RESEARCH PAPER

A multi-site case study of community-clinical linkages for promoting HPV vaccination

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ABSTRACT

Human papillomavirus (HPV) vaccination rates in the U.S. are suboptimal, requiring innovative partnerships between community and clinical entities to remedy this issue. A rigorous evaluation of HPV-related community-clinical linkages (CCLs) was conducted to understand their components, processes, and outcomes to increase HPV vaccination. Cancer Prevention and Control Research Network (CPCRN) investigators explored CCLs in their communities employing an iterative, case study approach. Information describing nine CCLs on HPV vaccination was collected from representatives from the community organization and clinical setting. Thematic content analysis was used to analyze and interpret data. Five CCLs included a federally qualified health center as the clinical partner, and five included a non-profit organization as the community partner. Five reflected clinically focused integration wherein engagement occurs in the community but vaccine delivery and follow-up occur in the clinical setting. The main impetus was the need to improve HPV vaccination and a community's strong interest in preventing cancer. Noted critical components were a designated person to support the CCL and funding. Results will guide HPV vaccination promotion, education, and intervention efforts. CCLs provide an opportunity to study the adaption, integration, and enhancement of evidence-based approaches to increase HPV vaccination.

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1. Introduction

Human papillomavirus (HPV) accounts for a large proportion of cervical, anal, penile, vaginal, vulvar, and oropharyngeal cancers in the United States (U.S.).¹ HPV vaccination is recommended for females and males aged 9–26; however, the primary target for HPV vaccination is children aged 11–12 as part of the guideline-recommended adolescent immunization platform covered by public and private insurers.^{2–6} Despite these recommendations and financial coverage, uptake remains well below the *Healthy People 2020* national goal of 80% for adolescents aged 13–17 with only 65% of adolescent girls and 56% of boys having received 1 dose and only 50% of girls and 38% of boys having completed the three-dose series (up-to-date) in 2016.^{7,8}

To date, the majority of HPV vaccination interventions have largely focused on clinical setting implementation, increasing community demand, or improving access to vaccination.^{9,10} In particular, interventions have targeted provider recommendation through clinical setting changes, such as provider reminders, standing orders, or provider assessment and feedback, because of the noted influence on parental/adolescent immunization behaviors, including initiation

and uptake.¹⁰ Most community-based HPV vaccination interventions have occurred in school settings or have been linked in some way to schools.⁹ In addition, interventions aimed at expanding access to and community awareness of the HPV vaccine have occurred in pharmacy, mobile clinic, and dental settings, and through the use of strategic health communication campaigns.^{11,12} Despite previous HPV vaccination interventions, uptake, and completion of the HPV vaccine series remains a public health challenge.^{13–15} Innovative and coordinated partnerships between vested stakeholders and implementation of evidence-based prevention strategies in clinical and community settings offers a way to connect these settings.¹⁶ Community-clinical linkages (CCLs), which are “...collaborations between health care practitioners in clinical settings and programs in the community – both working to improve the health of people and the communities in which they live”,¹⁷ build upon this concept by linking community programs and clinical practice settings together, thereby capitalizing on the synergy of these two settings and their collective resources.^{18–21}

CCLs have been used to enhance referral services and train providers on methods to improve clinical practices,²² including heart disease among women, cancer prevention and

control, obesity prevention, promotion of physical activity, tobacco cessation, and influenza immunizations.^{17,22–26} The integration of CCLs can vary, with either a mutual focus, or one that more heavily favors the clinical or community setting.²⁷ Building on the success of CCLs in other health domains and in connecting providers and community organizations, one of the overarching goals of this study was to provide a formal assessment of CCLs focused specifically on HPV vaccination.^{17,22,28} Effective CCLs may improve HPV vaccine promotion and programmatic sustainability, HPV awareness and knowledge among linkage constituents, and patient/parent demand resulting in increased HPV vaccination rates. Therefore, the purpose of this study was to assess the mechanics of CCLs dedicated to HPV vaccination, including types of clinical and community partners, CCL impetus, available HPV vaccination services, outcomes evaluation, linkage sustainability, and partnership dynamics^{18,22,29} in five diverse geographic sites.

2. Results

Table 2 presents a summary of descriptive results of the nine HPV vaccination-focused CCLs examined for this analysis. Following is a more detailed description of the results by construct.

2.1 Descriptive information

Community sites were defined broadly and diversely, and reflected where people live, work, learn, play, and pray. Clinical sites were defined as having the ability to administer clinical services (i.e. HPV vaccination). Five of the nine CCLs included a FQHC as the clinical site. The missions of the community and clinical sites varied; however, the mission of all clinical sites included a focus on delivering health care to patients/clients. The mission of all community sites reflected health and human services interests. The missions of both community and clinical sites permitted a focus on HPV vaccination, and in some cases, the mission mandated a focus on vaccination (e.g., immunization coalition). Staffing reflected the nature of the site. For example, clinical settings were staffed with health-care providers. The populations served by the CCLs varied. Two of the nine CCLs focused on a targeted population (e.g., Hispanic/Latino). A focus on uninsured or underserved populations was less clear. There was some mention of this in the transcripts, but it was not clearly communicated whether vaccination of these populations was a priority among the interviewed CCL representatives. Geographical characteristics of locations served were mixed, as three of nine CCLs were rural-located.

2.2 Type of integration

When examining engagement (i.e., engaging individuals in need of a service), delivery (i.e., administering the service), and follow up as key indicators of the type of CCL integration, six CCLs exhibited clinically focused integration and three exhibited equally shared integration. In clinically focused integration, engagement occurs in the community setting

but delivery and follow-up occur in the clinical setting. For example, a community site may work to increase HPV vaccination awareness and provide referrals to a clinical site. The clinical site delivers HPV vaccination and follows up with patient care. In equally shared integration, engagement, delivery, and follow-up occur in both the community and clinical spaces. For example, a pharmacy (community) and primary care clinic (clinical) both identify individuals in need of vaccination (i.e., engagement), provide education and administer HPV vaccines (i.e., delivery), and follow-up occurs by ensuring accurate documentation of vaccination and plan for subsequent doses.

2.3 Impetus

Impetus examines the influences behind the CCL (e.g., in response to leadership or policies at the national, state, or local level), and whether a focus on HPV vaccination is supported (i.e., both encouraged and resourced). Across all CCLs, the need to address HPV vaccination was noted as a priority with varying degrees of emphasis. In at least one example, a needs assessment was conducted revealing the necessity to focus on HPV vaccination. Other examples influencing the level of priority included the influence of an elected official (governor), state policy, and the efforts of state public health departments. At the local level, CCLs conducted work on a local level but due to a national initiative (e.g., national non-profit organization with a HPV vaccination initiative conducted in partnership with a local FQHC). CCLs reported wide-ranging differences in financial and personnel resources available. Resources contributed to the level of priority a community and/or clinical partner was able to devote to partnerships and increasing HPV vaccination.

2.4 Types of services offered

All clinical sites offered HPV9 as well as all ACIP-recommended vaccines. In some cases, CCLs had existing relationships on which a HPV vaccination focus was built. Community and clinical sites had previously partnered to educate individuals around various health issues, including HPV vaccination, through media and promotional campaigns. Responses about planned or future efforts demonstrated an interest in continuing existing efforts to increase HPV vaccination coverage as well as extend/expand efforts, but resources were identified as an important element influencing the feasibility and sustainability of these efforts. CCLs reported that limited training was offered, especially on HPV vaccination linkages, but there was some mention of national conferences, webinars, or community town hall meetings as training activities. Clinical settings referenced more training opportunities, especially for clinical staff to meet continuing education requirements.

2.5 Spanning support

Spanning support refers to the arrangements, processes, tools, resources, information systems, and surveillance data

required to facilitate collaboration between the community and clinical entities. In order for community and clinical sites to work well together and achieve mutual goals, overcoming institutional boundaries is necessary. The main type of spanning support reported by CCLs was staff-related. A designated and dedicated person to oversee the CCL and ensure good communication and collaboration was essential. No specific information on the qualifications of the designated and dedicated person was provided by respondents; however, there was great emphasis on the need for a person to provide spanning support. Desired types of support focused on processes, resources, policies, and data required for the HPV vaccination CCLs. Examples of desired spanning support included: school mandates for vaccination, increased awareness and knowledge of HPV and need for vaccination among the general public, increased awareness about low HPV vaccination coverage among providers, effective routine communication between partners, organizational communication, stable or increased funding, improved administrative support, and enhanced data connectivity for the CCLs' efforts to increase HPV vaccination.

2.6 Facilitators

Facilitating factors ranged from historical to substantive. The mutual interest and desire to increase HPV vaccination was a common theme across CCLs. Additional facilitating factors included a history of collaboration between entities, personal relationships between key staff members in both community and clinical sites, administrative support, and routine communication.

2.7 Barriers

CCL representatives from both community and clinical respondents identified several barriers, which reflected practical challenges associated with working across organizational boundaries on common issues and HPV vaccination. Barriers identified included the public's lack of knowledge about HPV and need for vaccination, challenges talking about HPV due to its sexually transmitted nature, poor technology linkage between partners impeded expeditious communication, competing staff priorities, limited planning time to focus on the CCL and HPV vaccination, staff turnover, absence of protocols to guide work, and evaluation challenges due to data infrastructure issues or other factors influencing available data and usability. For three of these barriers, respondents provided expanded descriptions. Examples of lack of knowledge about HPV include a general sense of misunderstanding about the HPV vaccine, lack of familiarity with the needs for HPV vaccine, and unclear about recommendations for HPV vaccination (e.g., such as recommended for boys as well as girls). Competing priorities among staff included directives to staff to focus on other issues, and HPV vaccination was not always viewed as a priority. For example, in FQHC settings, HPV vaccination is not a current quality measure. FQHC staff perceived a need to focus on current quality

measures. In terms of poor technology linkages between partners, the main focus was on challenges posed by where and who documents vaccination. For example, immunization registries, pharmacy records, and/or medical records are not always concordant or updated.

2.8 Evaluation

Limited information on evaluation plans and processes was provided by the collective interviewees. Eight of nine CCLs conducted some evaluation activities related to their collaborative efforts. The most common activities included the collection of clinical data on HPV vaccination, including patient-level data, dose completion data, and dose ordering data. Additional evaluation activities included surveys examining the public's knowledge and beliefs about HPV and HPV vaccination, assessing the feasibility of pharmacy-clinic relationship for increasing HPV vaccinations, and estimated the reach of advertisements to promote HPV vaccination.

3. Discussion

This preliminary, qualitative case study provides insights from nine community-clinical collaborations across five geographic areas focused on improving HPV vaccination rates. We used a landscape assessment to explore potential CCLs in place, at various stages of collaboration, to further explore the CCL in terms of evidence indicating there was some work related to HPV vaccination being conducted. Community sites spanned non-profit organizations, faith-based organizations, and pharmacies, aligning with other HPV vaccination initiatives found in the literature.^{30–33} Five of the nine clinical sites were FQHCs, an indicator of the commitment among clinical and community sites to providing preventive care to economically disadvantaged populations and a common site for research and quality improvement projects focused on HPV vaccination across the country.^{34,35} The profiled linkages included urban and rural settings; inclusion of rural communities is particularly important given the disparities in HPV-related cancers in rural areas of the U.S.¹¹ Each CCL had unique characteristics, but several common themes emerged from these profiles.

First, the collaborations build on a strong national commitment to cancer prevention through effective vaccination. Seven CCLs indicated the importance of a national initiative as the impetus for the collaboration, either directly or through the local level. National HPV vaccination initiatives organized by the National Cancer Institute, Centers for Disease Control and Prevention, and American Cancer Society were particularly salient among these CCLs. Second, most CCLs relied on funding, with a majority being funded by both the clinical and community site. Third, there is a strong commitment to CCL evaluation efforts, reflected in eight of the nine collaborations indicating that they have conducted evaluations to determine input, process, and outcome indicators.³⁶ Finally, CCLs focused on HPV vaccination are strengthened when there are other areas of previous and/or current collaboration between organizations, suggesting the importance of sustained relationships and communication across partner sites.

Most CCLs were classified as clinically focused, meaning that the clinical site provides all of the vaccination services and follow-up, with community sites engaged primarily in outreach to target populations. Even with clinically focused CCLs, the most common barriers and needs described focused on creating demand and enhancing the public's awareness and knowledge about HPV, which according to national surveillance data is still suboptimal, and particularly limited among minority and medically underserved populations.^{37–39} This may reflect the need for communication tools and messages specifically targeting populations served in both the community and clinical settings, such as culturally appropriate and literacy-appropriate tools. It could also suggest the need for fewer barriers between outreach and behavior (i.e., more CCLs with equally shared integration that make vaccination available at the time of education and outreach).

Interviews with CCL leaders revealed a robust commitment to collaborative activities. All of the interviewees emphasized the importance of accountable staff, such as “HPV vaccination champions,” at each site that are recognized across organizations for their role in enhancing vaccination efforts. Champions – recognized as an implementation strategy – are commonly used to support, market, and drive changes across an organization and have been identified as an important player in creating a climate supportive of HPV vaccination.^{40–42} This ‘spanning support’ needs to be strategically developed and encouraged by organizational leadership in both settings. Because CCLs fit well with the overarching concept of population health, establishing and maintaining CCLs can be encouraged as an effective approach to bring prevention and health care beyond the clinical setting and into the community.

This study has limitations to be noted. This assessment of the mechanics of CCLs was selective and should not be construed as representative of the total range of clinical-community collaborations focused on HPV vaccination. In addition, the qualitative approach to data collection was limited in terms of gathering specific details such as the composition of each community, the patient population of each clinical entity, the disciplinary and sectoral cultures of the community and clinic staff, and the clinics' HPV vaccination rates. CPCRN site leaders knew the CCLs profiled and some of them involved university collaboration. Nonetheless, the assessment indicates that CCLs for HPV vaccination can be robust, sustained, and can provide generalizable best practices for broader dissemination.

Results will inform future HPV vaccination promotion, education, and interventional efforts across CPCRN sites and contribute to dissemination and implementation science focused on CCLs to improve public health, including the identification of opportunities to disseminate clear descriptions of effective CCLs as implementation strategies aimed at increasing HPV vaccination.⁴² Specifically, the results may guide the development of strategies for community and clinical partners to collaborate in order to increase HPV vaccination rates. Indeed, CCLs are ripe for further study using an implementation science lens, including theoretical considerations, study designs, and implementation outcomes.⁴³ The focus on CCLs is novel given most HPV vaccination

intervention-related research has occurred in one, but not both, clinical and community settings.^{9,10} CCLs offer an opportunity to facilitate connections between previously developed clinical interventions and community-based interventions to, as one example, increase provider recommendation while also increasing community demand for vaccination^{9,10} in a coordinated manner to maximize outcomes. It is important to note in this study we were unable to determine differentiation between CCLs for initiation and/or completion of the HPV vaccination series. As a result, examining the role of CCLs specifically in initiation and completion is an important area of exploration. CCLs provide an opportunity to study the adaption, integration, and enhancement of evidence-based approaches to increase HPV vaccination.

4. Methods

4.1 Setting

The Cancer Prevention and Control Research Network (CPCRN) is a network of academic, public health, and community partners, with a mission of accelerating adoption of evidence-based cancer prevention and control strategies, to ultimately reduce cancer burden.⁴⁴ CPCRN is a thematic research network of the Prevention Research Centers (PRC), a program funded by CDC and the National Cancer Institute. The network is comprised of eight institutions, and investigators from participating sites collaborate on cancer-related signature projects. The current study is the result of the CPCRN HPV Vaccination Signature Project workgroup, represented by the Oregon Health and Science University, University of Iowa, University of Kentucky, University of South Carolina, and University of Washington. The aim of the workgroup is to contribute to the science and evidence-base supporting innovative CCLs to increase HPV vaccination rates. To achieve this aim, the workgroup chose to focus on understanding the current status of HPV vaccination-focused CCLs across participating CPCRN sites to obtain in-depth information about existing CCLs in five sites, Iowa, Kentucky, Oregon, South Carolina, and Washington.

4.2 Selection of CCLs

Prior to CCL selections, the five CPCRN sites participated in a brief landscape assessment to identify HPV vaccination-related CCLs in which they are participating, of which they were aware, and/or interested in learning more about. Using an online survey, one respondent from each site responded to a cross-tabulated list of possible clinical and community dyads dedicated to HPV vaccination. Possible clinical sites included: primary care, federally qualified health center (FQHC), pediatric, obstetrics/gynecology, internal medicine, immunization clinic, sexually transmitted disease clinic, community hospital, school health center, and other. Community sites included faith-based entities, schools, pharmacies, community centers, community-based organizations, state/local health departments, and others. For each possible CCL, respondents indicated whether the CPCRN site was actively involved in the linkage,

aware of but not actively involved in the linkage, not aware but interested in the linkage, or not interested in the CCL. Of the original 10 categories, three clinical sites – primary care, FQHCs, and internal medicine – were frequently endorsed for existing collaborations or aware of but not actively involved in collaborations. Faith-based organizations, state and local health departments, and pharmacies were frequently endorsed as community linkage sites. Based on landscape assessment results, the five CPCRN site respondents were then asked to identify two CCLs to be contacted for further insight into their HPV vaccination activities. To be selected, the CPCRN site confirmed that each of the two chosen CCLs were engaged in activities that promote, educate about, and/or deliver HPV vaccination services among their target populations and were actively working in this space (or recently completed work). For all sites, only two CCLs met these criteria. The CPCRN site respondent was either directly involved in the CCL or was familiar with/connected to the community and/or clinical partner through other cancer control collaborations. One site was unable to profile one of their selected CCLs due to confidentiality concerns (i.e., vulnerable population), therefore results from nine CCLs are included. The study protocol was approved by the Institutional Review Board at each of the five CPCRN sites.

4.3. Case examples

A conceptually driven case study approach was used to collect information describing the chosen CCLs from each of the five CPCRN sites. Krist and colleagues²⁷ integrative CCL

framework guided the development of a standard interview protocol. This framework highlights three core components for effective collaboration in service delivery: engaging individuals in need of service (i.e. HPV vaccination), administering the service, and follow-up. Further, the model outlines critical stakeholders for achieving integration that spans each of these effective collaboration components: clinicians; community members and organizations; spanning personnel and infrastructure; national and/or state leadership; local leadership; and funders and purchasers.²⁷ As summarized in Table 1, the semi-structured interview guide assessed descriptive information about each of the community and clinical sites, type of CCL integration (based on the Krist et al.²⁷ categories of mutual, community-focused, and clinically focused), impetus for the CCL, types of HPV vaccination services offered, spanning support, partnership facilitators and barriers, and evaluation activities.

Interviews were conducted with a knowledgeable leader at the clinical and community organizations, respectively, that were involved in each CCL. The respondents were most often directly involved with the CCL and could speak to site characteristics and specifics of the collaboration. To lessen participant burden and increase participation, interviews could be completed via email, telephone, in person, or a combination of these modes. Following the completion of the qualitative interviews, each CPCRN site independently completed an abstract form designed to facilitate retrieval of emergent information on the primary constructs identified in Table 1 for each interview and uploaded the original transcript and abstract form to a password-protected shared workspace. Abstract forms were

Table 1. Construct table and interview guide questions for community and clinical linkage leaders.

Construct/Domain	Related Questions
Descriptive Information	<ol style="list-style-type: none"> 1. How would you describe the mission of your organization? 2. Who are the primary staff in your organization? 3. What locations does your organization serve? 4. What is the target population of your organizational setting?
Type of Integration	<ol style="list-style-type: none"> 5. Please tell me the extent to which your site offers the following services related to HPV vaccination: <ul style="list-style-type: none"> • Information and counseling for parents and children/adolescents • Making arrangements for children/adolescents to receive vaccinations • Administering vaccinations • Providing referral and/or feedback to a partner organization • Other (specify)
Impetus	<ol style="list-style-type: none"> 6. To what extent is your involvement in HPV vaccination in response to leadership/policies at the national, state or local level?
Types of Services Offered	<ol style="list-style-type: none"> 7. What types of HPV vaccination are offered? 8. Describe any <i>past</i> efforts to address HPV vaccination.* 9. Describe any <i>planned</i> efforts to address HPV vaccination.* 10. What resources are devoted to <i>current</i> efforts to address HPV vaccination? (E.g. resources are funding, staff time, other). <ul style="list-style-type: none"> • What resources were devoted to <i>past</i> efforts?* • What resources will be devoted to <i>planned</i> efforts?* 11. What type of training, such as professional development or education, have you offered on HPV vaccination?
Spanning Support	<ol style="list-style-type: none"> 12. Who is the person in your organization responsible for working with {partnering site}? <ul style="list-style-type: none"> • What is his/her role in the organization? 13. What would help you in your work with {partnering site} to address HPV vaccination?
Facilitators	<ol style="list-style-type: none"> 14. What do you think is working well to make your partnership successful?
Barriers	<ol style="list-style-type: none"> 15. What challenges have you experienced in your partnership?
Evaluation	<ol style="list-style-type: none"> 16. What evaluation activities have been conducted of your HPV program? <ul style="list-style-type: none"> • If applicable, briefly describe the focus on your evaluation

Table 2. Descriptive characteristics of HPV vaccination community-clinical linkages.

#	Clinical Site	Community Site	Modality of Interview Administration	Urban/Rural Focus	Racial/Ethnic Minority Focus (y/n)	Funding	Type of Integration	Impetus	Evaluation of HPV programs
1	FQHC	Non-profit organization	Combination	Rural	Yes (Hispanic/Latino)	No	Clinically focused integration	State level (Influence of health department)	No
2	Primary care, University-based mobile clinic	Faith-based organization	In-person	Rural	Yes (Hispanic/Latino)	Yes (Both)	Equally shared integration	Local level* (National initiative, implemented locally)	Yes
3	Local health department	State or local organization (Immunization Coalition)	Combination	N/A	No	Yes (Clinical)	Equally shared integration	National initiative, implemented locally	Yes
4	FQHC	Non-profit organization, national organization	Email	Urban	No	Yes (Both)	Clinically focused integration	National initiative, implemented at state and local levels	Yes
5	FQHC	Non-profit organization, national organization	Combination	N/A	No	Yes (Both)	Clinically focused integration	National initiative, implemented locally	Yes
6	Primary care, pediatrics	Pharmacy	In-person	Urban	No	Yes (Both)	Equally shared integration	Local level* (National initiative, implemented locally)	Yes
7	University-based clinic	University health education program	Combination	Urban	No	Yes (Both)	Clinically focused integration	National initiative, implemented locally	Yes
8	FQHC, pediatric	Non-profit organization, national organization	Email	Rural	No	Yes (Both)	Clinically focused integration	National initiative, implemented at state and local levels	Yes
9	FQHC, primary care, dental	State or local organization, non-profit organization	Combination (In-person, Email)	N/A	No	No	Clinically focused integration	Local level	Yes

independently reviewed by two investigators to confirm accuracy of the information extracted from the transcript. If discrepancies were noted, individual sites were asked to submit revised abstract forms and these were reviewed again by the investigators. The final abstract forms were used to guide thematic content analysis conducted by two investigators with a third investigator serving as an independent source to resolve conflicting interpretations. The first step in thematic content analysis was to use the Krist et al. framework to organize responses based on the conceptual model.²⁷ The interview guide was highly structured and allowed for organizing the data by type of CCL integration, impetus for the CCL, types of HPV vaccination services offered, spanning support, partnership facilitators and barriers, and evaluation activities. From there, two investigators carefully reviewed the data to glean emergent similarities and differences across the CCLs. This process was iterative and involved the two investigators conferring throughout the process to ensure a similar approach. However, a third investigator was instrumental in providing insight into interpretations when there were differences in the interpretation of the two investigators who conducted the analysis. This process continued until results were compiled and then presented to representatives from all five CPCRn sites for further discussion and confirmation.

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References

- Centers for Disease Control and Prevention. How many cancers are linked with HPV each year? Atlanta (GA): Division of Cancer Prevention and Control; 2018 Aug 15. [accessed 2018 Oct 12]. <http://www.cdc.gov/cancer/hpv/statistics/cases.htm>
- Centers for Disease Control and Prevention. Recommendations on the use of quadrivalent human papillomavirus vaccine in males—Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep.* 2011;60(50):1705–08.
- Petrosky E, Bocchini JA Jr, Hariri S, Chesson H, Curtis CR, Saraiya M, Unger ER, Markowitz LE. Centers for disease control and prevention. Use of 9-valent human papillomavirus (HPV) vaccine: updated HPV vaccination recommendations of the advisory committee on immunization practices. *MMWR Morb Mortal Wkly Rep.* 2015;64:300–04.
- Centers for Disease Control and Prevention. For parents of pre-teens and teens: vaccines for your children. Atlanta (GA): National Center for Immunization and Respiratory Diseases; 2016 Apr 1. [accessed 2018 Oct 12]. <https://www.cdc.gov/vaccines/parents/diseases/teen/index.html>
- The Henry J. Kaiser Family Foundation. The HPV vaccine: access and use in the U.S. San Francisco (CA): The Henry J. Kaiser Family Foundation; 2018. [accessed 2018 Oct 12 Oct9]. <http://kff.org/womens-health-policy/fact-sheet/the-hpv-vaccine-access-and-use-in/>
- Centers for Disease Control and Prevention. The VCF program: at a glance. Atlanta (GA): National Center for Immunization and Respiratory Diseases; 2016 Feb 18. [accessed 2018 Oct 12]. <http://www.cdc.gov/vaccines/programs/vfc/about/index.html>
- U.S. Department of Health and Human Services. Immunization and infectious diseases: objectives. Washington (DC): U.S. Department of Health and Human Services; 2017. [accessed 2018 Oct 12]. <https://www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases/objectives>
- Walker TY, Elam-Evans LD, Yankey D, Markowitz LE, Williams CL, Mbaeyi SA, Fredua B, Stokley S. National, regional, state, and selected local area vaccination coverage among adolescents aged 13–17 years - United States, 2017. *MMWR Morb Mortal Wkly Rep.* 2018;67(33):909–17. doi:10.15585/mmwr.mm6733a1.
- Niccolai LM, Hansen CE. Practice- and community-based interventions to increase human papillomavirus vaccine coverage: A systematic review. *JAMA Pediatr.* 2015;169(7):686–92. doi:10.1001/jamapediatrics.2015.0310.
- Smulian EA, Mitchell KR, Stokley S. Interventions to increase HPV vaccination coverage: A systematic review. *Hum Vaccin Immunother.* 2016;12(6):1566–88. doi:10.1080/21645515.2015.1125055.
- Vanderpool RC, Stradtman LR, Brandt HM. Policy opportunities to increase HPV vaccination in rural communities. *Hum Vaccin Immunother.* 2019;1–6. doi:10.1080/21645515.2018.1553475.
- Vanderpool RC, Brandt HB, Pilar MR. HPV vaccination case study. In: Chambers DA, Vinson C, Norton WE, editors. *Optimizing the cancer control continuum: advancing implementation research.* (pp. 126–131). New York (NY): Oxford University Press; 2018.
- Centers for Disease Control and Prevention. HPV vaccine: safe, effective, and grossly underutilized. Atlanta (GA): Centers for Disease Control and Prevention; 2013 Jul 25. [accessed 2018 Oct 12]. <https://www.cdc.gov/media/releases/2013/p0725-hpv-vaccine.html>
- National Cancer Institute. Accelerating HPV vaccine uptake: urgency for action to prevent cancer. A report to the president of the United States from the president's cancer panel. Bethesda (MD): National Cancer Institute; 2014.
- National Vaccine Advisory Committee. Overcoming barriers to low HPV vaccine uptake in the United States: recommendations from the national vaccine advisory committee: approved by the national vaccine advisory committee on June 9, 2015. *Public Health Rep.* 2016;131(1):17–25. doi:10.1177/003335491613100106.
- U.S. Preventive Services Task Force. Integrating evidence-based clinical and community strategies to improve health. Rockville (MD): U.S. Preventive Services Task Force; 2016 Sep. [accessed 2018 Oct 12].
- Centers for Disease Control and Prevention. Developing community-clinical linkages for WISEWOMAN programs. Atlanta (GA): National Center for Chronic Disease Prevention and Health Promotion. [accessed 2018 Oct 12]. http://www.cdc.gov/wisewoman/docs/ww_brief_developing_community-clinical_linkages.pdf
- Etz RS, Cohen DJ, Woolf SH, Holtrop JS, Donahue KE, Isaacson NF, Strange KC, Ferrer RL, Olson AL. Bridging primary care practices and communities to promote healthy behaviors. *Am J Prev Med.* 2008;35(5 Suppl):S390–397. doi:10.1016/j.amepre.2008.08.008.
- Woolf SH, Krist AH, Rothenich SF. Joining hands: partnerships between physicians and the community in the delivery of preventive care. Washington (DC): Center for American Progress; 2006.
- Association of State and Territorial Health Officials. Community-clinical linkages to improve hypertension identification, management, and control. Arlington (VA): Association of State and Territorial Health Officials; 2015. [accessed 2018 Oct 12]. <http://www.astho.org/Prevention/Community-Clinical-Linkages-Issue-Brief/>
- Centers for Disease Control and Prevention, AARP, and American Medical Association. Promoting preventive services for adults 50–64: community and clinical partnerships. Atlanta (GA): Centers for Disease Control and Prevention, AARP, and American Medical Association; 2009. [accessed 2018 Oct 12]. <https://www.cdc.gov/aging/pdf/promoting-preventive-services.pdf>
- Porterfield DS, Hinnant LW, Kane H, Horne J, McAleer K, Roussel A. Linkages between clinical practices and community organizations for prevention: a literature review and environmental scan. *Am J Prev Med.* 2012;42(6 Supple 2):S163–171. doi:10.1016/j.amepre.2012.03.018.
- Ockene JK, Edgerton EA, Teutsch SM, Marion LN, Miller T, Genevro JL, Loveland-Cherry CJ, Fielding JE, Briss PA. Integrating evidence-based clinical and community strategies to improve health. *Am J Prev Med.* 2007;32(3):244–52. doi:10.1016/j.amepre.2006.11.007.
- Schensul JJ, Radda K, Coman E, Vazquez E. Multi-level intervention to prevent influenza infections in older low income and minority adults. *Am J Community Psychol.* 2009;43(3–4):313–29. doi:10.1007/s10464-009-9235-y.
- Coady MH, Galea S, Blaney S, Ompad DC, Sisco S, Vlahov D. Project viva intervention working group. Project VIVA: a multilevel community-based intervention to increase influenza vaccination rates among hard-to-reach populations in New York City. *Am J Public Health.* 2008;98(7):1314–21. doi:10.2105/AJPH.2007.119586.
- Ndiaye SM, Hopkins DP, Shefer AM, Hinman AR, Briss PA, Rodewald L, Willis B. Task force on community preventive services. Interventions to improve influenza, pneumococcal polysaccharide, and hepatitis B vaccination coverage among high-risk adults: a systematic review. *Am J Prev Med.* 2005;28(5 Suppl):248–79. doi:10.1016/j.amepre.2005.02.016.
- Krist AH, Shenson D, Woolf SH, Bradley C, Liaw WR, Rothenich SF, Slonim A, Benson W, Anderson LA. Clinical and community delivery systems for preventive care: an integration framework. *Am J Prev Med.* 2013;45(5):508–16. doi:10.1016/j.amepre.2013.06.008.
- Savas LS, Fernandez ME, Jobe D, Carmack CC. Human papillomavirus vaccine: 2-1-1 helplines and minority parent

- decision-making. *Am J Prev Med.* **2012**;43(6 Suppl 5):S490–496. doi:[10.1016/j.amepre.2012.09.003](https://doi.org/10.1016/j.amepre.2012.09.003).
29. Poterfield D, Hinnant L, Kane H, Horne J, McAleer K, Roussel A. Linkages between clinical practices and community organizations for prevention. Research Triangle Park (NC): RTI International; **2010**.
 30. Wigfall LT, Bynum SA, Brandt HM, Sebastian N, Ory MG. HPV-related cancer prevention and control programs at community-based HIV/AIDS service organizations: implications for future engagement. *Front Oncol.* **2018**;8:422. doi:[10.3389/fonc.2018.00422](https://doi.org/10.3389/fonc.2018.00422).
 31. The University of Iowa College of Public Health. Video highlights community-based efforts to increase HPV vaccination. Iowa City: The University of Iowa College of Public Health; **2018** Nov6. [accessed 2019 Mar 26]. <https://www.public-health.uiowa.edu/news-items/video-highlights-community-based-efforts-to-increase-hpv-vaccination/>
 32. Fava JP, Colleran J, Bignasci F, Cha R, Kilgore PE. Adolescent human papillomavirus vaccination in the United States: opportunities for integrating pharmacies into the immunization neighborhood. *Hum Vaccin Immunother.* **2017**;13(8):1844–55. doi:[10.1080/21645515.2017.1325980](https://doi.org/10.1080/21645515.2017.1325980).
 33. Calo WA, Shah PD, Gilkey MB, Vanderpool R, Barden S, Doucette W, Brewer NT. Implementing pharmacy-located HPV vaccination: findings from pilot projects in five states. *Hum Vaccin Immunother.* **Forthcoming**.
 34. Perkins RB, Zisblatt L, Legler A, Trucks E, Hanchate A, Gorin SS. Effectiveness of a provider-focused intervention to improve HPV vaccination rates in boys and girls. *Vaccine.* **2015**;33(9):1223–29. doi:[10.1016/j.vaccine.2014.11.021](https://doi.org/10.1016/j.vaccine.2014.11.021).
 35. Fisher-Borne M, Preiss AJ, Black M, Roberts K, Saslow D. Early outcomes of a multilevel human papillomavirus vaccination pilot intervention in federally qualified health centers. *Acad Pediatr.* **2018**;18(2s):S79–s84. doi:[10.1016/j.acap.2017.11.001](https://doi.org/10.1016/j.acap.2017.11.001).
 36. Centers for Disease Control and Prevention. CDC approach to evaluation: indicators. Atlanta (GA): Program Performance and Evaluation Office; **2016** Dec2. [[accessed 2019 Mar 26]. <https://www.cdc.gov/eval/indicators/index.htm>
 37. Radecki Breitkopf C, Finney Rutten LJ, Findley V, Jacobson DJ, Wilson PM, Albertie M, Jacobson RM, Colon-Otero G. Awareness and knowledge of Human Papillomavirus (HPV), HPV-related cancers, and HPV vaccines in an uninsured adult clinic population. *Cancer Med.* **2016**;5(11):3346–52. doi:[10.1002/cam4.933](https://doi.org/10.1002/cam4.933).
 38. Cooper DL, Hernandez ND, Rollins L, Akintobi TH, McAllister C. HPV vaccine awareness and the association of trust in cancer information from physicians among males. *Vaccine.* **2017**;35(20):2661–67. doi:[10.1016/j.vaccine.2017.03.083](https://doi.org/10.1016/j.vaccine.2017.03.083).
 39. Ojeaga A, Alema-Mensah E, Rivers D, Azonobi I, Rivers B. Racial disparities in HPV-related knowledge, attitudes, and beliefs among African American and White women in the USA. *J Cancer Educ.* **2019**;34(1):66–72. doi:[10.1007/s13187-017-1268-6](https://doi.org/10.1007/s13187-017-1268-6).
 40. Powell BJ, Garcia KG, Fernandez ME. Implementation strategies. In: Chambers DA, Vinson C, Norton WE, editors. *Optimizing the cancer control continuum: advancing implementation research.* (pp. 98–120). New York (NY): Oxford University Press; **2018**.
 41. Chuang E, Cabrera C, Mak S, Glenn B, Hochman M, Bastani R. Primary care team- and clinic level factors affecting HPV vaccine uptake. *Vaccine.* **2017**;35(35Pt B):4540–47. doi:[10.1016/j.vaccine.2017.07.028](https://doi.org/10.1016/j.vaccine.2017.07.028).
 42. Powell BJ, Waltz TJ, Chinman MJ, Damschroder, LJ, Smith, JL, Matthieu, MM, Proctor, EK and Kirchner, JE A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project. *Implement Sci.* **2015**;10:21. doi:[10.1186/s13012-015-0209-1](https://doi.org/10.1186/s13012-015-0209-1).
 43. Chambers DA, Vinson C, Norton WE, editors. *Optimizing the cancer control continuum: advancing implementation research.* New York (NY): Oxford University Press; **2018**.
 44. Cancer Prevention and Control Research Network. Cancer prevention and control research network. Carrboro (NC): Cancer Prevention and Control Research Network; **2018**. [accessed 2018 Oct 12]. www.cpcrn.org