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Key Stakeholder Perspectives on Challenges and Opportunities for Rural HPV Vaccination in North and South Carolina

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Key stakeholder perspectives on challenges and opportunities for rural HPV vaccination in North and South Carolina

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ABSTRACT

The objective of this study was to identify factors at the individual, provider, and systems levels that serve as challenges or opportunities for increasing adolescent vaccination—including Human Papillomavirus (HPV) vaccination—in rural communities in the southern United States (US). As part of a broader study to increase HPV vaccine uptake in the southern US, we conducted in-depth interviews with vaccination stakeholders representing public health and education agencies in North Carolina (NC) and South Carolina (SC). Fourteen key stakeholders were recruited using purposive sampling to obtain insights into challenges and solutions to rural-urban disparities in HPV vaccination coverage. Stakeholders were also queried about their experiences and attitudes toward school-based vaccination promotion programs and campaigns. We used a rapid qualitative approach to analyze the data. Stakeholders identified factors at the individual, provider, and systems levels that serve as challenges to vaccination in rural communities. Similar to previous studies, stakeholders mentioned challenges with healthcare access and vaccine-related misconceptions that pose barriers to HPV vaccination for rural residents. Systems-level challenges identified included limited access to high-speed internet in rural areas that may impact providers' ability to interface with state-level digital systems such as the vaccination registry. Stakeholders identified a number of opportunities to increase HPV vaccination coverage, including through school-based health promotion programs. Stakeholders strongly supported school-based programs and approaches to strengthen confidence and demand for HPV vaccination and to help address persistent social determinants and system level factors that pose challenges to HPV vaccination coverage in many rural areas.

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Introduction

Each year, HPV infections cause approximately 36,000 cancers in the US, including the majority of anal, cervical, vulvar, penile, and oropharyngeal cancer cases among men and women.[1] The majority (92%) of these HPV attributable cancers could have been prevented by the HPV vaccine, which is recommended for routine vaccination at ages 11–12 years.[1] Though the vaccine provides significant protection against the oncogenic strains of HPV, rates of vaccine coverage among adolescents, defined as uptake (getting the first dose) and completion (getting all recommended doses), continue to lag behind those of other recommended adolescent vaccines and are below the Healthy People 2030 target of 80% coverage among adolescents nationally.[2,3]

There are rural-urban disparities in the uptake and completion of the HPV vaccination series.[4] Several factors that influence rural-urban disparities in HPV vaccination coverage have been identified in the literature, including parental knowledge and attitudes about HPV, knowledge about the vaccine, and provider recommendations for vaccination.[4–12] By contrast, uptake for other adolescent vaccines, particularly Tdap and MenACWY was similar among rural and urban youth, indicating challenges that are specific to the uptake of the HPV vaccine in rural areas. Closer examination of urban-rural differences indicate that the geographic disparities may be present only for adolescents at or above the poverty level, suggesting that higher socioeconomic status may be a moderating factor in the association between rurality and HPV vaccination.[4,13] Historically, adolescents in the southern US have had the lowest rates of HPV vaccination.[6] In 2019, rates of HPV vaccine uptake in North Carolina (NC) (71.3%) and South Carolina (SC) (71.8%) were similar to the national average (71.5%),[4] however, completion rates in NC and SC are below the national average.[2,14] Further exploration of the drivers of rural-urban disparities and important subgroup differences is an important first step toward developing effective interventions and campaigns to promote HPV vaccination.

As part of a broader study to develop and evaluate a school-based intervention to reduce rural-urban disparities in HPV vaccination in the southern US, we conducted semi-structured in-

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depth interviews with vaccination stakeholders and providers from NC and SC to learn more about barriers and opportunities to scaling up adolescent vaccination—including HPV vaccination—in rural areas. We applied a social-ecological framework to explore challenges to vaccination, potential solutions to HPV vaccination disparities, and suggestions for the design of school-based programs aimed at increasing HPV vaccination rates in rural areas. The social-ecological approach prioritizes understanding health challenges and health promotion within the context of individual and interpersonal factors; institutional and community factors; and social, economic, and political factors.[15] Our aim was specifically to identify factors at the individual, provider, and systems levels that serve as challenges to adolescent vaccination in rural communities in NC and SC and to generate potential solutions that are acceptable and feasible to key vaccination stakeholders.

Methods

Setting and design

This qualitative descriptive study involved completing individual interviews with a purposive sample of key stakeholders in NC and SC to obtain insights into the multifaceted drivers of rural-urban disparities in HPV vaccine coverage. The details of the methods and analysis of this study are presented according to the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist.[16] The study protocol was approved by the Duke University Health System's (DUHS) Institutional Review Board (Pro00101137), and the University of South Carolina's Institutional Review Board (Authorization agreement for reliance on DUHS IRB; Pro00085811). Since the Centers for Disease Control and Prevention (CDC) only had access to de-identified data, it was determined that the CDC was not engaged in human subjects research and CDC's IRB approval was not required.

Sampling and *recruitment*

From November 2019 – January 2020, the first and second authors conducted semi-structured individual interviews with 14 key stakeholders in NC and SC. The first author is a behavioral scientist and the second author is a pediatric school psychologist. Both have doctoral degrees and extensive experience conducting qualitative research with patients, community members, providers, and key stakeholders. Key stakeholders identified for participation in this study were involved in HPV vaccination efforts in North Carolina ($n = 8$) and South Carolina ($n = 6$). They included statewide and regional public health and public school officials working in the area of adolescent vaccination, leaders from relevant statewide professional organizations (e.g., pediatrics, school nursing), rural health officials, and providers engaged in the delivery of vaccination services to rural youth. Key stakeholders were recruited through e-mails and phone calls introducing the study purpose and procedures.

Data collection

The study team developed a semi-structured interview guide to gather stakeholders' insights into the landscape of HPV vaccination in rural NC and SC, including challenges to HPV vaccination in rural settings, and the relevance and feasibility of school settings for implementing HPV vaccination promotion campaigns and interventions (Figure 1). All participants reviewed the purpose of the study and signed an electronic or written consent form prior to participation. Interviews were conducted in English by the first and second author, in-person or via telephone. All interviews were audio-recorded and professionally transcribed to facilitate data analysis. Given that qualitative

• From your perspective, what are the salient issues and concerns related to adolescent vaccine programs, especially HPV? How is this different in rural areas?
• What are existing activities, organizations, partners, or linkages that work well to promote adolescent vaccines, especially HPV, in rural areas?
• What kinds of resources, knowledge, capacity, or skills are needed to promote HPV vaccines in rural areas?
• What collaborations or partnerships do you think can be developed to promote HPV vaccination in rural areas? What community members or organizations should be included?
• From your perspective, what are the main barriers to a school-based program to promote HPV vaccination for teens?
• From your perspective, what are the main facilitators that would help make a school-based program to promote HPV vaccination successful?
• What are some important things to consider when developing a school-based program to promote HPV vaccination?

Figure 1. Stakeholder interview guide.

research aims to investigate factors that underlie behavior and is concerned more with the richness than the representativeness of data, meaningful data emerge from smaller, focused samples. For qualitative interviews and focus groups, evidence suggests that data saturation can occur within 12 interviews, with primary themes arising as early as six interviews.[17]

Data analysis

We used a rapid qualitative analysis approach to analyze the stakeholder interview data.[18–20] We developed a deductive coding template based on the interview guide to structure the analysis. The coding template included three primary areas for data summarization based on the aims of the research: 1) challenges to HPV vaccination uptake in rural areas of NC and SC, and 2) opportunities to improve rural HPV vaccine coverage and thus reduce rural-urban HPV vaccination disparities, and 3) feedback on school-based interventions. After developing the template, our team tested the coding template by having three separate members of the research team code two transcripts, compare, and resolve discrepancies. After initial coding, the template was revised and the remaining 12 transcripts were double coded by two members of the research team, including the first and second author who conducted the interviews. The team met to discuss and reconcile discrepancies between coders to yield a single coded template for each key stakeholder. Data from the coded templates for each stakeholder were then put in a matrix to analyze the depth and breadth of information in each domain.[21] We used the Social Ecological Model[15]as an organizing framework for identifying challenges and opportunities to rural HPV vaccination.

Results

We interviewed stakeholders from state public health and education agencies in NC ($n = 8$) and SC ($n = 6$). Stakeholders from the NC and SC public health departments included senior administrative supervisors and medical consultants for immunization and children's health as well as program managers responsible for overseeing adolescent health programs, vaccination programs, and rural health programs (n = 9). Stakeholders from NC and SC education agencies included a senior administrative supervisor with knowledge of vaccination programs in the public schools, and staff (PA/RN) responsible for implementing and monitoring vaccination programs in schools (n = 3). We also interviewed stakeholders working with community based organizations involved in vaccine programs (n = 2). Several challenges and opportunities to improve HPV vaccine coverage among rural adolescents were identified at the individual, provider, and systems levels of the social-ecological framework. Exemplar quotes for challenges are shown in Table 1 and opportunities are shown in Table 2.

Individual level

Stakeholders identified multiple challenges to scaling up HPV vaccine uptake in rural areas, including lack of knowledge; negative attitudes and norms related to HPV infection; consequences of infection and HPV vaccination; and fears and concerns about the vaccine. Stakeholders reported that there were limited opportunities for parents to receive education about HPV infection and vaccination in rural communities and identified lack of access to comprehensive, high quality sexual health education as a persistent challenge.

In addition, a number of stakeholders reported that misinformation about the safety of the vaccine continues to limit HPV vaccine uptake. Stakeholders indicated that many parents have concerns about the side effects of HPV vaccination and/or report having heard stories about adolescents who were allegedly harmed or killed by the HPV vaccine. Some stakeholders reported continued concerns among rural parents that HPV vaccination promoted sexual activity among youth, with one stakeholder stating "it's [seen as] the 'permission to have sex' vaccine." Other stakeholders observed that this concern, although present, is not as prevalent now as it was in the past.

Attitudes toward engagement in care—specifically preventive care—were also mentioned by a number of stakeholders. Stakeholders reported that engaging in preventive care is sometimes seen as a sort of 'luxury' for individuals in rural communities, particularly those who are made vulnerable by various social determinants of health (e.g., poverty, transportation challenges, housing challenges).

Stakeholders emphasized the trusted and important role of schools in rural communities as a potential way to overcome parent misinformation or mistrust. Stakeholders discussed that school-based programs should stress the importance of HPV vaccination for girls and boys to prevent cancer. Stakeholders suggested using diverse strategies to deliver vaccination information to rural parents due to challenges associated with broadband access. They also suggested use of broader information sharing strategies included sending brochures/handouts home with students, using social media or online resources to distribute information from public health sources, including the local health department, and leveraging health fairs and other community events for information dissemination.

Provider level

Stakeholders identified the lack of providers in rural areas, specifically pediatric providers, as a significant barrier to HPV vaccine acceptance. Provider shortages in rural areas were described as resulting in fewer opportunities to interact with parents and adolescents about the HPV vaccine.

The lack of a medical home for many rural adolescents was discussed as a challenge to HPV vaccine uptake. Stakeholders observed that children generally see health care providers less frequently as they age. Adolescents may see a provider for sick visits or sports physicals, but many adolescents do not have regular well visits where the HPV vaccine might be discussed. When adolescents see providers less frequently, parents may not have the opportunity to develop a trusting relationship with providers, and this can impede effective communication about HPV vaccination. Infrequent use of health care among adolescents is even more challenging when a series of vaccine doses require multiple visits, as is the case with the HPV vaccine.

Stakeholders in both NC and SC also suggested that rural providers perceive and/or have actual challenges in obtaining, storing, and getting reimbursement for HPV vaccines. The

Table 1. Challenges to HPV vaccination in rural areas.

	Domain	Quotes
Individual Level	Vaccine Beliefs/ Misinformation	*With HPV . . . from the very beginning when it was rolled out you know, there was miscommunication about it and parents misheard and [thought] it's all about sex . . . It was like, if we could just rewind time and start with the cancer prevention message, it would be so different here.*
		Obviously in the South, where . . . we're still not allowed to talk about sex in school except under the auspices of marriage . . . I think we have kind of outdated laws related to how we educate students about sex education and health education in general . . . especially in more conservative communities.
		Sometimes [parents] come in and say 'I've heard this [HPV vaccine] kills people. I had a friend whose child died', and it's really hard to respond to that cause I'm like, 'I need to see that exact case, but I can tell you that if that were real, if they felt, people investigating . . . that [it] was due to the HPV vaccine, it would not be on the market'. . . . but it's hard to convince people of that.
		It's social media . . . It's fear. . . . They may feel very educated but it's like a lot of times there's a lot of misinformation in what they've heard. They misperceive the risks you know . . . I think that they really . . . want to be holistic. You know, they want to do the best thing for their child.
		. . . there isn't a huge percentage of [people who choose vaccine] exemptions, but they're loud and they're challenging to deal with because they're very opinionated, they're very vocal and often very unfriendly and of course you know, as a nurse, you don't want to be confrontational.
	Valuation of preventive health care	*They're not necessarily . . . valuing or understanding the value of primary care and the value of having a medical home.*
		[It's] the lack of understanding of the importance of healthcare, the lack of understanding of the importance of education. The parent didn't get a lot of education, [they don't] see the value in it for their kids . . . and you know, they certainly won't understand a lot about the value of vaccination.
Provider Level	Shortage of providers	*I've worked with . . . STATE PUBLIC HEALTH AGENCY and they have rural pilot sites that have just not even been able to get their projects off the ground due to just, lack of resources, not having the correct qualified providers.*
		It's still an access issue that I think that we are seeing being a problem, people not getting the vaccines that they need cause if they can't get into a VFC provider and they can't get into the [STATE PUBLIC HEALTH AGENCY], if they're too young to go to a pharmacist, then where are they gonna go and get the vaccine from?
		While there's VFC providers there, you have to hope that those VFC providers have the ability to take on new patients.
		So, if a clinic does not have an RN, so the RN has to give the injection, if you are an [medical assistant] working under, you cannot do that. It has to be. So, a lot of our small practices only have medical assistants, so it's the doctor that has to give the injection which is another workflow.
	Lack of Medical Home	*They don't get primary care and then I think so when they, it's rare that they get primary care, if they do, they're going to a clinic for a sick visit. They're not going to a medical home, they're not necessarily [. . .] kind of valuing or understanding the value of primary care and the value of having a medical home.*
		...they may not come in for well child checks. It's not a priority for parents at that point. They're not thinking, my kid needs a physical when they're eleven, twelve. They're pretty much done with that at a you know, young age after they go to kindergarten, they may not even get-well child checks when they're in elementary school.
		...but it is hard to get parents, as children age up, to take those to the provider, just a regular provider you know, for things when they're not, like they're not sick or don't have an immediate you know, reason to go see and so you're fighting that battle
	Lack of Strong Provider Recommendation	*Some of the providers, especially family practice, maybe are not as up-to-date on the reasons for the vaccine, the availability of the vaccine, the recommendations for the vaccine, how to present the vaccine and the importance of the vaccine. And so, I think sometimes . . . there are not strong recommendations made to that population.*
		I've heard a lot of these concerns, having staff . . . that's comfortable, working with the vaccine schedule and promoting the vaccines . . . confidently [and] . . . not understanding what the arguments are and really not pushing back [against parent concerns/misinformation].
		A doctor comes in the room with the parent and says 'Look, you need to have Tdap today. That's recommended for school, you need [it] . . . It's also required that you get meningococcal and then there's another one, it's called HPV . . . and as soon as you say, . . . 'sex', you know, the parent says, 'Well my kid's not having sex. My kid's eleven years old . . . and you know, they don't need that right now. They can get that later'. . . . and then later comes and then they become an adolescent and then when do you come back in?
	Participation in VFC program	*As far as rural [barriers, there's] access to care, insurance, people knowing that those vaccines are gonna be covered, the physicians, the providers storing . . . the vaccines and afford[ing] them, and I feel like okay, my entire life savings [are] locked up in this refrigerator and I can't afford a generator.*
		I think that there's definitely some [provider] pushback. The first thing we always hear about is, 'We can't do [the VFC program] because we can't afford a $5,000 pharmaceutical refrigerator. I'm a small rural practice you know. We barely make enough money as it is'. So, that's one common misconception that we have to then educate them on to say, it doesn't have to be a pharmaceutical refrigerator.
		Some people see [the state vaccine registry system] as, 'Oh, it's Big Brother checking us out', and really that isn't what we use it for. We don't have the policing ability to just sit there and say . . . Dr. So and So's office is out [of vaccines] again . . .
	Reimbursement	*Thinking about the payment . . . I think that's another complexity within the schools. Each kid can have a different health insurance plan and you know, who's gonna fund that [school-based vaccinations] for sustainability?*
	Broadband Connectivity	*[Providers] can have spotty Wi-Fi. Obviously, they're gonna have some internet connection. They don't even have to have Wi-Fi really, but they just have to have the ability to upload [vaccine data] to the cloud, so that way [vaccinations] can be monitored by them and [the state public health agency] can also monitor it.*
		For many of our rural families, transportation, communication, you know even if they had a connection to a primary practice you know, the parent may not get a robocall because they may not have access to a cell phone or a cell phone that doesn't have minutes for the whole month. Bandwidth is a big issue in this state.
Systems Level	Recommended vs. required	*Well, I think number one is, it's not required, it's a recommended vaccine.*
		If you have a choice of three vaccines, Tdap, meningococcal, HPV and the doctor says well in order to go to middle school, this child needs Tdap, meningococcal, but we recommend HPV, the parent may say, 'Just give the two that they <u>have</u>to have'.
		HPV, meningococcal are not required [in South Carolina], and so . . . people get exactly what they need to get into the school and then they're good.
		Several years ago, we went to the [state public health agency] and presented the recommendations to make all ACIP vaccines required . . . for adolescents. . . . HPV was discussed and it was decided [not to do this] at the time . . . , that based on what they felt like would be a lot of pushback from the public, from the parents.

Table 2. Opportunities to improve HPV vaccination rates in rural areas.

	Opportunity	Quotes
Individual	Multimodal messaging to address misinformation and lack of information	*Accurate information versus false information on social media—that's a big one. I would think posters, brochures, any type of handout that students could take or parents could have access to, like in the health department or at local health fairs.*
		It would be great to figure out how [HPV vaccine] information can be disseminated to the parents in rural areas . . . cause if the school's not pushing it or . . . educating about it, where are [parents] getting their messaging? . . . They may not be seeing billboards or on Twitter or anything like that.
		There's gonna have to be really strong education about . . . cancer prevention versus STD prevention, and . . . strong infrastructure that supports whoever is implementing that within the schools who can know how to respond to the [parent] pushback and misinformation.
		Schools are a trusted kind of voice in the community. So, if the school is talking about it and we get the providers talking about it, I think that would help, a lot. And you know . . . a lot of times the school is the main resource for kids.
Provider Level	Training	*Making sure that the staff inside the office are saying the same message too, because if the doctor is telling you something and the nurse says something [else], and then at checkout you have the front desk clerk saying, 'Oh, you don't really need the HPV [vaccine]', then . . . what's the message now to the parent?*
	School based programs	*If those school nurses are health department employed, then yes, they do give vaccines and they're doing that under the umbrella of the health department. School nurses that are employed by the school district itself only provide a supportive role in that. In other words, they might do the communication, they might get the consent forms, they might help to run the venue . . . but they won't be administering the vaccines because they are not protected under that umbrella.*
		School nurses, in general, are really onboard. They definitely understand and are promoters . . . of vaccines.
Systems Level	Collaboration with schools and other community organizations	*I'd start with the superintendent and the local health director you know, ... So, if there was a presence like that, whoever would be in charge of that to engage them, then they say, hey, go ahead you know, there's a tapping of the form that I don't know, to give that opportunity to be a part of that conversation.*
		In those counties specifically, COUNTIES, they've got some really good leadership through their school health services leaders, people that have been there a long, people that have been there a long time, it would be worth talking to. The school health nurses in particular.
		The people that need to be promoting it in those communities need to be part of those communities. I mean cause for me to go in and you know, a black church and say hey, you know we really should be doing this, it's not gonna go over as well I think as somebody that's, my child had this, and I think it's really important cause my mother died of cervical cancer.
		I do think having a faith-based champion would be really helpful cause I think that is a potential barrier, not just in rural areas, but potentially more.
	Expanded school-based vaccination services	*We have started reviewing student's immunization records annually, instead of just once while they're in middle school and we actually send out permission forms because we require written consent from the parents for the student to have a vaccine in the school-based health centers and we are available and have a trained RN who does immunizations to answer any questions and provide accurate information to the parent or guardian.*

Vaccines for Children (VFC) program is a federally funded program that provides vaccines at no cost to children and adolescents who might not otherwise be vaccinated because of inability to pay.[22] Several stakeholders in South Carolina reported that providers perceived the "red tape" related to VFC program participation VFC as a significant barrier. Specifically, vaccine ordering, storage requirements, and monitoring were seen as burdensome. In addition, lack of consistent high-speed internet required for reporting to the state registry may pose a barrier to VFC program participation among rural providers.

Stakeholders reported that lack of strong provider recommendation as a significant challenge to HPV vaccination. Provider and staff training were considered essential to ensure that all providers are conveying consistent, accurate messages regarding HPV vaccination. Stakeholders in both NC and SC recommended additional training for providers and staff in medical offices so that parents hear a unified message regarding the importance of HPV vaccination. Stakeholders noted that providers needed assistance in presenting strong and consistent information on the need for HPV vaccination and the importance of vaccinating during early adolescence. Assisting HPV providers in 'pushing back' against false vaccination beliefs was also identified as a need, and stakeholders strongly endorsed a continued focus on 'HPV vaccination as cancer prevention' messaging.

Systems level

Stakeholders highlighted one key systems level barrier: lack of state-level mandates for the HPV vaccine for school enrollment. The HPV vaccine is currently recommended for adolescents but is not required in either NC or SC for enrollment in public schools. Most stakeholders identified this as an important contributor to low vaccine coverage. Stakeholders indicated that, for parents, the fact that HPV vaccination is not required for school entry may be interpreted to mean that it is not a priority. One stakeholder suggested that when many things are required in a visit, parents may opt to forgo the "recommended but not required" vaccines to speed the visit and/or reduce the number of shots their child has to receive at one visit. Stakeholders also reported that the lack of a school mandate for HPV vaccination causes some providers to present the HPV vaccine as "optional" or "an add-on" to core

services, which, in turn, may foster false beliefs among parents that the HPV vaccine is not as critical for children as the required vaccines.

To increase HPV vaccination rates, stakeholders suggested that state and local organizations could build on successful programs such as existing statewide teen pregnancy prevention programs. In addition, stakeholders noted that current efforts to improve rural primary care (i.e., a statewide pilot program in NC) to make it more welcoming to adolescents could be expanded to include adolescent vaccination. Capitalizing on ongoing programs and initiatives targeting health and wellness in adolescents were noted to be prime opportunities to increase HPV vaccine coverage.

A number of stakeholders recommended collaborating with local leaders in rural areas to develop and implement HPV vaccine education programs for adolescents and parents at the local level. While statewide efforts can help improve vaccine coverage, local area initiatives and collaboration with local key opinion leaders were deemed essential to increase HPV vaccination rates in rural areas. Examples of key opinion leaders include the health department, school administrators, or those involved in school health programs at the county level. For example, a number of school systems in NC and SC have established strong relationships with the local public health departments. These collaborations have supported initiatives such as having county health department nurses come into the school and provide required vaccines. Stakeholders noted that this strategy was needed because school nurses employed by local public school systems are typically not able to provide vaccinations. Combining onsite vaccination and vaccine education in school settings has the potential to address both local norms and misinformation around vaccination and access-related challenges that rural families experience.

Several stakeholders discussed the process of school nurses reviewing vaccination records at the beginning of the school year to identify students who are not up-to-date on public school-mandated vaccines such as Tdap (in both NC and SC) and MenACWY (in NC only). School nurses also take this opportunity to remind parents to get recommended vaccines for their adolescents, including HPV and influenza. This process occurs yearly and offers an ongoing opportunity to provide information to parents about recommended vaccinations and to provide families with resources to address logistical challenges to vaccinations. Stakeholders remarked on the importance of school nurses providing strong recommendations for HPV—especially in rural communities with shortages of pediatric providers.

Discussion

The results from this study of key stakeholder perspectives in NC and SC offer insights into challenges and opportunities to increase HPV vaccination in rural communities. Stakeholders noted challenges to HPV vaccination specific to rural communities such as the shortage of providers and limited broadband connectivity. The stakeholders also identified challenges that were nonspecific to rural areas, such as vaccine misinformation and concerns about HPV vaccine safety. Some of these challenges, especially vaccine misinformation and vaccine hesitancy, have intensified during the COVID-19 pandemic.[23] In the early days of the pandemic, fewer adolescents received vaccines, leading to a drop in adolescent vaccination coverage.[24] Further research is warranted to understand the full impact of the COVID-19 pandemic on adolescent vaccination coverage and challenges to vaccination.

Stakeholders brought up several systems-level challenges not previously discussed in detail in the literature. Participants identified limited access to high-speed internet as a barrier that may create challenges for rural providers in terms of ordering vaccines and exchanging vaccine data efficiently with state registries. Evidence suggests that low resource practices such as those in rural areas may not have the technological expertise or infrastructure to engage with health information technology.[25] Further, limited internet connectivity can pose barriers to information dissemination to parents via social media or other web-based modalities. Recent efforts to increase broadband access in rural areas have included investing in infrastructure and providing resources to local and state governments to increase internet connectivity.[26] Stakeholders in both NC and SC also identified the lack of statewide mandates on HPV vaccination for public school enrollment as a significant barrier—though this barrier would apply to both rural and urban adolescents enrolled in public schools. Evidence from Rhode Island suggests that requiring HPV vaccination for school entry can boost coverage rates for the vaccine.[27,28] While most stakeholders suggested that the lack of HPV vaccine requirement was a significant barrier to uptake, most also acknowledged that inadequate political support to enact such policies in NC and SC.

Stakeholders identified a number of opportunities to increase HPV vaccine coverage through school-based strategies and interventions in rural NC and SC. Collaboration with schools was cited as an optimal way to reach rural parents and adolescents to increase HPV vaccine initiation and completion as schools were noted to play a central, and often unifying, role in small rural communities. For example, NC has a network of school-based health centers, with many serving families in rural areas who otherwise would have difficulty accessing primary care services. Previous research supports HPV vaccination programs in school-based health centers and identifies the need to improve systems to coordinate across health and school systems.[29] In addition, collaborating with school nurses was identified as a promising strategy for reaching adolescents and parents. A recent study from SC found that most school nurses in leadership roles believed the HPV vaccine should be given to male and female preteens and that the HPV vaccine was safe, nontoxic, and prevents HPV cancer.[30] However, challenges that may limit the ability of school nurses to engage in HPV vaccine promotion may include lack of time, competing responsibilities, and lack of knowledge (e.g. how to work with vaccine hesitant parents). As school nurses can play an integral role in facilitating adolescent vaccinations, further research is needed to address challenges and to support school nurses in delivery of HPV vaccine information programs.

There are several limitations to this study. First, there may be limited generalizability as this study focused on a small sample of key stakeholders in NC and SC. Second, because stakeholders knew this study was being conducted

as part of a broader initiative to develop a school-based HPV vaccination promotion intervention, social desirability bias may have influenced them to speak more positively about the role that schools and school nurses can play in increasing rural HPV vaccination. Extending this work through the collection of quantitative survey data with a large and diverse sample of school stakeholders (e.g., school nurses, administrators) would be useful.

Conclusion

Many persistent individual, provider and system level challenges to HPV vaccination in rural areas were identified (e.g., lack of access, missed opportunities during provider-patient encounters, competing priorities for rural families), suggesting the need to accelerate efforts to address rural vaccination challenges. Stakeholders highlighted the central role that schools play in many rural communities—including serving as key avenues for providing resources, education, and even healthcare to children and their families. Individuals strongly supported school-based programs and approaches to strengthen confidence and demand in HPV vaccination and to help address persistent social determinants of health (e.g., poverty, transportation challenges, and health care disparities) that continue to persist in many rural areas.

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