

# A National Survey of Obstetrician/Gynecologists' Knowledge, Attitudes, and Beliefs Regarding Adult Human Papillomavirus Vaccination

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## Abstract

**Background:** Many women see an obstetrician/gynecologist (OB/GYN) annually and receive their primary care from an OB/GYN. Understanding OB/GYNs' human papillomavirus (HPV) vaccination practices, including knowledge of and barriers to vaccination, is essential to design effective interventions to increase vaccination. This study evaluated OB/GYN knowledge, attitudes, and beliefs regarding vaccinating both younger (18–26 years) and mid-adult (27–45 years) women.

**Materials and Methods:** Data were collected from OB/GYN providers in October 2019 through a nationwide web-based survey. Items included the following: HPV-related vaccination practices, recommendation strength, knowledge (seven items), benefits (four items), and barriers (eight items).

**Results:** The sample ( $n=224$ ) was majority were White (69%), men (56%), and practice in suburban clinics (55%). Most (84%) reported they usually or always recommend HPV vaccine to eligible patients, but estimated only about half (51%) of other OB/GYNs did the same. Recommendation strength varied by patient age with 84% strongly recommending it to patients  $\leq 18$  years, compared with 79% and 25% strongly recommending to younger and mid-adult patients, respectively ( $p < 0.01$ ). Participants reported lower benefits ( $p = 0.007$ ) and higher barriers ( $p < 0.001$ ) for 27- to 45-year-old patients compared with younger patients. Cost was the most frequently reported barrier, regardless of patient age. Overall knowledge was high ( $m = 5.2/7$ ) but 33% of participants did not know the vaccine was safe while breastfeeding.

**Conclusions:** Although providers reported strongly and consistently recommending the HPV vaccination to their adult patients, there were gaps in knowledge and attitudinal barriers that need to be addressed. Provider performance feedback may be important in improving HPV vaccination awareness among providers.

**Keywords:** human papillomavirus vaccines, health knowledge, attitudes, and practice, health care quality, access, and evaluation, obstetrics/gynecology, surveys

## Introduction

**H**UMAN PAPILLOMAVIRUS (HPV), THE most prevalent sexually transmitted infection in the United States, causes cervical, vaginal, vulvar, anal, penile, and oropharyngeal cancers as well as genital warts.<sup>1–4</sup> The nine-valent vaccine has the potential to prevent up to 90% of cervical cancers and genital warts.<sup>5</sup> The Advisory Committee on

Immunization Practices (ACIP) routinely recommends the HPV vaccine for all adolescents 11–12 years old and recommends routine catch-up vaccination for those up through age 26.<sup>6–8</sup> It is a two-dose series for those who initiate vaccination at ages 9–14, and a three-dose series for initiation after age 14.<sup>9</sup> Because there is uncertainty as to the extent of clinical benefit of HPV vaccination in mid-adults, the ACIP and American College of Obstetricians and Gynecologists

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(ACOG) recommend the decision to vaccinate individuals at 27–45 years of age should be based on shared clinical decision-making (SCDM) between patients and their providers.<sup>8,10</sup> Deviating from this SCDM recommendation, the American Cancer Society issued a recommendation against vaccinating those at 27–45 years, stating that vaccination is more effective if it occurs at younger ages.<sup>11</sup> However, the ongoing low rate of HPV vaccine series completion among U.S. adolescents at 13–17 years of age (only 54.2% in 2019) means that many adults remain unvaccinated or under-vaccinated and, therefore, vulnerable to HPV-related cancers and genital warts.<sup>12</sup>

The first HPV vaccine was licensed by the Food and Drug Administration (FDA) for use in women in 2006<sup>13</sup> and was recommended for females at age 9–26 years by the ACIP shortly thereafter.<sup>6</sup> In 2018, the FDA extended the licensure to include all persons at 27–45 years (mid-adults).<sup>14</sup> Vaccine efficacy studies indicate the HPV vaccine is 88% effective in mid-adult women.<sup>14</sup> Although research is ongoing to determine HPV vaccination cost-effectiveness for mid-adults,<sup>8</sup> current research suggests that while young adult women are acquiring high-risk (*i.e.*, oncogenic) HPV infections at higher rates than mid-adult women, mid-adult women do acquire new high-risk HPV infections.<sup>15,16</sup>

A large proportion of women see an obstetrician/gynecologist (OB/GYN) annually and many receive their standard primary care from an OB/GYN,<sup>17,18</sup> including pregnant women and mothers of newborns, who are most likely to identify their OB/GYN as their primary care provider.<sup>18</sup> Given the regular interactions between OB/GYN and their mid-adult female patients, this presents an opportune time for discussion and uptake of preventive services, such as the HPV vaccine. In addition, research shows mid-adult women who are vaccinated against HPV are more likely to vaccinate their children against HPV, suggesting an important cascading effect.<sup>19</sup>

HPV vaccine acceptability is high among mid-adult women<sup>20,21</sup>; however, the strongest predictor of uptake of preventive services is provider recommendation.<sup>22,23</sup> To date, little research has been carried out on the attitudes of OB/GYNs and the barriers they may face when vaccinating their patients, although early studies show OB/GYNs are generally accepting vaccinating their patients against HPV.<sup>24</sup> In addition, research indicates that health care providers, including OB/GYNs, look to their professional organizations as important sources of information about HPV vaccination.<sup>25</sup> Understanding OB/GYNs' current HPV vaccination practices for mid-adult patients, awareness of current vaccination licensure, perceived barriers to vaccinating those patients, and areas for optimal HPV vaccination integration into standard practice are essential steps to designing effective interventions to increase HPV vaccination in this population.

The medical encounter presents competing demands for health care providers, which may influence how they recommend and provide preventive services during patient encounters. Therefore, this study aimed to understand current HPV vaccination practices and HPV-related knowledge, attitudes, beliefs, and barriers to vaccination their mid-adult patients among a national sample of OB/GYNs. Once these factors are understood, they can be addressed in a future intervention aimed at increasing HPV vaccination uptake in mid-adult women in a gynecologic setting.

## Materials and Methods

### *Participants and procedures*

Participants for this study were OB/GYNs practicing in the United States. OB/GYNs were recruited in October 2019 by Dynata, a market research firm that provides support for academics in yielding national and representative samples. Participants received e-mail invitations from Dynata to participate in the survey, and compensation was provided through Dynata, which offers a small incentive (\$30). This study was approved by the Institutional Review Board at Purdue University and granted exempt status.

### *Measures*

Our survey was developed using previously validated items where possible. It consisted of 73 questions and took ~20 minutes to complete. We collected basic demographic information from the OB/GYNs as well as information on their patient population and characteristics of their clinics.

**HPV-related vaccination practices.** Recommendation practices were measured using items modified from previous surveys, when possible.<sup>26–30</sup> We used the well-established constructs defining an effective recommendation by asking about HPV recommendation frequency, strength, and consistency.<sup>27,29</sup> To measure frequency, OB/GYNs were asked how often they recommended HPV vaccination to their eligible patients on a 5-point scale from “never/almost never (<10% of the time)” to “always, almost always (>90% of the time).” They were also asked, in their opinion, how frequently other OB/GYNs recommended the HPV vaccine to their eligible patients, using the same response scale. To measure strength, participants were asked how strongly they recommend the HPV vaccine for patients in four separate age groups: 18 years and younger, 19–26 years, 27–45 years, and older than 45 years. This was asked on a 4-point Likert scale ranging from “strongly recommend” to “recommend against.” To measure consistency, they were asked if they routinely recommend the HPV vaccine for their patients. This was asked separately based on the patient's age (19–26 years and 27–45 years) as well as whether the patient was a gynecologic patient or an obstetric patient being seen postpartum. When a participant indicated they would not recommend the HPV vaccine for a patient, they were given the opportunity to indicate why by selecting an option from a list or selecting “other” and filling in the reason in a free textbox. Finally, participants were asked whether they believed that HPV vaccination should be integrated into their regular clinical protocol (yes/no) and what percentage of their patients would be interested in receiving it (all of them, not all but >50%, <50%, none).

**Knowledge.** Participant knowledge was assessed with 7 true/false questions that were adapted from previous surveys.<sup>27,31,32</sup> Participants could answer “true,” “false,” or “unsure.” Participants were given one point for each correct answer and zero points for an incorrect or unsure answer. Correct responses were summed to create a knowledge score (range: 0–7).

**Attitudes and beliefs.** Attitudes and beliefs about HPV vaccination were assessed with previously validated measures where possible and modified when necessary to fit the study population.<sup>27,33–37</sup> Participants were given a 9-item scale measuring how important certain factors (the cost of the vaccine, the patient's history of high-risk HPV, *etc.*) were when deciding whether to recommend the HPV vaccine to their patients. Responses were measured on a 5-point scale from “extremely important” to “not at all important” (Cronbach's alpha=0.75). Benefits and barriers of vaccination were asked separately for the two adult age groups (19–26 years and 27–45 years). Benefits were measured with 4 items (*e.g.*, “it prevents a sexually transmitted infection”) on a 5-point scale from 1 = “not at all important” to 5 = “extremely important,” which were then summed for an overall score (possible score range: 4–20; Cronbach's alpha for benefits for 19- to 26-year-old patients=0.71; Cronbach's alpha for benefits for 27- to 45-year-old patients=0.80). Barriers were measured with 8 items (*e.g.*, “patients are opposed to vaccines in general”) on a 5-point scale from “strongly disagree” to “strongly agree,” which were then summed for an overall score (possible score range: 8–40; Cronbach's alpha for barriers for 19- to 26-year-old patients=0.746; Cronbach's alpha for barriers for 27- to 45-year-old patients=0.764).

#### Data analysis

Data were described with frequencies and percentages. Categorical variables examining within subjects' differences were analyzed with McNemar's tests. Continuous variables were compared with paired *t*-tests, analysis of variance, or Pearson correlation coefficients, as appropriate. Analyses were performed between November 2019 and April 2020 using IBM SPSS v24 (IBM Corp., Armonk, NY).

## Results

### Descriptives

**Demographic information.** The total sample consisted of 224 OB/GYNs from 40 states across the United States. Mean age of the sample was 53.1 (SD=10.4; range=31–78), they had an average of 23.1 years practicing medicine (SD=11.2; range=0–48) and the majority were men ( $n=115$ ; 55.8%), non-Hispanic White ( $n=138$ ; 67.0%), and were not personally vaccinated against HPV ( $n=165$ ; 80.1%). For a full description of the provider sample, see Table 1.

**Clinic description.** Providers were asked to select the two categories (from multiple categories presented) that described the age and racial/ethnic categories that represented the majority of their patient population. Most physicians reported their patients were in an age range that represented adults who are eligible to receive the HPV vaccine. That is, 35.7% ( $n=80$ ) reported 18- to 26-year-olds as one of the two categories who represented the majority of their patients, 47.3% ( $n=106$ ) reported 27- to 30-year-olds as one of the two categories who represented the majority of their patients, and 58.5% ( $n=131$ ) reported 31- to 45-year-olds as one of the two categories who represented the majority of their patients. Most providers reported the majority of their patient popu-

TABLE 1. PROVIDER CHARACTERISTICS

| Variable                                     | n (%)              |
|--|--------------------|
| Age [mean (SD; range)]                       | 53.1 (10.4; 31–78) |
| Sex  |                    |
| Male   | 115 (55.8)         |
| Female                                       | 86 (41.7)          |
| Prefer not to answer                         | 5 (2.4)            |
| Race/ethnicity                               |                    |
| Non-Hispanic White                           | 138 (67.0)         |
| Non-Hispanic Black                           | 4 (1.9)            |
| Non-Hispanic Asian                           | 36 (17.5)          |
| Non-Hispanic Other                           | 7 (3.4)            |
| Hispanic (of any race)                       | 8 (3.9)            |
| Prefer not to answer                         | 13 (6.3)           |
| Years practicing medicine [mean (SD; range)] | 23.1 (11.2; 0–48)  |
| Personal history of HPV vaccination          |                    |
| Yes  | 38 (18.4)          |
| No   | 165 (80.1)         |
| Unsure                                       | 3 (1.5)            |

HPV, human papillomavirus.

lation was non-Hispanic White (74.1%;  $n=166$ ) and had private insurance (70.4%;  $n=145$ ). Over half (55.1%;  $n=113$ ) reported their clinic was located in a suburban area. The full description of the participants' clinics is given in Table 2.

### HPV-related vaccination practices

When providers were asked how frequently they recommend the HPV vaccine for their age-eligible patients, 84.2% of the sample reported they usually (60%–90% of the time) or always (90%–100% of the time) recommend HPV vaccine to age-eligible patients. However, these OB/GYN providers perceived that only about half (50.7%) of their OB/GYN colleagues recommended it to age-eligible patients. Most providers indicated they thought HPV vaccination should be incorporated into regular clinical care for gynecologic patients ( $n=197$ ; 92.1%). When asked whether they thought their patients were interested in receiving the HPV vaccine, 4.5% ( $n=10$ ) reported all their patients would be interested and another 58.5% ( $n=131$ ) reported they thought more than half of their patients would be interested in receiving the HPV vaccination. Providers also reported they more frequently routinely recommend it to their 19- to 26-year-old patients ( $n=173$ ; 77.2%) than their 27- to 45-year-old patients ( $n=123$ ; 54.9%), the difference was significant ( $p<0.0001$ ).

Fewer than half the OB/GYNs in this study reported they currently vaccinate any of their postpartum patients ( $n=99$ ; 44.2%), although they were more likely to vaccinate 19- to 26-year-old postpartum patients ( $n=90$ ; 40.2%) than 27- to 45-year-old postpartum patients ( $n=72$ ; 32.1%) ( $p<0.0001$ ). The most common reason for not vaccinating postpartum was lack of time ( $n=40$ ; 17.9%). Another commonly reported reason was the OB/GYN incorrectly believed it was unsafe while breastfeeding ( $n=19$ ; 8.5%). When asked how strongly they recommended the HPV vaccine to different age groups, recommendation strength varied by patient age with 98.2% ( $n=213$ ) either recommending it or strongly recommending it to patients  $\leq 18$  years of age, and 95.9% ( $n=208$ ) either

TABLE 2. PROVIDER CLINIC DESCRIPTION

| Variable  | n (%)      |
|---|------------|
| Age group of the majority of the patient population*      |            |
| Younger than 18   | 5 (2.2)    |
| 18–26   | 80 (35.7)  |
| 27–30   | 106 (47.3) |
| 31–45   | 131 (58.5) |
| 46–65   | 59 (26.3)  |
| Over 65   | 8 (3.6)    |
| Race/ethnicity of the majority of the patient population* |            |
| Non-Hispanic White  | 166 (74.1) |
| Non-Hispanic Black  | 72 (32.1)  |
| Hispanic  | 80 (35.7)  |
| Asian   | 17 (7.6)   |
| Other (including multiracial)                             | 12 (5.4)   |
| No definable racial/ethnic majority                       | 8 (3.6)    |
| Payment method of the majority of patients                |            |
| Private insurance/HMO                                     | 145 (70.4) |
| Medicaid  | 46 (22.3)  |
| Uninsured/self-pay  | 4 (1.9)    |
| Other   | 2 (1.0)    |
| Unsure  | 1 (0.5)    |
| No definable payment majority                             | 8 (3.9)    |
| Clinic is FQHC  |            |
| Yes   | 20 (9.7)   |
| No  | 147 (71.4) |
| Unsure  | 39 (18.9)  |
| Geographic location                                       |            |
| Rural   | 26 (12.7)  |
| Urban   | 66 (32.2)  |
| Suburban  | 113 (55.1) |

\*Percentages do not add up to 100% because participants were asked to mark the two most common.

HMO, Health Maintenance Organization; FQHC, Federally Qualified Health Center.

recommending it or strongly recommending to patients 19–26 years of age. The difference in recommendation strength between ≤18-year-olds and 19- to 26-year-olds was not statistically significant ( $p=0.250$ ). In contrast, however, only 74.8% either recommended or strongly recommended it to patients 27–45 years of age, which was significantly lower than recommendation rates for both the ≤18-year-olds ( $p<0.0001$ ) and the 19- to 26-year-olds ( $p<0.001$ ).

### Knowledge

Overall knowledge was high ( $M=5.2$  of 7;  $SD=1.2$ ) but 33% of providers did not know women could receive the vaccine while breastfeeding and almost two-thirds (64%) did not know that it is a three-dose series for those who get the first dose at 15 years of age or older. Knowledge scores did not differ by geographic location ( $F=0.36$ ;  $p=0.698$ ), years practicing medicine ( $r=-0.082$ ;  $p=0.247$ ), or provider age ( $r=-0.076$ ;  $p=0.282$ ). One variable that was associated with knowledge was the OB/GYN's history of personal vaccination status, with those who were vaccinated having higher knowledge scores ( $M=5.5$ ;  $SD=1.1$ ) than either the unvaccinated ( $M=5.2$ ;  $SD=1.1$ ) or those who were unsure of their vaccination status ( $M=3.7$ ;  $SD=1.5$ ) ( $F=4.10$ ;  $p=0.018$ ). See Table 3 for each knowledge item and the percentage of providers who correctly answered that question.

TABLE 3. KNOWLEDGE SCORE

| Question  | n (%) answering correctly |
|---|---------------------------|
| Women can receive the HPV vaccine while breastfeeding (True)  | 151 (68.9%)               |
| The HPV vaccine is FDA approved for males and females 9- to 45-year-olds (True)   | 197 (90.0%)               |
| The CDC's ACIP recommends patients between the ages of 27 and 45 who have not been adequately vaccinated make a shared decision with their doctor about whether to receive the HPV vaccine (True)                                     | 206 (94.1%)               |
| The CDC's ACIP routinely recommends a two-dose series for HPV vaccination with the nine-valent HPV vaccine among people 15- to 26-year-olds (False)   | 79 (36.2%)                |
| The ACA requires most private insurance plans to cover some recommended preventive services and ACIP recommended immunizations without consumer cost-sharing. Plans must cover the HPV vaccine for the recommended populations (True) | 157 (71.7%)               |
| Warts induced by HPV6 and 11 are not cervical cancer precursors (True)  | 167 (76.6%)               |
| The only cancer the HPV vaccine protects against is cervical cancer (False)   | 181 (83.0%)               |

ACA, Affordable Care Act; ACIP, Advisory Committee on Immunization Practices; CDC, Centers for Disease Control and Prevention; FDA, Food and Drug Administration.

### Attitudes and beliefs

When OB/GYNs were asked why they would not vaccinate patients in each age group, the most common response for the 27- to 45-year-old group was "I believe patients have likely been exposed to HPV and would not benefit from vaccination" ( $n=29$ ; 12.9%). Although it was not one of the options given to respondents, 10 (4.5%) OB/GYNs indicated in a text box that they do not recommend the vaccine because they were concerned about insurance coverage and cost.

Providers were asked to indicate how important certain factors were when they were deciding whether to recommend the HPV vaccine for their patients. Almost all providers ( $n=212$ ; 98.6%) indicated cervical cancer prevention was either extremely or very important in their decision to recommend the HPV vaccine to their patients. Fewer providers reported the prevention of a sexually transmitted infection was an important reason for vaccinating their patients ( $n=171$ ; 78.4%). More than half ( $n=127$ ; 58.5%) indicated the number of sexual partners a patient had was an important factor in deciding whether to vaccinate their patients, and 60.6% ( $n=132$ ) reported a patient's history of high-risk HPV DNA was an important factor.

Providers reported significantly lower benefits ( $t=2.72$ ;  $p=0.007$ ) and higher barriers ( $t=-3.80$ ;  $p<0.001$ ) to HPV vaccination for 27- to 45-year-old patients compared with younger patients. Specifically, the mean score for benefits for the 19- to 26-year-old group was 17.9 ( $SD=2.2$ ; range = 12–

TABLE 4. REPORTED BARRIERS BY AGE GROUP

| Barrier  | n (%) saying agree or strongly agree for 19- to 26-year-old patients | n (%) saying agree or strongly agree for 27- to 45-year-old patients | McNemar test p-value |
|--|--|--|----------------------|
| Failure of some insurance companies to cover HPV vaccination                               | 126 (58.9%)  | 160 (74.8%)  | <b>&lt;0.0001</b>    |
| Your patients' concerns about the safety of the HPV vaccine                                | 142 (66.0%)  | 121 (56.3%)  | <b>0.005</b>         |
| Your own concerns about the safety of the HPV vaccine for your patients                    | 22 (10.2%)   | 30 (14.0%)   | 0.115                |
| Your patients' concerns about the efficacy of the HPV vaccine                              | 72 (33.5%)   | 84 (39.3%)   | 0.105                |
| Your own concerns about the efficacy of the HPV vaccine                                    | 30 (14.0%)   | 39 (18.3%)   | 0.078                |
| Patients refusing the HPV vaccine because they think it is unlikely that they will get HPV | 110 (51.2%)  | 127 (59.6%)  | 0.009                |
| Patients lack of education/understanding about HPV infection                               | 166 (77.2%)  | 160 (75.5%)  | 0.743                |
| Patients are opposed to vaccines in general  | 122 (57.5%)  | 125 (58.4%)  | 0.864                |

Values in bold indicate the difference is statistically significant at  $p < 0.05$

20) and it was 17.6 (SD=2.5; range=10–20) in the 27- to 45-year-olds ( $p=0.007$ ; higher score indicates greater benefits). The mean score for barriers for 19- to 26-year-old patients was 24.4 (SD=5.1; range=9–38) and it was 25.2 (SD=5.2; range=11–40) for the 27- to 45-year-old patients ( $p < 0.0001$ ). See Table 4 for a full description of each barrier item and differences between age groups. The most frequently reported barrier to vaccination was cost, regardless of patient age. Of note, more than 1 in 10 OB/GYNs either agreed or strongly agreed that they had concerns about HPV vaccine safety for 19- to 26-year-old patients ( $n=21$ ; 10.2%) and a slightly larger percentage had safety concerns for 27- to 45-year-old patients ( $n=30$ ; 14.0%).

## Discussion

This is among the first studies to examine OB/GYNs' HPV vaccination knowledge, attitudes, and beliefs, particularly after the extension of FDA licensure to include those at 27–45 years of age. It is important to understand HPV vaccination in this provider group given the overall low HPV vaccination rates in the United States and the fact that a large proportion of women receive their standard primary care from an OB/GYN.<sup>17,18</sup> Overall, our study participants reported frequently recommending the HPV vaccine to their patients. The majority routinely recommended it to 19- to 26-year-old patients (77%) and 27- to 45-year-old patients (55%). Indeed, the high reporting of routine recommendation for mid-adult patients was surprising given that ACIP and ACOG recommend SCDM rather than routine vaccination in this age group,<sup>8,10</sup> although it should be noted that at the time of data collection, the ACS had not yet issued their recommendation against vaccinating mid-adults.<sup>11</sup>

Although professional organizations have not issued strong support for vaccinating the mid-adult population, and in some cases have expressed concern that vaccinating this group of patients may hinder vaccinating patients in the younger age groups,<sup>11</sup> the majority of OB/GYNs in our sample still report recommending it to mid-adult patients. It is possible that, because OB/GYNs are the providers to most frequently encounter patients with cervical cancer, primary

prevention of the disease may be of particular importance to them. This was evidenced by the fact that 98.6% of providers in this sample indicated the prevention of cervical cancer as either extremely important or very important in their decision to vaccinate their patients. Alternatively, it is possible participants were overestimating their recommendation strength. Research on HPV vaccination recommendation among pediatricians has found that most (73%) report strongly recommending the vaccination to their patients,<sup>29</sup> whereas audio-recordings of clinical interactions show a minority of providers strongly recommend the vaccine.<sup>38,39</sup>

Whereas participants reported they personally frequently recommended the vaccine, they also indicated they did not think their OB/GYN colleagues were recommending it as frequently as they were. This concept of illusory superiority is often reported in the literature among various health care providers, with providers frequently overestimating their own knowledge, abilities, and performance.<sup>40,41</sup> Research has shown multilevel interventions, including performance feedback, are an effective way to improve awareness of a performance gap and increase uptake of HPV vaccination in pediatric and primary care clinics, and may also be effective in increasing HPV vaccination in other clinical settings.<sup>42,43</sup>

Our study did show some areas that could be the focus of future research to increase HPV vaccination in a gynecologic setting. Research shows one of the strongest predictors of HPV vaccine uptake is provider recommendation.<sup>22,23</sup> Providers in our study reported recommending it to >95% of women of age 26 years and younger. However, research shows only 75% of women report a provider discussed and recommended the HPV vaccine to them<sup>44</sup> and only 51.5% of 19- to 26-year-old women have received at least one HPV vaccination in 2017.<sup>45</sup> If 95% of women were, in fact, receiving a strong provider recommendation, rates would likely be much higher. This indicates there may be a disconnect between what constitutes a strong recommendation, and what providers are actually doing. In reality, research has shown the vast majority of providers fail to provide a high-quality recommendation for HPV vaccination.<sup>39</sup> Education on delivering a strong recommendation for HPV vaccination and

techniques for motivational interviewing have modestly increased HPV vaccination among providers and may translate well in a gynecologic setting.<sup>46–50</sup>

Overall, HPV-related knowledge was high in our sample. This finding is encouraging given research showing a strong association between provider knowledge and patient HPV vaccine series initiation and completion.<sup>51</sup> However, there were some notable knowledge gaps among our study participants that deserve further attention. In particular, approximately one-third of study participants did not know if it was safe to give the HPV vaccine to patients who are breastfeeding, despite evidence proving otherwise.<sup>52</sup> The postpartum period, when a patient may be breastfeeding, includes multiple points-of-contact between the patient and the health care system. This could be an opportune time to vaccinate the patient if the providers are made aware it is safe to receive while breastfeeding. Researchers have started to examine the feasibility and acceptability of integrating HPV vaccination into postpartum care. One study of providers in Texas<sup>24</sup> found there were overall positive attitudes toward HPV vaccination postpartum and it was seen as an effective strategy to vaccinating patients, especially hard-to-reach patients who may not access health care outside their postpartum visits. In addition, many of the OB/GYNs whom we surveyed did not know that HPV vaccination entails a three-dose series for those who get the first dose at age 15 years or older. This specific lack of knowledge could lead to the under-vaccination of patients or to miscommunication about the number of doses required and the higher cost of the three-dose series compared with two doses.

In addition to the knowledge gaps, providers in our sample reported other barriers to vaccination. Approximately 1 in 10 respondents reported personal concerns about HPV vaccine safety. This is notable, especially considering there have been almost two decades of research on HPV vaccine safety and it has consistently been demonstrated as safe and effective.<sup>14,53–55</sup> Although numerous research studies have explored patient and parental concerns about HPV vaccine safety,<sup>56–60</sup> few have examined provider concerns and, specifically, OB/GYN provider concerns about safety. Future research should examine the possibility that providers personally have concerns about HPV vaccine safety. If the providers themselves do not have accurate information about HPV vaccine safety, it may result in them not being able to effectively educate their patients and could result in lower uptake.

Provider participants in our study reported logistical barriers to HPV vaccination, including cost and insurance coverage concerns. This set of issues was likely compounded by the fact that almost 30% of our sample did not correctly answer the knowledge question regarding ACA-mandated coverage of the HPV vaccine. Because the HPV vaccine is routinely recommended for those people 9–26 years of age and based on a shared clinical decision for those of 27–45 years, it is mandated to be covered by insurance companies without a copay, per the Affordable Care Act,<sup>61</sup> when it is administered by an in-network provider. However, research has shown many clinicians are unaware that recommended preventive services must be covered by insurance.<sup>62,63</sup> If awareness of insurance coverage could be increased among providers, this may alleviate this concern, allowing them to convey this information to their patients when engaging in a shared clinical decision discussion about whether the patient should receive the HPV vaccine.

This study is among the first to examine a national sample of OB/GYNs' knowledge, attitudes, and beliefs regarding vaccinating their adult patients for HPV. Although previous research has focused on pediatricians, family medicine, and internal medicine providers, this is among the first to focus exclusively on OB/GYNs, particularly since the new FDA licensure for mid-adult vaccination. However, the results should be interpreted in light of some study limitations. First, these data are self-reported and are thus subject to recall bias and social desirability bias. Second, we recruited OB/GYN providers using a survey sampling company whose participants may not be reflective of the general population of providers. Indeed, according to the Association of American of Medical College's 2018 report on Diversity in Medicine, compared with licensed OB/GYNs nationwide, our sample had a higher proportion of men (55.8% vs. 42.9% nationwide) and non-Hispanic White participants (67.0% vs. 60% nationwide).<sup>64</sup> Thus, this limits the generalizability of our findings to the broader population of OB/GYN physicians in the United States. Likewise, this may also mean their patient populations are not reflective of the OB/GYN patient population in the United States, further limiting the generalizability of the results. Third, we asked about provider perception of patient barriers. The providers' perceptions of patient barriers may not be consistent with patient-reported barriers. Fourth, when ascertaining a description of the OB/GYNs' clinic population, we asked them to report the patient race/ethnicity and age groups they saw in their clinical practice. We believed limiting them to only one race/ethnicity and age group would decrease the granularity of the data, so we asked for the two most common to get a more nuanced description of their patient population. However, this resulted in the percentages for those variables not adding up to 100% (Table 2) and resulted in a confusing interpretation. Future research should examine more thorough ways for providers to self-report their clinic population so that clear distinctions can be made.

This study reports novel findings examining an understudied population of OB/GYN providers and provides valuable insight. It is important to understand their knowledge, attitudes, and beliefs to increase HPV vaccination in a gynecologic setting. Although providers in our study reported strongly and consistently recommending the HPV vaccination to their adult patients, there were notable gaps in knowledge and attitudinal barriers that need to be addressed in future research. Namely, future research should examine ways to increase knowledge of HPV vaccine safety, particularly postpartum while patients are breastfeeding and having more health care touchpoints. Furthermore, provider performance feedback may be an important way to improve awareness of HPV vaccination and increase HPV vaccine recommendations and uptake. The OB/GYN setting is an important point-of-care for many women and could be instrumental in increasing HPV vaccine coverage, particularly among adults.

#### Authors' Contribution

All authors contributed to (1) the conception or design of the work (M.L.K., K.J.H., M.K.N., A.R., S.E.R., C.E.R., G.D.Z.), acquisition (M.L.K., A.R.), analysis (M.L.K., A.R.), or interpretation (M.L.K., K.J.H., A.L.D., M.K.N., A.R., S.E.R., C.E.R., G.D.Z.) of data; (2) drafting the work

(M.L.K.) or critically revising for intellectual content (K.J.H., A.L.D., M.K.N., A.R., S.E.R., C.E.R., G.D.Z.); (3) final approval of the version to be published (M.L.K., K.J.H., A.L.D., M.K.N., A.R., S.E.R., C.E.R., G.D.Z.); and (4) agree to be accountable for all aspects of the work (M.L.K., K.J.H., A.L.D., M.K.N., A.R., S.E.R., C.E.R., G.D.Z.).

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