.gov/vaccines/imz-managers/coverage/teenvaxview/data-reports/hpv/trend/index.html>

Center for Disease Control and Prevention [CDC]. (2018c). Meningococcal ACWY vaccine: What you should know. *Vaccine Information Statement*. Retrieved from

<https://www.cdc.gov/vaccines/hcp/vis/vis-statements/mening.pdf>

Center for Disease Control and Prevention [CDC]. (2018d). Recommended immunization schedule for children and adolescents aged 18 years or younger, United States, 2018.

Retrieved from <https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html>

Center for Disease Control and Prevention [CDC]. (2018e). 2008 through 2016 adolescent tetanus and diphtheria (Td) or Tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccination coverage trend report. Retrieved from

<https://www.cdc.gov/vaccines/imz-managers/coverage/teenvaxview/data-reports/td-Tdap/trend/index.html>

Center for Disease Control and Prevention [CDC]. (2018f). 2008 through 2016 adolescent meningococcal conjugate (MenACWY) vaccination coverage trend report. Retrieved from <https://www.cdc.gov/vaccines/imz-managers/coverage/teenvaxview/data-reports/menacwy/trend/index.html>

Center for Disease Control and Prevention [CDC]. (2018g). Top 10 tips for HPV vaccination success. Retrieved from <https://www.cdc.gov/hpv/downloads/Top10-improving-practice.pdf>

Cercone, K. (2008). Characteristics of adult learners with implications for online learning design.

Association for the Advancement of Computing in Education Journal. 16(2). 137-159.

Retrieved from <https://www.learntechlib.org/p/24286>

- Chandler, R.E. (2017). Safety concerns with HPV vaccines continue to linger: Are current vaccine pharmacovigilance practices sufficient? *Drug Safety*. 40(12). 1167-1170. DOI: 10.1007/s40264-017-0574-6
- Clark, S.J., Cowan, A.E., Flipp, S.L., Fisher, A.M., & Stokley, S. (2016). Parent perception of provider interactions influences HPV vaccination status of adolescent females. *Clinical Pediatrics*. 55(8). 701-706. DOI: 10.1177/0009922815610629
- Dahlstrom, K.R., Fu, S., Chan, W., Shelal, Z., Ramondetta, L.M., & Lairson, D.R. (2018). Medical care costs associated with genital warts for commercially insured US patients. *PharmacoEconomics*. DOI: 10.1007/s40273-018-0691-9
- Daily, J.A. & Landis, B.J. (2014). The journey to becoming an adult learner: From dependent to self-directed learning. *Journal of the American College of Cardiology*. 64(19). 2066-2068. DOI: 10.1016/j.jacc.2014.09.023
- Daley, A.M. (2011). Providing adolescent-friendly HPV education. *The Nurse Practitioner*. 36(11). DOI: 10.1097/01.NPR.0000406486.97876.1d
- Daughtery, M. & Byler, T. (2018). Genital wart and human papillomavirus prevalence in men in the United States from penile swabs: Results from national health and nutrition examination surveys. *Sexually Transmitted Diseases*. 45(6). 412-416. DOI: 10.1097/OLQ.0000000000000761
- de Martel, C., Plummer, M., Vignat, J., & Franceschi, S. (2017). Worldwide burden of cancer attributable to HPV by site, country, and HPV type. *International Journal of Cancer*. 141. 664-670. DOI: 10.1002/ijc,30716

- de Sanjosé, S., Bruni, L., & Alemany, L. (2014). HPV in genital cancers (at the exception of cervical cancers) and anal cancers. *La Presse Médicale*. 43. 423-428. DOI: 10.1016/j.lpm.2014.10.001
- de Sousa, I.D., Vidal, F.C.B., Vidal, J.P.C.B., de Mello, G.C.F., Nascimento, M.D.S.B., Brito, L.M.O. (2015). Prevalence of human papillomavirus in penile malignant tumors: viral genotyping and clinical aspects. *BioMed Central Urology*. 15(13). DOI: 10.1186/s12894-015-0007-8
- D'Hauwers, K.W.M., Depuydt, C.E., Bogers, J.J., Noel, J.C., Delvenne, P., Marbaix, E., ... Tjalma, W.A.A. (2012). Human papillomavirus, lichen sclerosus, and penile cancer: A study in Belgium. *Vaccine*. 30. 6573-6577. DOI: 10.1016/j.vaccine.2012.08.034
- Dunphy, L.M., Winland-Brown, J.E., Porter, B.O., & Thomas, D.J. (2015). *Primary Care: The art and science of advanced practice nursing*. (4th ed.). Philadelphia, PA: F.A. Davis Company.
- Espinosa, C.M., Marshall, G.S., Woods, C.R., Ma, Q., Ems, D., Nsiah, I., ... Smith, M.J. (2017). Missed opportunities for human papillomavirus vaccine initiation in an insured adolescent female population. *Journal of Pediatric Infectious Diseases Society*. 6. 360-365. DOI: 10.1093/jpids/pix067
- Farmar, A.L.M., Love-Osborne, K., Chichester, K., Breslin, K., Bronkan, K., & Hambidge, S.J. (2016). Achieving high adolescent HPV vaccination coverage. *Pediatrics*. 138(5). DOI: 10.1542/peds.2015-2653
- Food and Drug Administration [FDA]. (2018a). Vaccine product approval process. Retrieved from

[https://www.fda.gov/biologicsbloodvaccines/developmentapprovalprocess/biologicslicen
seapplicationsblaprocess/ucm133096.htm](https://www.fda.gov/biologicsbloodvaccines/developmentapprovalprocess/biologicslicen
seapplicationsblaprocess/ucm133096.htm)

Food and Drug Administration [FDA]. (2018b). FDA approves expanded use of Gardasil 9 to include individuals 27 through 45 years old. Retrieved from

<https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm622715.htm>

Gilkey, M.B. & McRee, A.L. (2016). Provider communication about HPV vaccination : A systematic review. *Human Vaccines & Immunotherapeutics*. 12(6). 1454-1468. DOI: 10.1080/21645515.2015.1129090

Gilkey, M.B., Calo, W.A., Moss, J.L., Shah, P.D., Marciniak, M.W., & Brewer, N.T. (2016). Provider communication and HPV vaccination: The impact of recommendation quality. *Vaccine*. 34(9). 1187-1192. DOI: 10.1016/j.vaccine.2016.01.023

Gonçalves, A.K., Cobucci, R.N., Rodrigues, H.M., de Melo, A.G., & Giraldo, P.C. (2014). Safety, tolerability and side effects of human papillomavirus vaccines: a systematic quantitative review. *The Brazilian Journal of Infectious Diseases*. 18(6). 651-659. DOI: 10.1016/j.bjid.2014.02.005

Gowda, C., Schaffer, S.E., Dombkowski, K.J., & Dempsey, A.F. (2012). Understanding attitudes toward adolescent vaccination and the decision-making dynamic among adolescents, parents, and providers. *BMC Public Health*. 12. Retrieved from <http://www.biomedcentral.com/1471-2458/12/509>

Hacker, N.F., Gambone, J.C., & Hobel, C.J. (2016). *Essentials of obstetrics & gynecology*. (6th ed.). Philadelphia, PA: Elsevier.

- Hall, M.T., Simms, K.T., Lew, J.B., Smith, M.A., Brotherton, J.M.L., Saville, M., ... Canfell, K. (2018). The projected timeframe until cervical cancer elimination in Australia: A modeling study. *Lancet Public Health*. DOI: 10.1016/S2468-266(18)30183-X
- Hansen, C.E., Bredle, M., Shapiro, E.D., & Niccolai, L.M. (2016). "It all depends": A qualitative study of parents' views of human papillomavirus vaccine for their adolescents at ages 11-12 years. *Journal of Cancer Education*. 31. 147-152. DOI: 10.1007/s13187-014-0788-6
- Iverson, I.E., Miranda, M.J., Ulier, A., Soerdal, T., Lazarus, E., Chokephaibulkit, K., ... Luxembourg, A. (2016). Immunogenicity of the 9-valent HPV vaccine using 2-dose regimens in girls and boys vs a 3-dose regimen in women. *JAMA*. 316(22). 2411-2421. DOI: 10.1001/jama.2016.17615
- Javaid, M., Ashrawi, D., Landgren, R., Stevens, L., Bello, R., Foxhall, L., ... Ramondetta, L. (2017). Human papillomavirus vaccine uptake in Texas pediatric care settings: A statewide survey of healthcare professionals. *Journal of Community Health*. 42. 58-65. DOI: 10.1007/s10900-016-0228-0
- Joura, E.A., Giuliano, A.R., Iverson, O.E., Bouchard, C., Mao, C., Mehlsen, J., ... Luxembourg, A. (2015). A 9-valent HPV vaccine against infection and intraepithelial neoplasia in women. *New England Journal of Medicine*. 328(8). 711-723. DOI: 10.1056/NEJMoa1405044
- Joura, E.A. & Pils, S. (2016). Vaccines against human papillomavirus infections: protection against cancer, genital warts, or both? *Clinical Microbiology and Infection*. 22. 91-101. DOI: 10.1016/j.cmi.2016.12.017
- Kann, L., McManus, T., Harris, W.A., Shanklin, S.L., Flint, K.H., Queen, B., ... Ethier, K.A. (2018). Youth risk behavior surveillance—United States, 2017. *Morbidity and Mortality*

Weekly Report. 67(8). 60-69. Retrieved from

<https://www.cdc.gov/mmwr/volumes/67/ss/ss6708a1.htm>

Kornides, M.L., Fontenot, H.B., McRee, A.L., Panozzo, C.A. & Gilkey, M.B. (2018).

Associations between parents' satisfaction with provider communication and HPV vaccination behaviors. *Vaccine*. 36. 2637-2642. DOI: 10.1016/j.vaccine.2018.03.060

Krantz, L., Ollberding, N.J., Beck, A.F., & Burkhardt, M.C. (2017). Increasing HPV vaccination coverage through provider-based interventions. *Clinical Pediatrics*. 1-8. DOI:

10.1177/0009922817722014

Kulczycki, A., Qu, H., & Shewchuk, R. (2016). Recommend, but also discuss: Different patterns of physician-perceived barriers to discussing HPV vaccination and their association with vaccine administration in 11-12 year-old girls. *Maternal Child Health Journal*. 20. 2539-2547. DOI: 10.1007/s10995-2079-9

Lee, M.J. & Cho, J. (2017). Promoting HPV vaccination online: Message design and media choice. *Health Promotion Practice*. 18(5). 645-653. DOI: 10.1177/1524839916688229

Luckett, R. & Feldman, S. (2016). Impact of 2-, 4-, and 9-valent HPV vaccines on morbidity and mortality from cervical cancer. *Human Vaccines & Immunotherapeutics*. 12(6). 1332-1342. DOI: 10.1080/21645515.2015.1108500

Lui, X.C., Bell, C.A., Simmonds, K.A., Svenson, L.W., & Russell, M.L. (2016). Adverse events following HPV vaccination, Alberta 2006-2014. *Vaccine*. 34. 1800-1805. DOI: 10.1016/j.vaccine.2016.02.040

Markowitz, L. (2018). Possible expanded age indication for 9-valent HPV vaccine through age 45 years. *Advisory Committee on Immunization Practices*. Retrieved from

<https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2018-06/hpv-04-Markowitz-508.pdf>

Maxwell, J.H., Grandis, J.R., & Ferris, R.L. (2016). HPV-associated head and neck cancer: Unique features of epidemiology and clinical management. *Annual Review of Medicine*. 67. DOI: 10.1146/annurev-med-051914-021907

McBride, K.R. & Singh, S. (2018). Predictors of adults' knowledge and awareness of HPV, HPV-associated cancers, and the HPV vaccine: Implications for health education. *Health Education & Behavior*. 45(1). 68-76. DOI: 10.1177/1090198117709318

McClave, J.T. & Sincich, T. (2017). *Statistics*. (13th ed.). New York, New York: Pearson.

McClean, H.Q., VanWormer, J.J., Chow, B.D.W., Birchmeier, B., Bickers, E., DeVries, E., ... Belongia, E.A. (2017). Improving human papillomavirus use in an integrated health system: Impact of a provider and staff intervention. *Journal of Adolescent Health*. 1-7. DOI: 10.1016/j.jadohealth.2017.02.019

Meites, E., Kempe, A., & Markowitz, L.E. (2016). Use of a 2-dose schedule of human papillomavirus vaccination—Updated recommendations of the Advisory Committee on Immunization Practices. *Morbidity and Mortality Weekly Report*. 65(49). DOI: <http://dx.doi.org/10.15585/mmwr.mm6549a5>

Melnyk, B.M. & Fineout-Overholt, E. (2015). *Evidence-based practice in nursing and healthcare: A guide to best practice*. (3rd ed.). Philadelphia, PA: Wolters Kluwer.

Merriam, S.B. (2001). Andagogy and self-directed learning: Pillars of adult learning theory. *The New Update on Adult Learning Theory*. 3-96. Retrieved from <https://pdfs.semanticscholar.org/348f/4ec428384d90bafad92e226fa447ff56539.pdf>

- Mirabello, L., Clarke, M.A., Nelson, C.W., Dean, M., Wentzensen, N., Yeager, M., ... Burk, R.D. (2018). The intersection of HPV epidemiology, genomics and mechanistic studies of HPV-mediated carcinogenesis. *Viruses*. *10*(80). DOI: 10.3390/v10020080
- Mollers, M., King, A.J., Knol, M.J., Scherpenisse, M., Meijer, C.J.L.M., van der Klis, F.R.M., & de Melker, H.E. (2015). Effectiveness of human papillomavirus vaccine against incident and persistent infections among young girls: Results from a longitudinal Dutch cohort study. *Vaccine*. *33*. 2678-2683. DOI: 10.1016/j.vaccine.2015.04.016
- Moore, K.L., Frankhauser, M.K., & Hull, P.C. (2016). Tennessee's 3-star report: Using available data systems to reduce missed opportunities to vaccinate preteens. *Biomedical Informatics Insights*. *8*(S2). 15-21. DOI: 10.4137/BII.S40207
- Naleway, A.L., Crane, B., Smith, N., Daley, M.F., Donahue, J., Gee, J., ... Weintraub, E.S. (2016). Absence of venous thromboembolism risk following quadrivalent human papillomavirus vaccination, Vaccine Safety Datalink 2008-2011. *Vaccine*. *34*. 167-171. DOI: 10.1016/j.vaccine.2015.10.006
- National Vaccine Information Center [NVIC]. (2018). California state vaccine requirements. Retrieved from <https://www.nvic.org/Vaccine-Laws/state-vaccine-requirements/california.aspx>
- Nicol, A.F., de Andrade, C.V., Russomano, F.B., Rodrigues, L.S.L., Oliveira, N.S., Provance Jr., D.W., & Nuovo, G.J. (2015). HPV vaccines: their pathology-based discovery, benefits, and adverse events. *Annals of Diagnostic Pathology*. *19*. 418-422. DOI: 10.1016/j.anndiagpath.2015.07.008

- North, A.L. & Niccolai, L.M. (2016). Human papillomavirus vaccination requirements in US schools: Recommendations for moving forward. *American Journal of Public Health*. 106. 1765-1770. DOI: 10.2105/AJPH.2016.303286
- North Dakota Immunization Information System [NDIIS]. (2018). Adolescent immunization rates 13-17 years of age. Retrieved from <https://www.ndhealth.gov/immunize/rates/adolescent.aspx>
- North Dakota State University [NDSU]. (2017). Strategic Plan 2017-2022. Retrieved from https://www.ndsu.edu/fileadmin/healthprofessions/documents/College_Strategic_Plan_2017-2022_approved_2.14.17.pdf#
- Office of Disease Prevention and Health Promotion [ODPHP]. (2018). Healthy People 2020 Objectives. Retrieved from <https://www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases/objectives>
- Oldach, B.R. & Katz, M.L. (2012). Ohio Appalachia public health department personnel: Human papillomavirus (HPV) vaccine availability and acceptance and concerns among parents of male and female adolescents. *Journal of Community Health*. 37. 1157-1163. DOI: 10.1007/s10900-012-9613-5
- Opel, D.J., Heritage, J., Taylor, J.A., Mangione-Smith, R., Salas, H.S., DeVere, V., ... Robinson, J.D. (2013). The architecture of provider-parent vaccine discussions at health supervision visits. *Pediatrics*. 132. 1-10. DOI: 10.1542/peds.2013-2037
- Patel, C., Brotherton, J.M.L., Pillsbury, A., Jayasinge, S., Donovan, B., Macartney, K., & Marshall, H. (2018). The impact of 10 years of human papillomavirus (HPV) vaccination in Australia: what additional disease burden will a nonvalent vaccine prevent? *Euro Surveillance*. 23(41). 30-40. DOI: 10.2807/1560-7917.ES.2018.23.41.1700737

- Pierre Joseph, N., Bernstein, J., Pelton, S., Belizaire, M., Goff, G., Horanieh, N., & Freund, K.M. (2016). Brief client-centered motivational and behavioral intervention to promote HPV vaccination in a hard-to-reach population: A pilot randomized controlled trial. *Clinical Pediatrics*. 55(9). 851-859. DOI: 10.1177/0009922815616244
- Pierre-Victor, D., Stephens, D.P., Clarke, R., Gabbidon, K., & Madhivanan, P. (2017a). Role of healthcare providers' recommendation style in HPV vaccine decision-making among Haitian parents and female patients. *California Journal of Health Promotion*. 15(3). 68-80. Retrieved from www.cjhp.org/volume15Issue3_2017/documents/68-80_Pierre-Victor_CJHP2017_Issue3.pdf
- Pierre-Victor, D., Trepka, M.J., Page, T.F., Li, T., Stephens, D.P., & Madhivanan, P. (2017b). Impact of Louisiana's HPV vaccine awareness policy on HPV vaccination among 13- to 17-year-old females. *Health Education & Behavior*. 44(4). 548-558. DOI: 10.1177/1090198116684766
- Perkins, R.B., Clark, J.A., Apte, G., Vercruyssen, J.L., Sumner, J.J., Wall-Haas, C.L., ... Pierre Joseph, N. (2014). Missed opportunities for HPV vaccination in adolescent girls: A qualitative study. *Pediatrics*. 134(3). e666-e674. DOI: 10.1542/peds.2014-0442
- Qi, S.Z., Wang, S.M., Shi, J.F., Wang, Q.Q., Chen, X.S., Sun, L.J., ... Qiao, Y.L. (2014). Human papillomavirus-related psychosocial impact of patients with genital warts in China: a hospital-based cross-sectional study. *BMC Public Health*. 14. 1-8. Retrieved from <http://www.biomedcentral.com/1471-2458/14/739>
- Rand, C.M., Schaffer, S.J., Dhepyasuwan, N., Blumkin, A., Albertin, C., Serwint, J.R., ... Szilagyi, P.G. (2018). Provider communication, prompts, and feedback to improve HPV vaccination rates in resident clinics. *Pediatrics*. 141(4). DOI: 10.1542/peds.2017-0498

- Reagan-Steiner, S., Yankey, D., Jeyarajah, J., Elam-Evans, L.D., Curtis, R., MacNeil, J.,... Singleton, J.A. (2016). National, regional, state, and selected local area vaccination coverage among adolescents aged 13-17 years—United States, 2015. *Morbidity and Mortality Weekly Report*. 65(33). 850-858. DOI: 10.15585/mmwr.mm6533a4
- Rendle, K.A. & Leskinen, E.A. (2017). Timing is everything: Exploring parental decisions to delay HPV vaccination. *Qualitative Health Research*. 27(9). 1380-1390. DOI: 10.1177/1049732316664499
- Roussos-Ross, K., Foster, L., Peterson, H.V., & Decesare, J. (2017). Do educational seminars for the human papillomavirus vaccine improve attitudes toward the value of vaccination? *Journal of Pediatric & Adolescent Gynecology* 30. 456-459. DOI: 10.1016/j.jpag.2016.12.003
- Selcuk, O.T. (2016). Human papillomavirus positive oropharyngeal cancer: the general information. *Egyptian Journal of Ear, Nose, Throat and Allied Sciences*.17. 127-132. DOI: 10.1016/j.ejenta.2016.07.007
- Serrano, B., de Sanjosé, S., Tous, S., Quiros, B., Muñoz, N., Bosch, X., & Alemany, L. (2015). Human papillomavirus genotype attribution for HPVs 6, 11, 16, 18, 31, 33, 45, 52 and 58 in female anogenital lesions. *European Journal of Cancer*. 51. 1732-1741. DOI: 10.1016/j.ejca.2015.06.001
- Simons, H.R., Unger, Z.D., Lopez, P.M., & Kohn, J.E. (2015). Predictors of human papillomavirus vaccine completion among female and male vaccine initiators in family planning centers. *American Journal of Public Health*. 105(12). 2541-2548. DOI:

- Sussman, A.L., Helitzer, D., Bennett, A., Solares, A., Lanoue, M., & Getrich, C.M. (2015). Catching up with the HPV vaccine: Challenges and opportunities in primary care. *Annals of Family Medicine*. 13(4). 354-360. DOI: 10.1370/afm.1821
- Tan, Y.Q. & Gerbie, M.V. (2017). Perception, awareness, and acceptance of human papillomavirus disease and vaccine among parents of boys aged 9 to 18 years. *Clinical Pediatrics*. 56(8). 737-743. DOI: 10.1177/0009922816682788
- Taylor, D.C.M. & Hamdy, H. (2013). Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83. *Medical Teacher*. 35. e1561-e1572. DOI: 10.3109/0142159X.2013.828153
- Tom, A., Robinett, H., Buenconsejo-Lum, L., Soon, R., Hamilton, M., Francisco-Natanauan, P., ... Hernandez, B.Y. (2016). Promoting and providing HPV vaccination in Hawaii: Barriers faced by health providers. *Journal of Community Health*. 41. 1069-1077. DOI: 10.1007/s10900-016-0191-9
- Viens, L.J., Henley, S.J., Watson, M., Markowitz, L.E., Thomas, C.C., Thompson, T.D., ... Saraiya, M. (2016). Human papillomavirus-associated cancers—United States 2008-2012. *Morbidity and Mortality Weekly Report*. 65(26). DOI: 10.15585/mmwr.mm6526a1
- Williams, D.L., Wheeler, C.S., Lawrence, M., Hall, S.S., & Hagensee, M. (2017). Louisiana physicians are increasing HPV vaccination rates. *Journal of the Louisiana State Medical Society*. 169. 63-67. Retrieved from journal.lsms.org
- Yih, W.K., Greene, S.K., Zichittella, L., Kuldorff, M., Baker, M.A., de Jong, J.L.O., ... Nguyen M.D. (2016). Evaluation of the risk of venous thromboembolism after quadrivalent human papillomavirus vaccination among US females. *Vaccine*. 34. 172-178. DOI: 10.1016/j.vaccine.2015.09.087

Zimmerman, R.K., Moehling, K.K., Lin, C.J., Zhang, S., Raviotta, J.M., Reis, E.C., ... Nowalk, M.P. (2017). Improving adolescent HPV vaccination in a randomized controlled cluster trial using the 4 Pillars practice transformation program. *Vaccine*. 35. 109-117. DOI: 10.1016/j.vaccine.2016.11.018

APPENDIX A. IRB EXEMPT APPROVAL LETTER



October 4, 2018

Dr. Allison Peltier
Nursing

Re: IRB Determination of Exempt Human Subjects Research:
Protocol #PH19065, "HPV Immunization: Reducing Missed Opportunities through Enhanced Provider Knowledge and Communication Strategies"

Co-investigator(s) and research team: Carly Hanson
Date of Exempt Determination: 10/4/2018 Expiration Date: 10/3/2021
Study site(s): Sanford Clinic - Jamestown and Valley City
Sponsor: n/a

The above referenced human subjects research project has been certified as exempt (category #1, 2b) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, Protection of Human Subjects). This determination is based on the original protocol submission (received 9/28/2018).

Please also note the following:

- If you wish to continue the research after the expiration, submit a request for recertification several weeks prior to the expiration.
- The study must be conducted as described in the approved protocol. Changes to this protocol must be approved prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
- Notify the IRB promptly of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
- Report any significant new findings that may affect the risks and benefits to the participants and the IRB.

Research records may be subject to a random or directed audit at any time to verify compliance with IRB standard operating procedures.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.
Sincerely,

A handwritten signature in purple ink that reads "Kristy Shirley".

Kristy Shirley, CIP, Research Compliance Administrator

For more information regarding IRB Office submissions and guidelines, please consult http://www.ndsu.edu/research/integrity_compliance/irb/. This Institution has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

INSTITUTIONAL REVIEW BOARD

NDSU Dept 4000 | PO Box 6050 | Fargo ND 58108-6050 | 701.231.8995 | Fax 701.231.8098 | ndsu.edu/irb

Shipping address: Research 1, 1735 NDSU Research Park Drive, Fargo ND 58102

NDSU is an EO/AA university.

APPENDIX B. EDUCATIONAL PRESENTATION



HPV Immunization: Reducing Missed Opportunities through Enhanced Provider Knowledge and Communication Strategies

Carly Hanson, DNP-S
North Dakota State University

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

Objectives

- Identify HPV & associated complications
- Understand the HPV vaccine, safety, efficacy, & statistics
- Identify the barriers of vaccination coverage
- Understand what can be done to improve coverage rates
- Increase confidence levels in new communication strategies

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

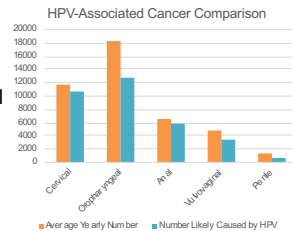
What is HPV?

- Virus with over 150 different strains
- Sexually transmitted infection (STI)

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

Why is HPV a problem?

- Cancer
 - Cervical
 - Oropharyngeal
 - Vaginal/vulvar
 - Penile
 - Anal
- Genital warts



STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

What can we do to reduce the burden of HPV?

VACCINATE

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

HPV Vaccine Schedule

- Males & Females 9-14 years
 - 2-dose regimen: now & 6 months
- Males 15-21 years & Females 15-26 years
 - 3-dose regimen: now, 1-2 months, & 6 months

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

Vaccine Safety

- Monitored by FDA
- Pain at injection site is the most common adverse event
- No significant risk increase for developing VTE, autoimmune, or neurologic adverse event

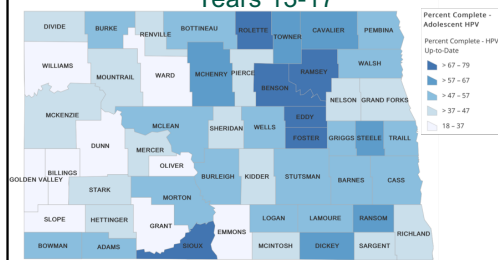
STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

Vaccine Efficacy

- 96% efficacy demonstrated against HPV 6, 11, 16, 18, 31, 33, 45, 52, & 58
- Future II trial
- Estimated protection against cervical cancer will increase to 90%

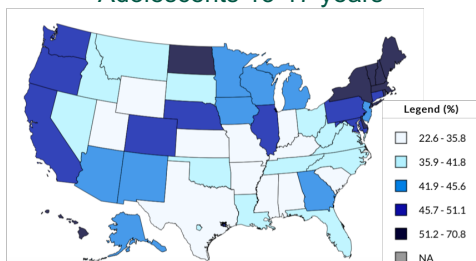
STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

Adolescent HPV Immunization Rates: Years 13-17

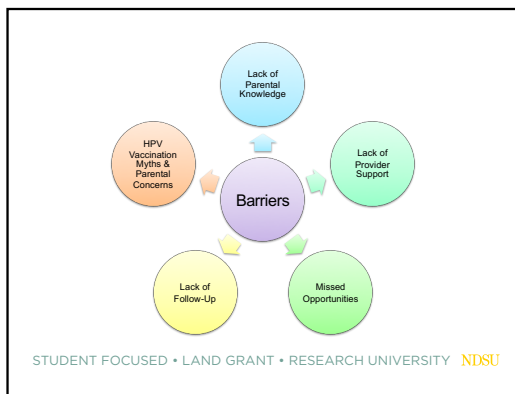


STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

HPV Vaccination Coverage: Adolescents 13-17 years



STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU



STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

HPV Myths & Parental Concerns

- Increased risk of sexual activity
- Cost
- Safety
- Not necessary due to abstinence

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Lack of Parental Knowledge

- Not receiving education or recommendations from healthcare professionals
 - Correlates with the amount of time providers spend educating
- Deficits among parents of male and female adolescents

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Lack of Provider Support

- Provider ambivalence
- Lack of time
- Lack of provider knowledge
- Lack of strong recommendation

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Missed Opportunities

- Definition: HPV vaccine not provided but other adolescent vaccines are provided
- Over 90% of problem-focused visits
- Every visit is an opportunity to educate and vaccinate

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Lack of Follow-Up

- Linked with HPV completion rates
- Need to remind and educate about the importance of series completion

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

How do we improve HPV immunization acceptance?

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU



Framing

- How HPV vaccination is discussed and compared to other adolescent vaccines
- ~~Optional~~ approach
- Loss-framing messages

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY **NDSU**

Bundling

- Communication technique
- Sandwich the HPV vaccine
 - Tdap, HPV, Meningococcal

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY **NDSU**

Provider Recommendation

- #1 reason for vaccine initiation and completion
- Provide education & knowledge + a clear and strong recommendation
- Be consistent and remember the framing

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY **NDSU**

Presumptive Communication

- Frame and recommend HPV vaccination with the result of vaccination today in the statement
- Continue to pursue HPV vaccination at every visit

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY **NDSU**

Normalizing

- Do not single out the HPV vaccine
- Used with Bundling
- Makes the HPV vaccine appear to be of equal importance with the other adolescent vaccines

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY **NDSU**

“ How do you make the HPV vaccine recommendation, and why do you say it that way? ”
#HowIRecommend

<https://www.youtube.com/watch?feature=oembed&v=zvrrRQcitr>

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

“ How does your practice routinely recommend HPV cancer prevention? ”
#HowIRecommend

<https://www.youtube.com/watch?feature=oembed&v=MS3gCZra>

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

“ WHAT DO YOU SAY TO PARENTS WHO DECLINE OR REFUSE HPV VACCINATION? ”
#HowIRecommend

https://www.youtube.com/watch?feature=oembed&v=cFr8_0_RAhIQ

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

Appointment Scheduling

- 65% of parents expect the clinic to schedule
- 52% of providers explain the HPV schedule but expect the parents to schedule
- Scheduled follow-up = higher completion rates

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

Education

- Focus on cancer prevention
- Prioritize!

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

Summary

- HPV complications continue to exist
- HPV immunization rates lag behind other adolescent immunizations
- Nine-valent HPV vaccine demonstrated to be safe & effective
- Healthcare professionals are on the frontlines for improving vaccination rates

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

APPENDIX C. CONDENSED EDUCATIONAL PRESENTATION



HPV Immunization: Reducing Missed Opportunities through Enhanced Provider Knowledge and Communication Strategies

Carly Hanson, DNP-S
North Dakota State University

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

Objectives

- Identify HPV & associated complications
- Understand the HPV vaccine, safety, efficacy, & statistics
- Identify the barriers of vaccination coverage
- Understand what can be done to improve coverage rates
- Increase confidence levels in new communication strategies

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

What is HPV & why is HPV a problem?

- Sexually transmitted infection
- 150+ serotypes
- Cancer
 - Cervical
 - Oropharyngeal
 - Vaginal/vulvar
 - Penile
 - Anal
- Genital warts

Cancer Type	Average Yearly Number	Number Likely Caused by HPV
Cervical	~11,000	~10,000
Oropharyngeal	~18,000	~12,000
Penile	~6,000	~5,000
Vaginal/vulvar	~4,000	~3,000
Anal	~1,000	~800

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

What can we do to reduce the burden of HPV?

VACCINATE

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

HPV Vaccine Schedule

- Males & Females 9-14 years
 - 2-dose regimen: now & 6 months
- Males 15-21 years & Females 15-26 years
 - 3-dose regimen: now, 1-2 months, & 6 months

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY NDSU

Vaccine Safety

- Monitored by FDA
- Pain at injection site is the most common adverse event
- No significant risk increase for developing VTE, autoimmune, or neurologic adverse event

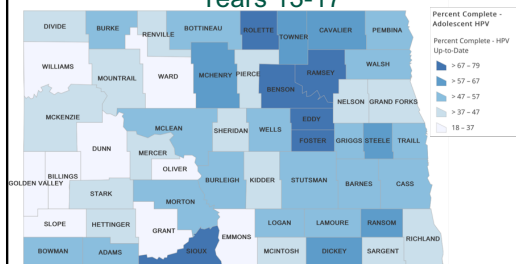
STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY 

Vaccine Efficacy

- 96% efficacy demonstrated against HPV 6, 11, 16, 18, 31, 33, 45, 52, & 58
- Future II trial
- Estimated protection against cervical cancer will increase to 90%

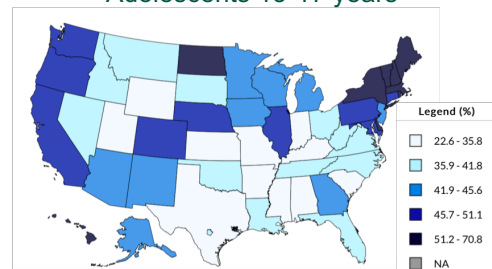
STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY 

Adolescent HPV Immunization Rates: Years 13-17



STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY 

HPV Vaccination Coverage: Adolescents 13-17 years



STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY 



STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY 

HPV Myths & Parental Concerns

- Increased risk of sexual activity
- Cost
- Safety
- Not necessary due to abstinence

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY 

Lack of Parental Knowledge

- Not receiving education or recommendations from healthcare professionals
 - Correlates with the amount of time providers spend educating
- Deficits among parents of male and female adolescents

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Lack of Provider Support

- Provider ambivalence
- Lack of time
- Lack of provider knowledge
- Lack of strong recommendation

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Missed Opportunities

- Definition: HPV vaccine not provided but other adolescent vaccines are provided
- Over 90% of problem-focused visits
- Every visit is an opportunity to educate and vaccinate

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Lack of Follow-Up

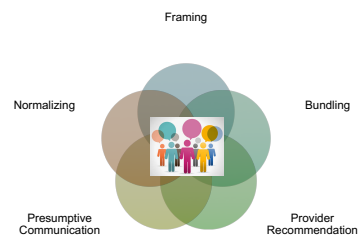
- Linked with HPV completion rates
- Need to remind and educate about the importance of series completion

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

How do we improve HPV immunization acceptance?

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Communication Strategies



STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Framing

- How HPV vaccination is discussed and compared to other adolescent vaccines
- ~~Optional~~ approach
- Loss-framing messages

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Bundling

- Communication technique
- Sandwich the HPV vaccine
 - Tdap, HPV, Meningococcal



STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Provider Recommendation

- #1 reason for vaccine initiation and completion
- Provide education & knowledge + a clear and strong recommendation
- Be consistent and remember the framing

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Presumptive Communication

- Frame and recommend HPV vaccination with the result of vaccination today in the statement
- Continue to pursue HPV vaccination at every visit



STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

Normalizing

- Do not single out the HPV vaccine
- Used with Bundling
- Makes the HPV vaccine appear to be of equal importance with the other adolescent vaccines

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU



STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU

APPENDIX D. TRANSCRIPTION OF HPV RECOMMENDATION VIDEOS

Video Clip 1: Dr. Alix Casler describes how she recommends HPV vaccine

When I recommend preteen vaccines, I recommend all three of the vaccines that we intend to do the same way basically. So here are three vaccines that we want to do. I do give a little information about each vaccine because that is my informed consent, just like when I talk about infant vaccines. I can talk about all three preteen vaccines in about a minute and have my informed consent done at the same time and kind of avoid the too much information thing.

So this is how I present things to parents, “Today, there are three vaccines that I’d like to do. The first one is the meningococcal vaccine which prevents a very, very rare but potentially very serious infection that could cause meningitis and when it does it’s uniformly devastating and potentially really deadly. The second one prevents the HPV infection which is extremely common. In fact, most of us get HPV in our lives and can go on to cause multiple different forms of cancers. That vaccine is given in a series of two. The second one would be given six to twelve months from now. And then the last one is the one that most people know about that’s the tetanus booster or the Tdap, which vaccinates against tetanus, diphtheria, and pertussis, which is whooping cough. If your child gets whooping cough, they could have a bad cough for two to three months, which is not fun. But really the big reason that we vaccinate big kids and grownups against pertussis, or whooping cough, is to protect babies who could die from that. Do you have any questions about those?” Usually parents don’t. about 80% of parents say, “Ok, that makes sense.”

Video Clip 2: Dr. Wolynn discusses how his office routinely recommends HPV vaccine

We really try and make sure that everybody is on board with the importance of the HPV vaccine, that includes people that are answering phones, that are in the billing department, certainly all of our clinical staff. We want them to understand with how common this virus is, how common the infections are. If everybody's onboard, then we have an office culture that is shared and everybody recognizes that we're often times the best chance for that child to become protected against cancers and diseases that they will potentially face if they are exposed and infected.

Video Clip 3: Talking with parents who decline HPV vaccine

When a parent turns down the HPV vaccine, first of all I ask them what I can do or say to help them change their mind. that's for sure. I ask them whether there are any specific concerns that they have that I can address. I ask them if they would mind reviewing some excellent information about the vaccine. And in my own mind, I really, really define the fact that they just haven't said yes yet. It isn't that they've said no, that they're never going to do it. I don't believe that most parents who say no are going to say no forever. I believe that most parents who say no, just aren't adequately educated.

I do let them know that I would like to follow up with them. I actually really like, there's one provider who I talk to who actually schedules a follow-up appointment to talk to them about it again in a month or two. I think that's a great idea. And sometimes I do that. But the big thing in my mind, I know that the next time we talk we're going to pick it up where we left. And I do tell parents, "You know I'm sorry that I keep bringing this up with you. But I really feel that it's my responsibility to protect your child as best as I can. I feel like if I haven't used my big mouth and said it to the point where you hear it and understand it and are ok with it, then if your child

later in life has a disease that I could have prevented by trying a little bit harder; I'm not going to be able to live with myself. I'm going to feel like I didn't do a good enough job in helping you to say yes."

APPENDIX E. HEALTHCARE PROFESSIONAL INVITATION EMAIL

NDSU **North Dakota State University**
Department of Nursing
College of Health Professions
Dept 2670
PO Box 6050
Fargo, ND 58108-6050
701.231.5692

HPV Immunization: Reducing Missed Opportunities through Enhanced Provider Knowledge and Communication Strategies

Dear Participants

My name is Carly Hanson. I am a graduate student in the Doctor of Nursing Practice program at North Dakota State University, and I am conducting a practice improvement project to reduce the numbers of missed opportunities for HPV immunization and enhance knowledge of HPV and the HPV vaccine. The project will also enhance communication strategies regarding the HPV vaccine and how to address parental concerns. It is our hope, that with this practice improvement project, we will improve healthcare professionals' level of knowledge and comfort with HPV immunization, as well as improve knowledge of barriers for vaccination and the impact of missed opportunities for vaccination.

Because you are healthcare professional, you are invited to take part in this practice improvement project. Your participation is entirely your choice, and you may change your mind or quit participating at any time, with no penalty to you.

It is not possible to identify all potential risks in practice improvement projects, but we have taken reasonable safeguards to minimize any known risks. There are minimal risks associated with completing the educational presentation.

By taking part in this project, you may benefit by improving your knowledge of HPV, the HPV vaccine, and vaccine safety and efficacy. Additional benefits include improving your knowledge of missed opportunities and level of comfort with communication strategies used to improve HPV vaccination uptake and series completion. However, you may not get any benefit from being in this project. Benefits to others are likely to include enhanced patient and parent satisfaction of healthcare through the delivery of knowledge and provider recommendations using key communication techniques and education. Improved HPV vaccination coverage and series completion are additional potential benefits of this project.

It should take about five minutes to complete the post-test questionnaire including demographics, healthcare professional knowledge of HPV and the HPV vaccine, and level of comfort with communication strategies. Lunch will not be provided; however, there will be snacks and refreshments. There will also be a drawing for a \$10 gift card.

This study is anonymous. That means that no one, not even members of my dissertation team, will know that the information given comes from you.

If you have any questions about this project, please contact me at 605-941-5049 or carly.hanson@ndsu.edu. You may also contact my advisor, Dr. Allison Peltier at 701-224-3820 or Allison.Peltier@ndsu.edu.

You have rights as a participant. If you have questions about your rights or complaints about this research, you may talk to the researcher or contact the NDSU Human Research Protection Program at 701.231.8995, toll-free at 1-855-800-6717, by email at ndsu.irb@ndsu.edu, or by mail at: NDSU HRPP Office, NDSU Dept. 4000, P.O. Box 6050, Fargo, ND 58108-6050.

By attending the educational presentation, you are giving your consent and are freely making the decision to participate in this practice improvement project.

Thank you for your taking part in this project. If you wish to receive a copy of the results, please contact me or my advisor.

Sincerely,

Carly Hanson, DNP-S, BAN, RN
Department of Nursing
North Dakota State University, Fargo, ND

APPENDIX F. POST-TEST QUESTIONNAIRE

HPV Immunization: Reducing Missed Opportunities through Enhanced Provider Knowledge and Communication Strategies Post-Test Questionnaire

Demographics

1. Please indicate your current position
 - Physician
 - Nurse Practitioner
 - Physician Assistant
 - RN
 - LPN
 - CNA
 - Other _____
2. Please indicate your years of clinical experience
 - Less than 1 year
 - 1 – 4.9 years
 - 5 – 9.9 years
 - 10 – 14.9 years
 - 15 – 19.9 years
 - 20 + years

Please choose the correct answer.

1. For both males and females ages 9 – 14 years, what is the correct HPV vaccine dose regimen?
 - a. 2-dose regimen: now & 3 months
 - b. 2-dose regimen: now & 6 months**
 - c. 3-dose regimen: now, 1-2 months, & 6 months
 - d. 3-dose regimen: now, 1 month, & 3 months
2. The HPV vaccine is associated with which of the following adverse events (select all that apply)
 - a. Venous thromboembolism (VTE)
 - b. Neurologic events
 - c. Autoimmune events
 - d. Localized injection site pain**
 - e. None of the above
3. The nine-valent HPV vaccine has demonstrated _____ efficacy if given prior to the initiation of sexual activity?
 - a. 92%
 - b. 87%
 - c. 96%**
 - d. 78%
4. Which of the following has been found to be the most significant factor in determining HPV vaccine acceptance and initiation among parents and adolescents?
 - a. Provider recommendation**
 - b. Amount of education provided
 - c. Increased time for appointment
 - d. Advertisement recommendation

Indicate your opinion about the following statements using the scale below:

1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

1. Following the educational presentation, I have an increased understanding of HPV, the HPV vaccine, and communication strategies used to reduce missed opportunities and improve vaccine coverage.
 - 1 2 3 4 5
2. Following the educational presentation, I am more comfortable discussing HPV and the HPV vaccine with parents and adolescents.
 - 1 2 3 4 5

APPENDIX G. HANDOUTS PROVIDED AT EDUCATIONAL INTERVENTION

Talking to Parents about HPV Vaccine



HPV VACCINE IS CANCER PREVENTION

Recommend HPV vaccination in the **same way** and on the **same day** as all adolescent vaccines. You can say, “Now that your son is 11, he is due for vaccinations today to help protect him from meningitis, HPV cancers, and whooping cough. Do you have any questions?” Remind parents of the follow-up shots their child will need and ask them to make appointments before they leave.

<p>Why does my child need HPV vaccine?</p>	<p>HPV vaccine is important because it prevents infections that can cause cancer. That's why we need to start the shot series today.</p>	<p>Some HPV infections can cause cancer—like cancer of the cervix or in the back of the throat—but we can protect your child from these cancers in the future by getting the first HPV shot today.</p>	<p>What diseases are caused by HPV?</p>
<p>How do you know the vaccine works?</p>	<p>Studies continue to prove HPV vaccination works extremely well, decreasing the number of infections and HPV precancers in young people since it has been available.</p>	<p>HPV is a very common infection in women and men that can cause cancer. Starting the vaccine series today will help protect your child from the cancers and diseases caused by HPV.</p>	<p>Is my child really at risk for HPV?</p>
<p>Why do they need HPV vaccine at such a young age?</p>	<p>Like all vaccines, we want to give HPV vaccine earlier rather than later. Getting the vaccine now protects your child long before they are ever exposed. If you wait until your child is older, he/she may end up needing three shots instead of two.</p>	<p>Studies tell us that getting HPV vaccine doesn't make kids more likely to start having sex. I made sure my child (or grandchild, etc.) got HPV vaccine, and I recommend we give your child her first HPV shot today.</p>	<p>I'm worried my child will think that getting this vaccine makes it OK to have sex.</p>
<p>Why do boys need the HPV vaccine?</p>	<p>HPV vaccination can help prevent future infections that can lead to cancers of the penis, anus, and back of the throat in men.</p>	<p>Yes, HPV vaccination is very safe. Like any medication, vaccines can cause side effects, including pain, swelling, or redness where the shot was given. That's normal for HPV vaccine too and should go away in a day or two. Sometimes kids faint after they get shots and they could be injured if they fall from fainting. We'll have your child stay seated after the shot to help protect him/her.</p>	<p>I'm worried about the safety of HPV vaccine. Do you think it's safe?</p>
<p>Are all of these vaccines actually required?</p>	<p>I strongly recommend each of these vaccines and so do experts at the CDC and major medical organizations. School entry requirements are developed for public health and safety, but don't always reflect the most current medical recommendations for your child's health.</p>	<p>There is no evidence available to suggest that getting HPV vaccine will have an effect on future fertility. However, women who develop an HPV precancer or cancer could require treatment that would limit their ability to have children.</p>	<p>Can HPV vaccine cause infertility in my child?</p>
<p>Would you get HPV vaccine for your kids?</p>	<p>Yes, I gave HPV vaccine to my child (or grandchild, etc.) when he was 11, because I wanted to help protect him from cancer in the future.</p>		

CS269453B
Last updated MAY 2018

Top 10 Tips for HPV Vaccination Success

Attain and Maintain High HPV Vaccination Rates



HPV VACCINE IS CANCER PREVENTION

- 1** Appreciate the significance of achieving high HPV vaccination rates. By boosting HPV vaccination rates among your patients, you will be preventing cancer.
- 2** Acknowledge the importance your recommendation has when it comes to parents choosing to get their children vaccinated. Clinician recommendation is the number one reason parents decide to vaccinate. This is especially important for HPV vaccination.
- 3** Use an effective approach by bundling your vaccine recommendation. Recommend the HPV vaccine the same day and the same way you recommend all other vaccines. For example, "Now that Danny is 11, he is due for vaccinations to help protect against meningitis, HPV cancers, and whooping cough. We'll give those shots during today's visit. Do you have any questions about these vaccines?"
- 4** Motivate your team and encourage their immunization conversations with parents. Starting with your front office, ensure each team member is aware of HPV vaccine's importance and is educated on proper vaccination practices and recommendations, ready to answer parents' questions, and/or regularly remind and recall parents. Be sure staff regularly check immunization records, place calls to remind families about getting vaccines, and let you know if parents have additional questions.
- 5** Implement systems to ensure you never miss an opportunity to vaccinate. Establish a policy to vaccinate at every visit. Create a system to check immunization status ahead of all visits. Before seeing the patient, staff should indicate if the patient is due for immunization, with special consideration to HPV vaccination. Use standing orders.
- 6** Use your local health department's resources. Use the resources of the local health department to achieve your goals of protecting your patients.
- 7** Know your rates of vaccination and refusal. Deputize your staff to assist you with knowing your actual vaccination rates and learning more about why some patients are behind on their vaccines. They can also help you facilitate solutions on how to bring these patients in and get or keep immunization rates up.
- 8** Maintain strong doctor-patient relationships to help with challenging immunization conversations. It is extremely gratifying when parents who initially questioned immunization agree to get their child vaccinated on time. It's always nice to hear: "Okay, that makes sense and I trust you!"
- 9** Learn how to answer some of parents' most common questions about HPV vaccine. Be prepared to answer parents' questions succinctly, accurately, and empathetically by using terms that they understand. A parent will often accept your explanations if presented with their children's best interests in mind.
- 10** Use personal examples of how you choose to vaccinate children in your family. Providing personal examples shows you believe in the importance of immunizations, especially HPV vaccine. These examples—combined with an effective recommendation—can help parents better understand the benefits of HPV vaccination for cancer prevention.

For more info visit: www.cdc.gov/hpv

Last updated MAY 2018

Adapted with Permission from: Khatib, B. (2015) The 10 Immunization Success Factors: Practical Strategies for Providers. Unpublished manuscript.



HPV Vaccine for Preteens and Teens

HPV vaccination is recommended at ages 11-12 to protect against cancers caused by HPV infection.

Why does my child need HPV vaccine?

Human papillomavirus (HPV) vaccine protects against cancers caused by HPV infection.

HPV is a common virus that infects teens and adults. About 14 million people, including teens, become infected with HPV each year. HPV infection can cause cervical, vaginal, and vulvar cancers in women and penile cancer in men. HPV can also cause anal cancer, cancer of the back of the throat (oropharynx), and genital warts in both men and women.

When should my child be vaccinated?

All kids who are 11 or 12 years old should get two shots of HPV vaccine six to twelve months apart. Getting vaccinated on time protects preteens long before ever being exposed to the virus. People get HPV from another person during intimate sexual contact.

Some children may need three doses of HPV vaccine. For example, adolescents who receive their two shots less than five months apart will need a third dose for best protection. Also, children who start the vaccine series on or after their 15th birthday need three shots given over 6 months. If your teen hasn't gotten the vaccine yet, talk to his/her doctor about getting it as soon as possible.

The best way to remember to get your child all of the recommended doses is to make an appointment for the remaining shots before you leave the doctor's office or clinic.

Is HPV vaccine safe for my child?

HPV vaccination provides safe, effective, and long-lasting protection against cancers caused by HPV. HPV vaccine has a reassuring safety record that's backed by 10 years of monitoring and research.

Like any vaccine or medicine, HPV vaccination can cause side effects. The most common side effects are mild and include pain, redness, or swelling in the arm where the shot was given; dizziness, fainting, nausea, and headache. Fainting after any vaccine, including HPV vaccine, is more common among adolescents.

To prevent fainting and injuries related to fainting, adolescents should be seated or lying down during vaccination and remain in that position for 15 minutes after the vaccine is given. The benefits of HPV vaccination far outweigh any potential risk of side effects.

It is important to tell the doctor or nurse if your child has any severe allergies, including an allergy to latex or yeast. HPV vaccine is not recommended for anyone who is pregnant.

How can I get help paying for these vaccines?

The Vaccines for Children (VFC) program provides vaccines for children ages 18 years and younger, who are uninsured, Medicaid-eligible, American Indian or Alaska Native.

Learn more at www.cdc.gov/Features/VFCprogram

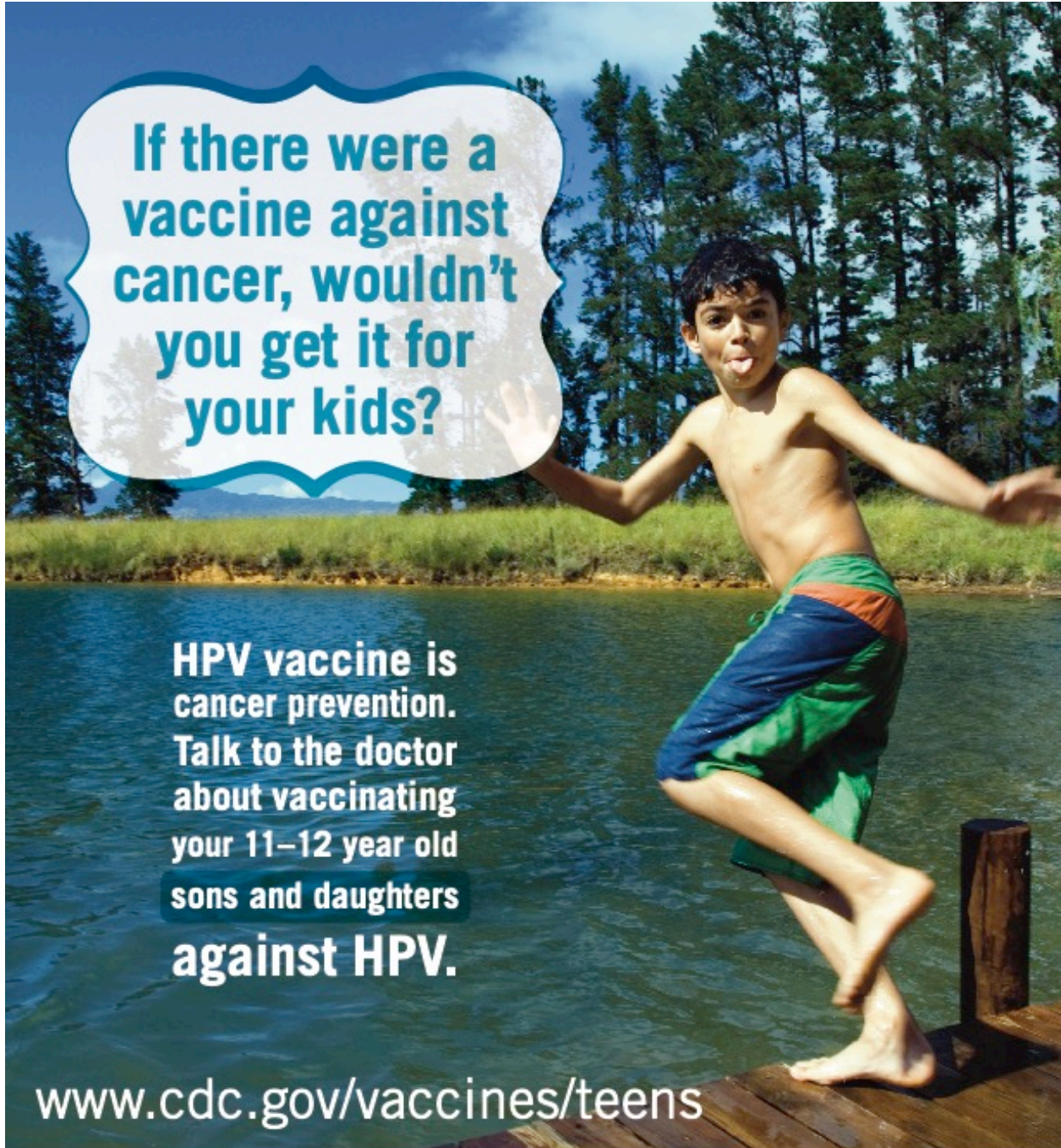
Where can I learn more?

Talk to your child's doctor or nurse to learn more about HPV vaccine and the other vaccines that your child may need.

You can also find out more about HPV vaccine at

www.cdc.gov/hpv

Last updated JUNE 2018



If there were a vaccine against cancer, wouldn't you get it for your kids?

HPV vaccine is cancer prevention. Talk to the doctor about vaccinating your 11–12 year old sons and daughters against HPV.

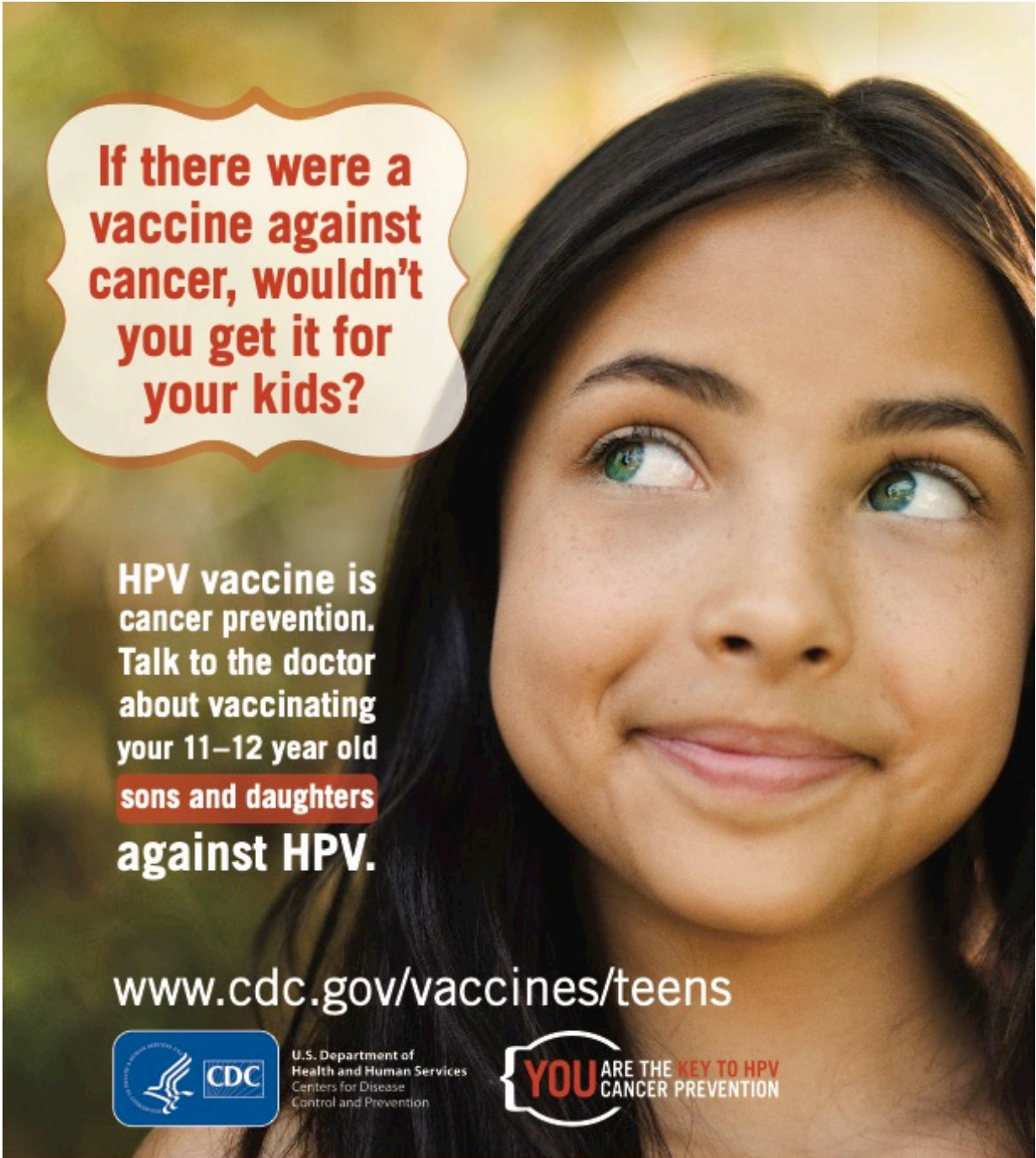
www.cdc.gov/vaccines/teens



U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

YOU ARE THE KEY TO HPV CANCER PREVENTION

Distributed by:



**If there were a
vaccine against
cancer, wouldn't
you get it for
your kids?**

**HPV vaccine is
cancer prevention.
Talk to the doctor
about vaccinating
your 11–12 year old
sons and daughters
against HPV.**

www.cdc.gov/vaccines/teens



U.S. Department of
Health and Human Services
Centers for Disease
Control and Prevention



Distributed by:

CS248886-2

APPENDIX H. EXECUTIVE SUMMARY

Background

The human papillomavirus (HPV) infects millions of people every year in the United States (CDC, 2016a). A majority of the infections can be cleared without treatment; however, some have serious complications, including cancer. Cervical, oropharyngeal, anal, vulvar, vaginal, and penile cancers are all linked with recurrent HPV infections. Over 30,000 cases of HPV-positive cervical cancer are diagnosed annually in the United States.

Fortunately, there is a vaccine to help reduce the rates of HPV infection and serious complications. The first HPV vaccine was released in 2006 and was a quadrivalent vaccine (CDC, 2016b). The current vaccine is nine-valent and provides protection against the most common and harmful serotypes of the HPV virus. The nine-valent vaccine was released in 2014. New 2-dose series recommendations were released by the ACIP in 2016 with hopes of increasing vaccination coverage in the United States (Meites, Kempe, & Markowitz, 2016).

Increased vaccination coverage of at least 80% is one of the goals within *Healthy People 2020* (ODPHP, 2018). The coverage rates for the HPV vaccine lag behind the goal. The 1-dose coverage rate in North Dakota is 67.6% (CDC, 2017a). The lag in coverage is linked with missed opportunities for HPV vaccination, as well as a lack of provider recommendation. Provider recommendation for vaccination has been shown to be a critical factor (Hansen et al., 2016). McLean et al. (2017) found that rates of HPV vaccination increase after successful implementation of healthcare provider education. Healthcare providers must recommend vaccination at every visit to increase coverage rates (Zimmerman et al., 2016).

Australia has had a HPV vaccination program since 2007 (Hall et al., 2018). Due to the program and their screening methods for cervical cancer, the rates of annual cervical cancer

diagnoses are decreasing. The rates are predicted to be less than 1% by the year 2020. By 2034, Australia is estimating a cervical cancer incidence of less than one per 100,000 cases annually. The vaccination program receives a large portion of the credit for this dramatic decrease, with HPV vaccination coverage rates at almost 80% for adolescent girls.

Project Summary

Based on the current HPV vaccination coverage statistics and research demonstrating the impact of provider recommendation and education, an educational practice improvement project was developed and implemented in rural North Dakota. Two rural family practice facilities were the setting for project implementation. The project was designed for all healthcare professionals, including physicians, advanced practice providers, nursing staff, and others. The purpose of the project was to enhance and increase healthcare professionals' knowledge and level of comfort regarding HPV, the vaccine, and various communication strategies available to increase vaccination uptake and acceptance. Additionally, the project was designed to evaluate and reduce the rate of missed opportunities for HPV vaccination in rural family practice healthcare facilities. The educational presentation lasted approximately 60 minutes with time allowed for questions or comments and used a Power Point presentation format.

Results

Two evaluation methods were used for the project: a post-test and missed opportunity statistics. The post-test was provided immediately after attending the educational presentation. Thirty-three healthcare professionals participated in the project. A five-point Likert scale was used to evaluate the impact of the educational information on the healthcare professionals' knowledge and level of comfort with new communication strategies. The average score for increased levels of knowledge after attending the presentation was 3.97. The average score for

the project increasing levels of comfort with new communication strategies was 4.06. The post-test results suggest the project had a positive impact for the healthcare professionals who were able to attend.

The results for missed opportunities for HPV vaccination at each of the locations were monitored for two months pre and post-educational intervention. The rates were broken into two age groups: 11-14 years and 15-26 years. The Valley City location did not have any reported missed opportunities before or after implementation. The Jamestown location did note missed opportunities but no significant change in rates post-intervention. The overall rate of missed opportunities for vaccination for the combined ages before was 30.3%. The post-intervention rate was 31.5% of missed opportunities.

Frequent diagnoses associated with missed opportunities were also tracked. The rate of missed opportunities at routine exams, including physicals and well child exams, was 32 visits prior to implementation in Jamestown. The rate did decrease to 17 visits after the educational intervention. The number of HPV vaccines provided before and after project implementation remained steady.

Recommendations

The results of the post-test indication an increase in healthcare professionals' knowledge and comfort with HPV vaccination and communication strategies. It is reasonable to recommend continued research into strategies to improve HPV vaccination coverage and reduce missed opportunities. Despite the lack of statistical findings supporting educational interventions reducing missed opportunities, further research into the impact of a multifaceted approach is needed. Educational interventions have been found to improve vaccination acceptance (Krantz et al., 2017).

One recommendation for future research is to include a multifaceted approach. The approach should include healthcare professional education, as well as provider feedback (Moore et al, 2017; Rand et al., 2018). Provider feedback methods are important for project sustainability as well. Additionally, the research should be over a longer period of time, as two months pre- and post-intervention was a limitation (Rand et al., 2018).

The continued impact of the successful HPV vaccination program in Australia indicates a need for further research in the United States (Hall et al., 2018). Cervical cancer will be virtually eradicated in Australia by the year 2034. Vaccination coverage rates are steadily increasing as well. Further research into the sustainability of a program to reduce missed opportunities for vaccination and increase coverage is needed to decrease the impact of HPV-positive cancers in the United States and meet the *Healthy People 2020* goal of over 80% coverage (ODPHP, 2018).

**APPENDIX I. CENTER FOR DISEASE CONTROL AND PREVENTION —
PERMISSION TO USE**

Ms. Hanson:

The image is in the public domain. You just need to reference the source of the image in the presentation or any publication.

Raymond A. Strikas, MD, MPH, FACP, FIDSA
Lead, Education Team
Communication and Education Branch
Immunization Services Division
National Center for Immunization and Respiratory Diseases
Centers for Disease Control and Prevention
1600 Clifton Road, NE, MS H24-6
Ras8@cdc.gov
Tel. 404 639 6465

Carly,

Thank you for your interest in the National Immunization Survey – Teen (NIS-Teen) data. You are welcome to use statistics, graphics, figures, etc from the CDC website. These are for public use. Please let me know if you have additional questions or need some other type of documentation of permission. Best Wishes with your dissertation!

Laurie

Laurie D. Elam-Evans, PhD, MPH
Lead Health Scientist / Team Leader
National Immunization Survey and National Immunization Survey-Teen
Assessment Branch
Immunization Services Division
National Center for Immunization and Respiratory Diseases
Centers for Disease Control and Prevention

**APPENDIX J. NORTH DAKOTA DEPARTMENT OF HEALTH — PERMISSION TO
USE**

Woinarowicz, Mary A. <mary.woinarowicz@nd.gov>

Mon 3/26/2018, 9:09 AM

Carly,

Yes, you may use any of the maps and graphs for coverage rate information that is publicly available on our Immunization Program web site. Please just make sure to note that the source data is from the North Dakota Immunization Information System (NDIIS) and was analyzed by the NDIIS Manager of the ND Immunization Program.

Mary Woinarowicz
NDIIS Manager
North Dakota Department of Health
701.328.2404
mary.woinarowicz@nd.gov

APPENDIX K. WOLTERS KLUWER HEALTH LICENSE — PERMISSION TO USE

Thank you for your order!

Dear Carly Hanson,

Thank you for placing your order through Copyright Clearance Center's RightsLink® service.

Order Summary

Licensee:	Carly Hanson
Order Date:	Apr 22, 2019
Order Number:	4574301386232
Publication:	book
Title:	Evidence-Based Practice in Nursing & Healthcare
Type of Use:	Dissertation/Thesis
Order Total:	0.00 USD

(Original Order Number: 501477392)

View or print complete [details](#) of your order and the publisher's terms and conditions.

Sincerely,

Copyright Clearance Center

WOLTERS KLUWER HEALTH LICENSE TERMS AND CONDITIONS

Apr 22, 2019

This Agreement between Carly Hanson ("You") and Wolters Kluwer Health ("Wolters Kluwer Health") consists of your license details and the terms and conditions provided by Wolters Kluwer Health and Copyright Clearance Center.

The publisher has provided special terms related to this request that can be found at the end of the Publisher's Terms and Conditions.

License Number	4574301386232
License date	Apr 22, 2019
Licensed Content Publisher	Wolters Kluwer Health
Licensed Content Publication	WK Health Book
Licensed Content Title	Evidence-Based Practice in Nursing & Healthcare
Licensed Content Author	Bernadette Mazurek Melnyk PhD, RN, CPNP/PMHNP, FNAP, Ellen Fineout-Overholt PhD, RN, FNAP, FAAN
Licensed Content Date	Jan 1, 2018
Type of Use	Dissertation/Thesis
Requestor type	academic/educational
Format	print and electronic
Portion	excerpt (up to 400 words)
Number of excerpts...	1
The pages the excerpts are from are...	294-298
Will you be translating?	no
Reusing current or a previous edition	previous edition
Previous edition being used...	Third
Circulation/distribution	5
Title of your thesis / dissertation	HPV Immunization: Reducing Missed Opportunities through Enhanced Provider Knowledge and Communication Strategies
Expected completion date	Apr 2019
Estimated size (number of pages)	134
Requestor Location	Carly Hanson 1424 5 1/2 Ave NE