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Using Concept Mapping to Identify Opportunities for HPV Vaccination Efforts: Perspectives from the Midwest and West Coast

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Abstract

Human papillomavirus (HPV) infection significantly contributes to the burden of cancer in the United States, despite the existence of a highly effective vaccine. While numerous interventions to address vaccination uptake exist, vaccination rates remain low. We conducted a concept mapping exercise to solicit perspectives on barriers and facilitators to HPV vaccination from state-level stakeholders in five states in the Midwest and West Coast of the U.S. We identified 10 clusters of barriers and facilitators based on participants' statements. For rural areas specifically, clusters rated as most important included education and provider influence; those rated as most feasible were education and coordinated/consistent messaging. Our results suggest that a combination of important (but potentially more difficult to implement) strategies, combined with those rated as

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most feasible (but potentially less impactful) may be beneficial. Our findings highlight similarities across diverse states, suggesting that states can learn from each other and work together to improve HPV vaccination rates. Using concept mapping proved to be an efficient way to collect information from diverse, stakeholders in different locations, and is a methodology that could be used for program planning in areas beyond HPV vaccination.

Keywords

Concept mapping; HPV vaccination; rural health; program planning

Introduction:

Human papillomavirus (HPV) infection is associated with about 44,000 new cases of cancer each year (CDC, 2019). Although a highly effective vaccine exists to protect against HPV and associated cancers, vaccination rates remain low across the United States (Walker et al., 2019). HPV vaccine is recommended for routine administration to adolescents ages 11-12 years (Walker et al., 2019). However, only 51% of adolescents aged 13-17 were up to date with the complete vaccine series in 2018 (Walker et al., 2019). Moreover, geographic disparities for HPV vaccination and related cancers are a particular concern. Individuals living in rural areas tend to have lower HPV vaccination rates (Walker et al., 2019; Vielot, Butler, Brookhart, Becker-Dreps & Smith, 2017), as well as higher rates of HPV-associated cancers (Zahnd et al., 2017) when compared to urban populations.

Although there are existing interventions to increase HPV vaccination that target individuals and health care providers (Brewer et al., 2017; Smulian, Mitchell, & Stokley, 2016) for promoting HPV vaccination, rates remain persistently low, suggesting the need for more work to support development and implementation of evidence-based interventions (EBIs). In this work, it is critical for public health and community sectors to consider potential barriers to vaccination including not having insurance, living in rural areas, and not receiving a strong provider recommendation (Walker et al., 2019). Interventions that enhance access to services, increase community acceptability of HPV vaccination and address provider or health system tools and protocols can be effective for increasing vaccination (CPSTF); multi-layer or multi-level approaches are needed to move the needle on community-level HPV vaccination coverage (Smulian et al., 2016) and it is important to tailor such programs to specific community contexts. Concept mapping is a useful tool to help identify priorities from stakeholders with on-the-ground contextual knowledge in order to plan tailored HPV vaccination interventions.

Concept mapping is a process that collects input about a topic from participants and creates visualization maps to display how responses are related (Kane & Trochim, 2007). It is a participatory research method that is useful for providing understanding about how people think and organize their ideas, including priorities and feasibility of efforts. Online concept mapping provides a system for gathering and organizing information from diverse, non-co-located people. Due to this ease of accessibility, concept mapping has been used across many study questions and within various populations (Soule, Rosas, & Nasim, 2016, 2015;

Tubbing, Harting, & Stronks, 2015). It is particularly well-suited to address public health challenges and aid in the process of program planning (Anderson & Slonim, 2017). Previous research has used concept mapping to compare stakeholder opinions on barriers to cancer screening (Lobb, Pinto, & Lofters, 2013), identify HIV intervention strategies (Szaflarski, Vaughn, Mclinde, Wess, & Ruffner), facilitate the building of a positive youth development program (Allen, et al., 2015), and identify options for patient-centered heath care services (Leyns, Maeseneer & Willems, 2018).

Concept mapping can be a particularly useful methodology for those planning public health programming. For example, researchers have successfully used concept mapping to understand the needs of potential program participants (Minh et al., 2015), develop a logic model (Anderson et al., 2006), and as a tool to aid in the development of program materials and activities (Askelson et al., 2015). The concept mapping process allows for the direct involvement of stakeholders ensuring that the data generated represents their collective experiences. In turn, this data can be used to inform stakeholders' future efforts. Concept mapping involves brainstorming with content experts; statement analysis and synthesis including the unstructured sorting of statements; multidimensional scaling and cluster analysis; and the generation of numerous interpretable maps and data displays (Kane & Trochim, 2007). Through this process, ideas can be grouped and organized into a common framework that is useful for planning and evaluation. The goal of this study was to utilize the concept mapping methodology to better understand the factors that state level stakeholders perceive to be important influences on HPV vaccination rates.

State-level stakeholders can directly impact widespread policies and programs related to vaccination and are, thus, critical partners for improving HPV vaccination. For example, states that have enacted policies related to limiting exemptions, expanding vaccine providers, adding vaccines to state vaccine programs, and initiating or improving state immunization registries have had significant effects on vaccination rates (ASTHO, 2019; Bradford and Mandich, 2015; Brandt, Pierce, and Crary, 2016; Shaw et al., 2018). With this in mind, we designed a study using concept mapping to understand how state-level public health professionals perceive factors related to HPV vaccine uptake. Within the context of HPV vaccination, this concept mapping can identify what is missing from current collective programmatic efforts, and inform the priority topics to address when planning future work.

Methods

Sample

We conducted our concept mapping project with state-level stakeholders from five states (Iowa, Minnesota, South Dakota, Washington, and Oregon). We identified individuals working in areas of cancer prevention, sexual health, adolescent health, and immunizations. Our research teams generated these lists through their own contacts as well as internet searches. The final sample included 134 stakeholders across all five states.

Data Collection

Brainstorming.—We used Concept System Global MAX (Concept System Global MAX, 2019) to collect all data. Concept mapping is a multi-step process that consists of statement generation, pile-sorting, and rating. We first invited individuals (n=134) to participate in an online brainstorming activity to respond to the following prompt: *What factors do you believe have the greatest influence on HPV vaccination rates in your state? Please provide an exhaustive list and consider both rural and urban regions, as well as both positive and negative influences*. Individuals received an email from a researcher at the University of Iowa, then two follow-up messages reminding people to participate. If individuals had not yet initiated the process, a researcher from their home state sent them a more personalized email message requesting their participation. Individuals who completed this phase of the project received a $20 gift card upon completion.

Participants brainstormed 372 statements. Researchers eliminated duplicate statements and split those that contained multiple ideas into the appropriate number of statements. This process resulted in a list of 172 unique statements. Because pile sorting a large number of statements can be time-consuming and burdensome for participants (Kane & Trochim, 2007), we narrowed the list of statements to those statements that would fall within the control of state-level stakeholders. For example, we considered "*evidence-based intervention tools online for primary care clinics to use and implement*" to be a statement that would be within work scope of these stakeholders, while "*recommendation changed from only females to later include males*" would not. This narrowing resulted in 68 statements to be used in the next phase.

Pile Sorting and Rating.—All identified stakeholders (n=134), were invited to participate in pile sorting regardless of whether they participated in the initial brainstorming activity. Two follow-up emails were sent and individuals who completed this phase received a $20 gift card. Participants were asked to pile-sort the list of 68 statements that we determined to be under control of state level stakeholders and name the piles. Participants were also directed to rate each statement based on: (a) how important it would be to improve HPV vaccination rates in rural areas (1= low importance to 5= high importance); and (b) how feasible it would be to accomplish it in rural areas in the next six months (1= low feasibility to 5= high feasibility).

Analysis

We used Concept System Global MAX™ software to complete all analyses. We generated concept maps using multidimensional scaling and cluster analysis (Kane & Trochim, 2007). We first used multidimensional scaling to assignment of x and y coordinates to each statement to create a two-dimensional point map. (Figure 1) This map shows statements that were more frequently sorted together as being located closer to each other. Fit between the similarity matrix and the point map was assessed with the stress value. Lower stress values indicate a better fit and a pooled analysis of concept mapping studies found that 0.28 was the average stress value (Rosas & Kane, 2012). In this study, the stress value was 0.25, indicating a good fit. This two-dimensional solution had a stress value of 0.25 indicating a good fit between the similarity matrix and the point map (Hierarchical cluster

analysis was then used with inputs from the MDS analysis to partition the map into unique clusters (Trochim & McLinden, 2017). At this point, we generated three cluster maps for solutions that showed 8, 10, and 12 clusters. Team members came together to examine these three solutions, came to consensus about the solution with the best fit, and named clusters using data from participants. Finally, we generated means for the importance and feasibility ratings for each of the 10 clusters and the individual 68 statements.

Results

Participants

A total of 78 invited individuals (58.2%) participated in the brainstorming phase. Of the original participants invited, 32 participants (23.8%) completed the sorting activity, 33 (24.6%) completed the importance ratings, and 29 (21.6%) completed the feasibility ratings. Participant characteristics for the brainstorm phase are shown in Table 1. The most common workplaces were state public health agencies (38.5%), cancer organizations (12.8%), and medical professional organizations (11.5%). Participants reported varying expertise areas, with the most common being public health (46.2%), followed by adolescent health (41.0%) and immunization (34.6%). Finally, the majority of participants identified as being in either management (41.0%) or programming roles (39.7%), with fewer reporting administrative (20.5%) or clinician duties (11.5%).

Concept Maps

Figure 2 shows the 10-cluster map which we identified as having the best fit. The list of statements and their corresponding clusters are presented in Table 2. The 10 clusters were: vaccines, access, provider influence, education, coordinated/consistent messaging, strong communication/support, evidence-based interventions, legislative, state support, and collaboration. The clusters with the fewest statements, collaboration and access, had 5 statements and the cluster with the most statements, evidence-based interventions, had 10.

Importance and Feasibility

Clusters rated as most important for improving vaccination in rural areas were: education (Mean [*M*]=4.21), provider influence (*M*=4.10), and evidence-based interventions (*M*=4.07). The individual statements rated as most important were strong, unwavering provider recommendations (*M*=4.84) and providers catching patients who have not completed the vaccine series (*M*=4.81). The cluster rated as least important was coordinated/consistent messaging (*M*=3.74) and the following individual statements were rated as least important: promotional posters for HPV vaccine displayed in provider offices (*M*=2.87) and CDC educational materials and infographics (*M*=3.07).

Clusters rated as most feasible were education (*M*=3.66) and coordinated/consistent messaging (*M*=3.76). The statements rated as most feasible were: reaching out to other states that have been successful in increasing HPV vaccination rates (*M*=4.20) and changing the message that this is a vaccine that can prevent cancer for children later in life (*M*=4.32). Clusters rated as least feasible included legislative (*M*=2.28), state support (*M*=2.64). The individual statements rated as least feasible were legislation to eliminate personal preference

as a reason to not vaccinate children (*M*=1.80), and that the HPV vaccine is not available at school (*M*=1.84).

Figure 3 shows the relationship between clusters for importance and feasibility. The correlation calculated between importance and feasibility was 0.12, reflecting the high level of variability observed with most items being rated as more important than feasible. All items, except for coordinated/consistent messaging, were rated as being more important than they were rated as feasible. The largest differences between importance and feasibility were seen in legislative (Difference [*D*]=1.53), state support (*D*=1.35) and access (*D*=1.16).

Discussion

In this novel, multi-state study, we used concept mapping as a tool to understand state-level stakeholders' perspectives and identify strategies for improving HPV vaccination coverage and, ultimately preventing HPV-associated cancers. Our findings identify 10 distinct clusters representing areas of influence on HPV vaccination ranging from education and collaboration to access and legislation. The clusters themselves reflect many of the important topics that vaccine researchers and public health practitioners have already identified about HPV vaccination which have important implications for program planning (Brewer et al., 2017; Smulian et al., 2016; Walling et al., 2016). For example, provider influence and evidence-based interventions were both identified as clusters with high importance, which is consistent with the literature emphasizing a focus on EBIs (Smulian et al., 2016; Walling et al., 2016) and the vital role of the provider in delivering a vaccine recommendation (Brewer et al., 2017). Overall, this research identifies some specific ways in which efforts for vaccination programming can be focused, and also underscores that concept mapping can be a useful tool in the program planning process to gather perspectives from diverse groups of stakeholders.

Interpretation of the cluster map itself reveals some important patterns about how stakeholders in this analysis organized factors they believe are impacting HPV vaccination in rural areas of their states. As seen in Figure 2, the cluster for evidence-based interventions is large and located in the center of the map, perhaps pointing to the idea that evidence-based interventions (EBIs) are tangentially related to some of the of the other clusters. EBIs frequently involve providers, use coordinated and consistent messaging, and focus on education and improving access. In the upper right comer, clusters for education, coordinated and consistent messaging, and strong communication or support are all close together. These three clusters all contain some aspect of communication, whether it is between providers and patients, ideas for specific messages to promote about the HPV vaccine, or ways that agencies can increase their communication. While these can all be tied to the idea of communication and messaging, it is clear that stakeholders conceptualized types of communication differently resulting in these three distinct clusters.

Our findings also highlight a critical discrepancy between how stakeholders view the importance and feasibility of strategies for increasing HPV vaccination in rural communities. Importance ratings ranged from 4.21 to 3.57, indicating that overall stakeholders felt all these factors were relatively important. However, feasibility ratings

ranged from 3.76 to 2.28, revealing that while these factors may be important, many of them were fall less feasible. For all but one cluster, feasibility ratings were lower than importance ratings, suggesting that stakeholders perceive significant barriers to their work on HPV vaccination. This is particularly evident in stakeholders' perceptions of their ability to impact legislative efforts and issues related to vaccine access compared to how important they perceive these factors to be. This mismatch may have implications for which programmatic efforts states should pursue first. For example, education had a high rating for both feasibility and importance, indicating that this may be a fruitful area to focus on first. Following education, provider influence was rated as the second most important in addressing vaccination efforts, however had a lower feasibility rating, suggesting there would be some barriers to this work. Within the education cluster, many statements focused on education for providers. Considering the evidence that provider recommendation of the vaccine is among the most important predictors of vaccination (Rahman et al., 2015), provider education is certainly an important place to focus.

While some of the more feasible strategies may be less important, these could be small wins for states as they continue to pursue other efforts identified as more important. The clusters rated as most feasible included coordinated/consistent messaging and education. Within the coordinated/consistent messaging cluster, statements with the highest feasibility rating highlighted individual-level efforts. Although the impact of any of these (i.e. hanging HPV posters in a clinic) may seem small, this should not be overlooked, as the "prevention paradox" interventions that seemingly only offer a small benefit at an individual level can none-the-less have a large population health impacts (WHO, 2002). Often it is the case that the easiest strategies may have minimal impact and the more effective strategies are the hardest to accomplish. In this study, while coordinated and consistent messaging was rated as highly feasible, it was also rated as low in importance. Alternatively, both the state support and legislative clusters were rated as highly important, but much lower on feasibility. Given that our sample was comprised of state-level stakeholders, with nearly 40% working in state public health agencies, it is important to take into account how their perspectives may influence their ratings. Stakeholders in this study clearly view working with state and legislative actors as important, but have the insiders' insight to know how challenging that may be. Our findings identify that, for rural areas, a combination of strategies identified as most important, although potentially harder to implement, and most feasible, could be one way to make decisions about programming for HPV vaccination.

Moreover, while previous research has focused largely on the perspectives of clinicians and parents, our findings highlight the distinct perspective of state-level stakeholders who may have a bigger picture understanding of what resources are available and what barriers exist at a population (vs. clinic) level (Dilley et al., 2018). Clinicians have previously identified similar factors to those highlighted in our study; for example, provider education, access and availability of the vaccine, and EBIs like patient and provider reminders (Lake et al., 2019). While our participants identified these factors as well, there was also a focus on the role of state and local health departments and collaboration between all these parties to improve vaccination. The clusters for state support and legislative efforts were among those rated as most important, which may reflect the "birds' eye view" that state-level stakeholders have in their perspectives on what is important for improving vaccination rates. Future efforts should

include groups like state-level stakeholders in HPV vaccination program planning as they may bring new perspectives that are not often captured.

Finally, given that the country is currently undertaking a massive vaccination campaign against SARS-CoV-2, there are some lessons from this study that may be applicable more broadly. As with HPV vaccination, there is evidence that there may be more COVID-19 vaccine hesitancy in rural areas (Khubchandani et al., 2021), and public health practitioners will have to employ different strategies to reach this population to ensure a majority of the population receives the vaccine. In our study, it is worth nothing that participants identified education, provider influence, and evidence-based interventions as the most important factors for addressing HPV vaccination in rural areas. For public health practitioners and researchers looking to promote COVID-19 vaccination in rural areas of the country, focusing on educating the public, working with providers, and looking for EBIs that could be adapted my help to improve COVID-19 vaccination rates.

Strengths and limitations

The principal strength of this study is the use of a participatory methodology—concept mapping—to gather information from stakeholders with diverse expertise and experience. However, concept mapping is time intensive for participants, which can affect the drop in participation rates for the sorting and rating activity (Jackson & Trochim, 2002). Other limitations include a low number of responses from some states and the fact that this project was conducted in five states, so findings may not be generalizable to other areas of the U.S. However, given the high degree of convergence in ideas we found across geographic regions and settings, we believe that this increased the credibility and transferability of our findings. Despite these limitations, to our knowledge, this study is the first use of concept mapping methodology to identify priorities for HPV vaccination efforts from a multi-state stakeholder group and helps to advance understanding of how best to organize future HPV vaccination promotion.

Conclusion

Concept mapping has proven very successful in the past to assist with program planning efforts for a variety of topics, including adolescent sexual health (Ewan et al., 2016) and obesity prevention (Kornet-van der Aa et al., 2017). Our findings may be useful for state-level stakeholders or even country wide networks looking to improve programming to support HPV vaccination, especially in more rural areas. Moreover, we found that we were successfully able to bring together a geographically diverse group using this tool, suggesting that other groups looking to conduct similar research could also use this process.

Our results highlight the commonalities in how a geographically diverse group of state level stakeholders perceive the challenges related to HPV vaccination. Knowing that these challenges were similar across states in this study suggests that states should not be siloed in their efforts, but, rather, should focus on sharing ideas and pooling resources to increase efficiency and avoid duplication. Networks like the Cancer Prevention Control and Research Network and the National HPV Roundtable have already begun cross-site collaboration efforts to improve vaccination rates (Reiter et al., 2018; Ribisl et al., 2017), indicating that

across the country resource sharing is already happening. These networks should continue to encourage collaboration and help states to identify what is actionable and necessary to move the needle on vaccination rates. In our study, participants identified the role of the provider and clinic as the most important for improving rates, while strategies related to communication were the most feasible. Given that multi-level (Paskett et al., 2016) and multi-component (Smulian et al., 2016) interventions may be most effective, stakeholders should consider prioritizing these strategies in their future program planning efforts to have the greatest impact on increasing HPV vaccination and preventing HPV-related cancers.

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Biography

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Highlights

- Stakeholders in five states identified barriers and facilitators to HPV vaccination
- Clusters rated as more important often also had lower feasibility ratings
- The misalignment between importance and feasibility suggests implementation barriers
- Concept mapping can be an effective tool for vaccination program planning

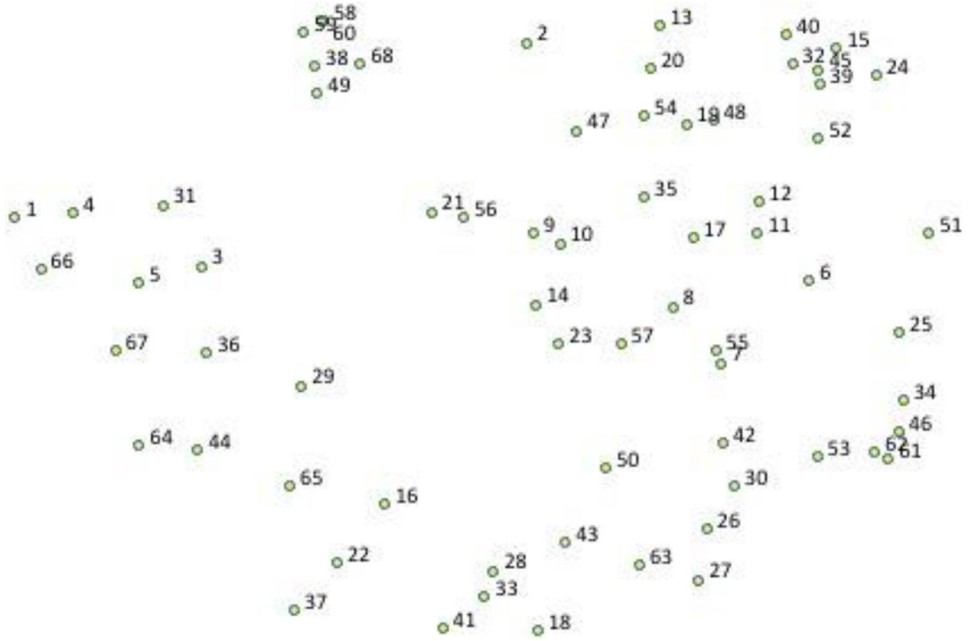

Figure 1.
Point map for statements generated in brainstorming activity (n=68)

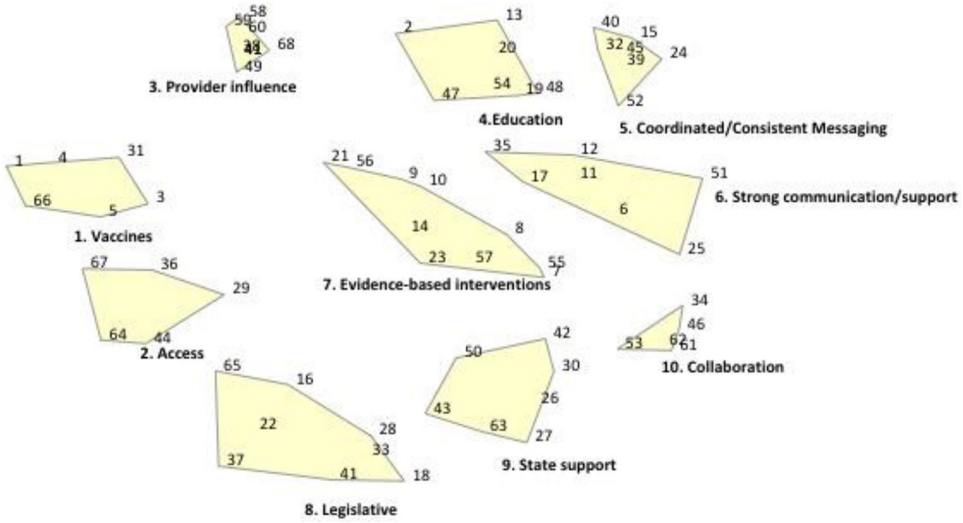

Figure 2.
10-solution cluster map of barriers and facilitators to HPV vaccination

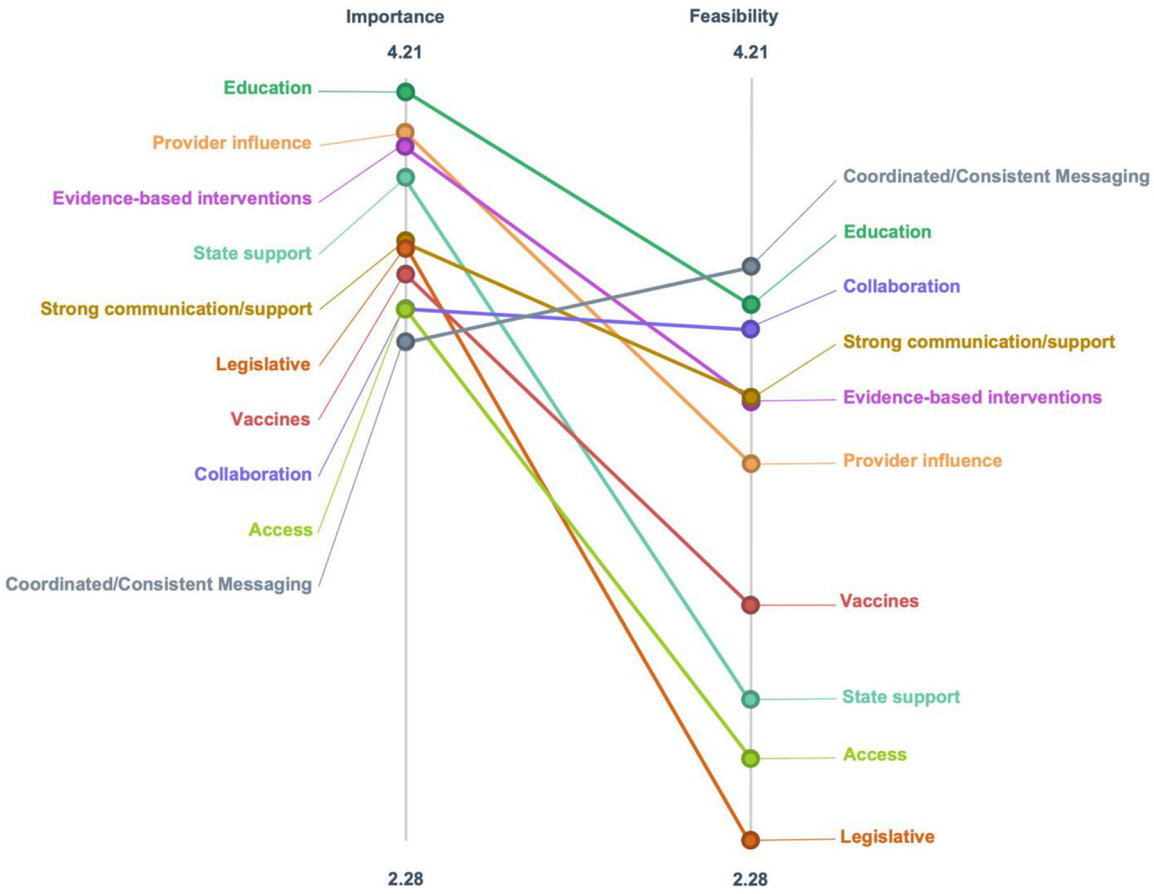

Figure 3.

Pattern match of importance and feasibility ratings

Correlation coefficient: r=0.12

Note. Figure shows the means of participants' ratings of the importance and feasibility of each cluster

Table 1

Participant Characteristics from Brainstorming Phase (N=78)

	Characteristic	*n*	(%)
State			
	Iowa	26	(33.3)
	Oregon	18	(23.1)
	Minnesota	17	(21.8)
	South Dakota	11	(14.1)
	Washington	6	(7.7)
Expertise [a]			
	Public health	36	(46.2)
	Adolescent	32	(41.0)
	Immunization	27	(34.6)
	Cancer	20	(25.6)
	Medicine	14	(17.9)
	Family planning/ob-gyn/women's health	9	(11.5)
	Oral health	2	(2.6)
	Tribal Community	1	(1.3)
Type of agency [a]			
	State public health	30	(38.5)
	Cancer organization	10	(12.8)
	Medical professional organization	9	(11.5)
	Educational organization	8	(10.3)
	Family planning organization	6	(7.7)
	Insurance organization	6	(7.7)
	Coalition	5	(6.4)
	Adolescent health organization	4	(5.1)
	American Indian health organization	4	(5.1)
	Other	10	(12.8)
Role [a]			
	Management	32	(41.0)
	Programming	31	(39.7)
	Administrative	16	(20.5)
	Clinician	9	(11.5)

[a]Participants could check all that apply

Table 2

Clusters and Individual Statements with Means for Importance and Feasibility Ratings for Rural Areas on a scale 1 to 5

Cluster	Statements	Importance	Feasibility
Vaccines		3.74	2.88
	1: Smaller rural clinics or independent practices do not have storage space for the vaccine	3.70	3.00
	3: Getting adolescents back into the office for next dose	4.52	3.78
	4: Doctors' willingness and ability to stock expensive vaccine inventory	3.63	3.00
	5: Clinic hours coincide with regular business hours	3.43	2.88
	31: Time available during physician visits to address exhaustive parental concerns	4.00	2.36
	66: Electronic health record systems can be difficult to use	3.13	2.20
Access		3.65	2.49
	29: School nurses and school-based health centers refer adolescents to providers of the HPV vaccine	4.03	3.20
	36: Ability to stock and provide HPV vaccines in express care (doc-in-the-box) convenient care facilities	3.97	2.79
	44: Adolescents get sports physicals from alternative providers (private practice, chiropractors)	3.43	2.12
	64: HPV vaccine is not available at school	3.47	1.84
	67: Pharmacists' willingness and ability to stock expensive vaccine inventory	3.47	2.50
Provider influence		4.10	3.25
	38: Primary care (and physicians) think their HPV vaccination rates are much higher than they actually are	3.63	3.64
	49: Providers that separate school law required vaccines like Tdap from 'optional' HPV and don't follow CDC recommendations	4.33	3.13
	58: Providers assume some parents/guardians will not want the HPV vaccine	4.06	3.04
	59: Providers assume religious families will not want the vaccine	4.06	3.04
	60: Providers assume Latino families will not want the vaccine	4.03	3.04
	68: Providers’ willingness to discuss HPV vaccine with hesitant parents	4.50	3.60
Education		4.21	3.66
	2: Rural, aging providers having tools to talk about HPV	4.16	3.96
	13: Education for dental professionals about HPV-related oropharyngeal cancers	3.80	3.50
	19: Direct provider education	4.03	3.92
	20: Education for medical staff around offering and explaining the vaccine	4.26	4.04
	47: Strong, unwavering physician recommendation of HPV vaccine for girls and boys	4.84	3.56
	48: Training providers in the "announcement approach" for HPV vaccine recommendations, which includes role-playing to address parental concerns	4.29	3.52
	54: Health care providers offer youth-friendly conversations, information, services and access to care	4.10	3.12

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Cluster	Statements	Importance	Feasibility
Coordinated or consistent messaging		3.57	3.76
	15: CDC educational materials and infographics	3.07	4.08
	24: HPV-related cancer survivor videos	3.13	3.52
	32: Highlighting how common HPV-related cancers are and that they occur in males and females	3.93	4.04
	39: Changing the message to this is a vaccine that can prevent cancer for your child later in life	4.20	4.32
	40: Messaging with faith-based organizations	3.52	3.20
	45: Promotional posters for HPV vaccine displayed in provider offices	2.87	3.96
	52: Universal messaging in healthcare clinics and networks (everyone giving the same message about the importance of immunization)	4.23	3.20
Strong communication or support		3.83	3.42
	6: Interprofessional advocacy	3.53	3.46
	11: Evidence-based intervention tools online for primary care clinics to use and implement	3.84	3.92
	12: Keeping HPV vaccination on agendas for medical associations/provider meetings	3.67	3.69
	17: Effective and committed HPV Physician Champions	4.40	3.58
	25: Promotion of HPV vaccination by states' insurance products	3.53	2.84
	35: Buy-in from nurses and medical assistants as advocates for vaccination	4.52	3.56
	51: Insurance providers sending out information specifically about HPV vaccination	3.27	2.88
Evidence-based interventions		4.07	3.41
	7: Incentives for practices to implement evidence-based strategies to improve vaccine delivery rates including HPV	3.74	3.04
	8: Evaluation of provider performance	3.90	3.46
	9: Primary care use of evidence-based interventions (patient reminders, provider prompts/reminders, modified EHR)	4.42	3.88
	10: Reminder prompts for physicians in electronic medical record	4.37	3.60
	14: Dental providers recommending vaccine and referring patients	3.97	3.12
	21: Knowledge of payment coverage by the Vaccines For Children (VFC) program that the state supports	3.81	4.04
	23: Strong navigation through health system	3.83	2.68
	55: Quality improvement projects using video conferencing to connect rural and urban regions	3.63	2.96
	56: Providers catch patients who have not completed the vaccine series whenever they come in, regardless of the type of visit	4.81	4.04
	57: Clinical enterprises in which the responsibility is shared and distributed amongst all the patient touch points (MA, RN, provider, front desk)	4.23	3.32
Legislative		3.81	2.28

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Cluster	Statements	Importance	Feasibility
	16: Pharmacist ability to administer HPV vaccine	3.93	2.72
	18: Legislation to eliminate personal preference as a reason to not vaccinate children	3.60	1.80
	22: Patient ability to get reimbursed for vaccination in pharmacy	3.83	2.24
	28: Inclusion in state's high school sports form as a routine vaccination	4.36	2.52
	33: IT support for state's immunization information system	3.43	2.54
	37: HPV vaccine is not required for school attendance	3.33	1.92
	41: Legal ability of teenagers to self-consent to HPV vaccination	4.17	2.0
	65: HPV vaccination in pharmacies	3.86	2.48
State Support		3.99	2.64
	26: Inclusion of HPV vaccination rates in statewide shared quality metrics of healthcare organizations	4.10	3.00
	27: Insurance providers mandating HPV vaccine	3.83	2.04
	30: Support from state health department for HPV vaccination including special attention to AFIX	3.83	3.72
	42: Incentive to health systems for improving rates	4.23	2.28
	43: Funding for prevention	4.30	2.36
	50: Incentives for patients to get vaccinated from managed care organizations	3.73	2.33
	63: Funding opportunities through health department and state-wide cancer organizations	3.90	2.72
Collaboration		3.65	3.60
	34: Reach out to other states that have been successful in increasing HPV vaccination rates	3.53	4.20
	46: Coordination across the state with health clinics, hospitals and other health systems	3.76	3.28
	53: Public Health working to support local communities through local public health departments and other health systems	3.90	3.60
	61: Collaboration/trust and relationships between non-profits, state-based organizations	3.50	3.48
	62: Collaboration and communication between primary care staff and non-profit/state-based organizations that come to the table with the expertise to support and advise clinics in their work to increase HPV vaccination	3.57	3.44

Note: Numbers for statements match to point and cluster maps

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