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## Lessons learned from HPV vaccination to increase uptake of adolescent COVID-19 vaccination

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Uptake of COVID-19 vaccination among adolescents has been low and highly variable across the U.S. As of July, 2021, the most recently available national data, 42% of adolescents ages 12 to 17 had received at least one dose of the COVID-19 vaccine, but that percentage varied widely from state to state [1]. Low vaccination rates threaten to prolong the pandemic and pose a health risk to unvaccinated adolescents as well as their families and social networks. To promote COVID-19 vaccinations for adolescents, it will be valuable to explore lessons learned about human papillomavirus (HPV) vaccination in this population. In this commentary, we outline the similarities between the HPV and COVID-19 vaccines

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and offer three recommendations that can be applied to efforts for adolescent COVID-19 vaccination promotion and delivery.

We identified several similarities between HPV vaccination and COVID-19 vaccination that make for a strong comparison. First, both are multi-dose vaccine series requiring two to three doses. For both HPV and COVID-19 vaccination, rates for subsequent doses are much lower than the initial dose [1,2]. As such, different strategies are needed to ensure adolescents receive the full vaccine series. Second, despite effective school mandates in some states for other adolescent vaccines (tetanus, diphtheria, and pertussis and meningococcal disease), there has been widespread resistance to mandates of both HPV and COVID-19 vaccines. While some states and school districts have begun to mandate COVID-19 vaccination, this trend is likely to vary regionally and there is unlikely to be a national mandate. Thus, as with HPV vaccination, most of the country will be unable to rely on vaccine mandates to ensure adolescent populations are vaccinated against COVID-19. Additionally, both vaccines have been similarly politicized. When first introduced in 2006 at least 20 states attempted to enact legislation around the HPV vaccine which was met with swift backlash of both political and religious objections [3]. Unfortunately, COVID-19 vaccination has had similar backlash amidst negative, politicized public perceptions [4]. Finally, both vaccines are plagued by widespread misinformation, primarily spread through social media. Given the similarities in the challenges of implementing the two vaccines, we offer three recommendations based on strategies that have worked to increase HPV vaccination rates that could be adapted to improve adolescent COVID-19 vaccination. These recommendations revolve around the role of healthcare providers, use of evidence-based interventions (EBIs), and reliance on multilevel, collaborative approaches.

First, the role of pediatricians and family practice providers serving adolescents will be vital in promoting COVID-19 vaccine uptake. Both parents and adolescents have indicated that they would feel most comfortable getting vaccinated in their provider's office and parents have said their adolescent's primary care doctor is their most trusted source of information [5]. From research on the HPV vaccination, we know that a strong provider recommendation is one of the most important determinants of HPV vaccine uptake among adolescents [6]. This research emphasizes that the most effective recommendations have three components: a strong endorsement, messaging about prevention, and a sense of urgency to vaccinate [6]. These same criteria should be applied to a strong recommendation for COVID-19 vaccination and providers should be making these recommendations at all encounters with adolescent patients to actively increase coverage rates. For providers unfamiliar with the strong recommendation approach, trainings for recommending the HPV vaccine could be adapted for this context.

Second, we need to turn to the evidence-based strategies that we know work to increase HPV vaccine uptake. While vaccine mandates have been discussed as critical to improving coverage, given what we know about the history of HPV vaccine mandates, it is unwise to depend on mandates as the sole solution to increasing adolescent COVID-19 vaccination rates. There is substantial resistance to these mandates and analyses of states that passed HPV vaccine mandates found that they have relatively limited impacts on raising vaccination coverage [7]. Instead, researchers and practitioners alike should rely on EBIs for HPV

vaccination. The Community Guide to Preventive Services highlights interventions that raise vaccination rates through (1) enhancing access to vaccine services, (2) increasing community demand, and (3) focusing on the provider or healthcare system level changes [8]. Additionally, the CDC's Immunization Quality Improvement program recommends several provider-level strategies, like scheduling subsequent vaccine visits and leveraging immunization registries, to ensure adolescents are vaccinated on time. Adapting these EBIs could be an efficient and effective way to encourage COVID-19 vaccination. Given the nature of the multi-dose series for both vaccines, one focus could be on EBIs related to completion of the HPV vaccine series. For example, state immunization registries could be leveraged to assess local vaccination patterns and then health care systems could implement reminder/recall systems through text messages, patient portals, or postcards to ensure adolescents receive their second dose of the COVID-19 vaccine, especially in areas identified as being under-vaccinated.

Finally, we have learned from HPV vaccination that multilevel approaches are needed [9], and that engaging not just medical providers, but other stakeholders including insurance companies, other medical settings (pharmacies/dental offices), and schools helps to increase HPV vaccination rates [10]. Moreover, coordinated and consistent messaging has been identified as a key facilitator to increasing HPV vaccination rates [9]. Thus, collaborative multilevel programming that prioritizes coordination between local, state, and national actors, not just in organizing vaccine delivery, but in developing messaging and interventions, will be needed to ensure all adolescents receive the COVID-19 vaccine. Researchers and practitioners must work together to ensure consistency in messaging about COVID-19 vaccination at all levels from local providers and community centers up to state and national government.

In closing, as with many other public health challenges, we need to focus on adapting existing EBIs rather than reinventing the wheel. In the last nearly two decades, we have gathered substantial knowledge about how to communicate with parents and design interventions and messaging to promote HPV vaccine uptake. It is now incumbent upon the medical and public health communities to incorporate lessons learned and adapt these evidence-based approaches to promote COVID-19 vaccination efficiently and effectively among adolescents.

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