

Knowledge, attitudes and human papillomavirus vaccine recommendation practices among primary care physicians in Bahrain: a cross-sectional study

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Abstract

Background

Physician recommendation is one of the main determinants of HPV vaccine uptake, yet little is known about how often primary care physicians in Bahrain recommend the vaccine. We assessed their knowledge, attitudes and recommendation practices and looked for factors associated with regular recommendation.

Methods

We surveyed 205 physicians working in primary health care centres in all four governorates of Bahrain in 2025. A self-administered questionnaire covered knowledge (24 items), attitudes (6 items), confidence, and how often the physician had recommended the vaccine in the previous six months. Regular recommendation (about once a month or more) was the outcome, and multivariable logistic regression was used to identify associated factors.

Results

The mean knowledge score was 19.1 of 24 (SD 2.8). Most physicians considered the vaccine safe (81.0%) and effective (88.8%), and 77.6% supported its place in the routine schedule. Far fewer perceived that parents will accept it (28.8%) or that the community would (36.1%). In the previous six months, 35.6% had never recommended the vaccine, 28.3% had done so once or twice, and 36.1% recommended it regularly. Regular recommendation was associated with more than four years of experience (5–15 years: aOR 5.34, 95% CI 2.39–11.93; over 15 years: aOR 5.15, 95% CI 2.15–12.35) and with higher perceived parental and community acceptance (aOR 1.33 per point, 95% CI 1.07–1.65). Knowledge was not associated with recommendation (aOR 1.04, 95% CI 0.92–1.18).

Conclusions

Primary care physicians in Bahrain have good knowledge of HPV vaccination and view the vaccine favourably. Because the vaccine is delivered through school campaigns, physicians have few routine opportunities to recommend it, and their role is mainly counselling hesitant parents. Recommendation was linked to experience and to what physicians expect parents to accept, not to knowledge. Training for early-career physicians and feedback on actual parental acceptance may help.

Introduction

Human papillomavirus (HPV) was responsible for an estimated 690,000 new cancer cases worldwide in 2018. Most were cervical cancers, but HPV also causes anal, oropharyngeal, penile, vulvar and vaginal

cancers [1]. The World Health Organization's cervical cancer elimination strategy calls for 90% of girls to be fully vaccinated against HPV by the age of 15 [2]. Progress towards this target has been slow: by mid-2020, 107 of the 194 WHO member states had introduced the vaccine, and population-weighted global coverage with the final dose was estimated at 15% [3]. In a multinational screening study in the Gulf region, high-risk HPV was detected in 20% of the women tested in Bahrain [4]. Meeting the elimination target requires parents to consent to adolescent vaccination, and parental decisions are shaped to a large extent by health care providers.

A provider's recommendation is consistently one of the strongest predictors of HPV vaccine uptake. In a systematic review of 101 studies, providers recommended the vaccine less often when they were uncomfortable discussing sexual health, judged the patient to be at low risk, or perceived the parents as hesitant. When they did recommend it, they often presented it as optional or something that could be postponed [5]. A review of 96 studies from 34 countries likewise identified anticipated refusal by patients or parents as a common barrier to recommendation [6]. How the vaccine is recommended also matters. In a national survey of 1495 US parents, a high-quality recommendation, meaning one that endorsed the vaccine strongly, encouraged same-day vaccination and mentioned cancer prevention, was associated with more than nine times the odds of vaccine initiation compared with no recommendation, but only about a third of parents had received one [7]. In Saudi Arabia, parents and teachers named the physician's recommendation as one of the main influences on their decision [8], and among women surveyed in Riyadh, advice from a physician was associated with twice the vaccination rate seen with other sources of information [9].

Evidence from the Gulf Cooperation Council (GCC) countries is limited and uneven. A systematic review of 52 GCC studies published up to March 2025 found that knowledge of HPV and its vaccine was generally low and that uptake was below 10% in most settings, the exception being a school-based programme in Abu Dhabi; trust in health care providers was among the main enablers [10]. In a 2024 survey of young adults in the six GCC countries, lack of knowledge and the absence of a medical recommendation were the main barriers to vaccination reported by participants [11]. An earlier systematic review of parental attitudes included studies from Saudi Arabia, the United Arab Emirates and Qatar, but none from Bahrain, Oman or Kuwait [12]. Among physicians, a survey of 557 doctors in Qatar reported good knowledge, but more than a third were not interested in recommending the vaccine [13]. A Saudi study found that physicians with longer clinical experience were more likely to recommend it [14], and in Lebanon, where the vaccine was not part of the national schedule, physicians with higher knowledge scores recommended it more often [15]. A 2019 study of 408 primary care attendees in Bahrain found that only 13.5% had heard of HPV, although 76% said they would accept the vaccine if it were recommended [16]. A survey of Bahraini parents carried out alongside the present study found that 80.6% would be encouraged to vaccinate their children by a recommendation from doctors and nurses [17].

In October 2023, Bahrain introduced HPV vaccination into its national immunization programme as a two-dose schedule for adolescents aged 12 to 13 years, delivered through school campaigns for

students in grades 8 and 9 [18]. The programme uses the nonavalent vaccine (Gardasil 9) (personal communication, Public Health Directorate, Ministry of Health, Bahrain, [name and date to be added]). Students who miss the vaccine during the campaign are directed to health centres to receive it. Primary care physicians are therefore not the main vaccinators under this model, but they remain a likely source of advice for parents deciding whether to consent, particularly parents who are hesitant. To our knowledge, no study has examined how often primary care physicians in Bahrain recommend the vaccine or what distinguishes those who do. The aims of this study were to assess the knowledge, attitudes and recommendation practices of primary care physicians in Bahrain regarding HPV vaccination, and to identify factors independently associated with regular recommendation.

Methods

Design and setting

This cross-sectional study was carried out in governmental primary health care centres in the Kingdom of Bahrain. Data was collected between July and September 2025. The report follows the STROBE guidelines for observational studies [19].

Participants and sampling

The study population consisted of physicians working in governmental primary health care centres, including family medicine consultants, specialists and residents, and general practitioners. The sample was distributed across the four governorates in proportion to the number of physicians working in each. Health centres were randomly selected within each governorate, and all eligible physicians present at the selected centres were invited to take part. Ten centres contributed participants. Physicians who did not give written informed consent were excluded.

The sample size was calculated using the formula for a single proportion, $n = Z^2P(1 - P)/e^2$, assuming that 60% of physicians recommend the HPV vaccine [13, 14], with a 95% confidence level and a 5% margin of error. This gave an initial estimate of 369, which was reduced to 205 after applying the finite population correction for the [] physicians working in governmental primary care centres.

Questionnaire

The questionnaire was developed for this study by the research team on the basis of the published literature and has not been published elsewhere. It was reviewed by family medicine experts, piloted with 10 primary care physicians before data collection, and administered in English as a printed, self-administered questionnaire. The English version is provided in Additional file 1. The first section recorded age, gender, marital status, whether the physician had children, current position, and years of experience in primary care, excluding training.

The knowledge section contained 24 items: six statements about HPV infection, six items on HPV-associated cancers, nine statements about the vaccine, and three questions on Bahrain's national HPV program (target age group, dose schedule and type of vaccine used in primary health care). Each correct answer scored one point, giving a total of 0 to 24 (Kuder–Richardson 20 = 0.61). Knowledge was classified using Bloom's cut-off points as good (80% or more; score of 20 or more), fair (60–79%; 15 to 19) or poor (below 60%; 14 or less). Participants were also asked whether they had attended continuing medical education (CME) on the HPV vaccine.

The attitude section had six statements rated on a five-point Likert scale, giving a total score of 6 to 30 (Cronbach's alpha = 0.84). Item–total correlations suggested two components, which were analysed as separate subscales. Personal endorsement comprised four items: the vaccine is safe, it is effective, the physician would give it to their own or relatives' children, and it should be in the routine schedule (range 4–20; alpha = 0.90). Perceived acceptance comprised two items: the vaccine is usually accepted by parents, and the community of Bahrain is likely to accept it (range 2–10; alpha = 0.70). Confidence in recommending the vaccine was rated on a separate five-point scale.

Recommendation practice was assessed with the question: "In the past 6 months, how often have you discussed and recommended the HPV vaccine to adolescent patients and/or their parents or guardians?" The response options were never, rarely (once or twice), sometimes (about once a month), often (several times a month) and always (with nearly every eligible patient).

Outcome

The primary outcome was regular recommendation, defined as recommending the vaccine sometimes, often or always, compared with never or rarely.

Statistical analysis

Categorical variables are reported as frequencies and percentages and continuous variables as means and standard deviations. Associations with regular recommendation were examined using the chi-square test or Fisher's exact test, and the independent-samples t-test, with the Mann–Whitney U test used as a check. Variables were then entered into a multivariable logistic regression model specified in advance: experience category, gender, CME attendance, knowledge score, personal endorsement score and perceived acceptance score. Age and position were not included because both were closely related to experience ($r = 0.93$ between age and years of experience, and 61 of the 62 consultants had more than four years of experience). Variance inflation factors were below 1.4 for all variables. With 74 outcome events and seven parameters, there were approximately 10.6 events per variable. Model fit was assessed with the Hosmer–Lemeshow test and discrimination with the area under the receiver operating characteristic curve (AUC).

We carried out three sensitivity analyses. The first used cluster-robust standard errors to account for clustering by health centre. The second fitted an ordinal logistic model to the full five-level practice variable. The third added confidence in recommending the vaccine to the main model; this variable was not included in the main model because it may lie on the causal pathway between attitudes and practice. A two-sided p value below 0.05 was considered statistically significant. Data were managed in IBM SPSS Statistics version 29, and analyses were performed in SPSS and Python (statsmodels).

Ethical considerations

The study was approved by the Research and Ethics Committee of the College of Medicine and Health Sciences, Arabian Gulf University (approval no. E21-PI-04-25), and by the Primary Health Care Research Committee, Ministry of Health, Bahrain (serial no. 44, dated 22 July 2025). All participants gave written informed consent. Participation was voluntary and all data were anonymised.

Results

Participants

A total of 205 physicians from 10 health centres took part (response rate 90%). Their mean age was 38.3 years (SD 8.1; range 27–65), and 173 (84.4%) were women. Almost half (45.9%) had four years or less of experience in primary care, and the mean length of experience was 9.3 years (SD 8.8). Table 1 summarises their characteristics.

Table 1
Participant characteristics and regular HPV vaccine recommendation (n = 205)

Characteristic	n (%)	Regular recommendation, %	p
Age			
< 35 years	82 (40.0)	23.2	0.005
35–45 years	85 (41.5)	42.4	
≥ 46 years	38 (18.5)	50.0	
Gender			
Male	32 (15.6)	31.2	0.69
Female	173 (84.4)	37.0	
Primary care experience			
≤ 4 years	94 (45.9)	18.1	< 0.001
5–15 years	65 (31.7)	52.3	
> 15 years	46 (22.4)	50.0	
Position			
Family medicine consultant	62 (30.2)	50.0	0.021
Family medicine specialist	98 (47.8)	31.6	
Resident or general practitioner	45 (22.0)	26.7	
Marital status			
Single	32 (15.6)	28.1	0.57
Married	166 (81.0)	37.3	
Divorced or widowed	7 (3.4)	42.9	
Has children			
No	47 (22.9)	27.7	0.23
Yes	158 (77.1)	38.6	
Attended HPV-related CME			
No	146 (71.2)	29.5	0.002
Yes	59 (28.8)	52.5	
Knowledge level			
Poor (< 60%)	10 (4.9)	20.0	0.30

Characteristic	n (%)	Regular recommendation, %	p
Fair (60–79%)	94 (45.9)	33.0	
Good ($\geq 80\%$)	101 (49.3)	40.6	

Chi-square test unless marked; χ^2 Fisher's exact test.

Knowledge

The mean knowledge score was 19.1 out of 24 (SD 2.8; median 19, IQR 17–21), which corresponds to 79.5% of answers correct. Knowledge was good in 101 physicians (49.3%), fair in 94 (45.9%) and poor in 10 (4.9%). Nearly all participants knew that HPV causes cervical cancer (99.5%) and that the vaccine protects against it (95.6%). Items answered correctly by fewer than 80% of physicians are listed in Table 2. Fewer than 70% knew that most HPV infections clear spontaneously, that the vaccine can cause nausea and headache, and that it does not slow the progression of existing cervical cancer. Knowledge of the national program was incomplete: 70.7% identified the target age group, 76.1% the two-dose schedule and 33.7% the type of vaccine in use. Only 59 physicians (28.8%) had attended CME on the HPV vaccine.

Table 2
Knowledge items answered correctly by fewer than 80% of physicians (n = 205)

Item	Correct, n (%)
Type of HPV vaccine used in primary health care centres (nonavalent)	69 (33.7)
HPV is associated with skin cancer (true)	77 (37.6)
Most HPV infections resolve within two years (true)	119 (58.0)
Vaccination can delay progression of established cervical cancer (false)	132 (64.4)
Vaccine may cause nausea and headache (true)	141 (68.8)
Target age group in Bahrain's program	145 (70.7)
Vaccine is safe in lactating mothers (true)	152 (74.1)
HPV is associated with oropharyngeal cancer (true)	156 (76.1)
Dose schedule in Bahrain's program	156 (76.1)
Condoms are fully protective against HPV (false)	160 (78.0)
Vaccine is safe in pregnancy (false)	161 (78.5)

Attitudes and confidence

Attitudes towards the vaccine itself were positive, but expectations of how parents and the community would respond were much less so (Table 3). Most physicians agreed that the vaccine is safe (81.0%) and

effective (88.8%), 74.1% were willing to give it to their own or relatives' children, and 77.6% supported its inclusion in the routine schedule. In contrast, 28.8% agreed that parents usually accept the vaccine and 36.1% that the community of Bahrain would accept it. Forty percent of physicians had a high personal endorsement score (mean item score of 4 or more) together with a low perceived acceptance score (mean item score of 3 or less). Overall, 59.0% felt quite or extremely confident about recommending the vaccine.

Table 3
Attitudes towards HPV vaccination and confidence in recommending it (n = 205)

Statement	Agree or strongly agree, n (%)	Neutral, n (%)	Disagree or strongly disagree, n (%)
HPV vaccine is very safe	166 (81.0)	27 (13.2)	12 (5.9)
HPV vaccine is effective	182 (88.8)	12 (5.9)	11 (5.4)
I am willing to give my children or relatives' children the vaccine	152 (74.1)	38 (18.5)	15 (7.3)
HPV vaccine should be in Bahrain's routine schedule	159 (77.6)	30 (14.6)	16 (7.8)
HPV vaccine is usually accepted by parents	59 (28.8)	80 (39.0)	66 (32.2)
The community of Bahrain is likely to accept the vaccine	74 (36.1)	81 (39.5)	50 (24.4)
Confidence in recommending (quite or extremely confident)	121 (59.0)	59 (28.8)☒	25 (12.2)☒

☒ Somewhat confident. ☒ Not or slightly confident.

Recommendation practice

During the previous six months, 73 physicians (35.6%) had never discussed or recommended the HPV vaccine and 58 (28.3%) had done so only once or twice, while 74 (36.1%) met the definition of regular recommendation (Fig. 1). Regular recommendation was less common among physicians with four years of experience or less (18.1%) than among those with 5–15 years (52.3%) or more than 15 years (50.0%).

Factors associated with regular recommendation

On bivariate analysis, regular recommendation was more frequent among older physicians, those with more experience, consultants, and those who had attended CME (Table 1). Physicians who recommended regularly also had higher personal endorsement scores (mean 17.9 vs 16.1; $p < 0.001$), higher perceived acceptance scores (6.7 vs 5.8; $p < 0.001$) and greater confidence (4.2 vs 3.4; $p < 0.001$). There was no association with knowledge score (19.3 vs 19.0; $p = 0.50$), gender, marital status or having children.

In the multivariable model (Table 4), physicians with 5–15 years of experience (aOR 5.34, 95% CI 2.39–11.93) and those with more than 15 years (aOR 5.15, 95% CI 2.15–12.35) had about five times the odds of regular recommendation compared with those with four years or less. Each one-point increase in the perceived acceptance score was associated with 33% higher odds of regular recommendation (aOR 1.33, 95% CI 1.07–1.65). The association with personal endorsement was of borderline significance (aOR 1.11, 95% CI 1.00–1.24; $p = 0.054$), and knowledge was not associated with the outcome (aOR 1.04, 95% CI 0.92–1.18). The model showed adequate fit (Hosmer–Lemeshow $p = 0.16$) and moderate discrimination (AUC 0.79).

Table 4

Factors associated with regular HPV vaccine recommendation: logistic regression ($n = 205$; 74 regular recommenders)

Factor	Crude OR (95% CI)	Adjusted OR (95% CI)	p (adjusted)
Experience ≤ 4 years	1 (reference)	1 (reference)	
Experience 5–15 years	4.97 (2.43–10.17)	5.34 (2.39–11.93)	< 0.001
Experience > 15 years	4.53 (2.07–9.89)	5.15 (2.15–12.35)	< 0.001
Female (vs male)	1.29 (0.58–2.90)	2.45 (0.97–6.19)	0.057
Attended HPV-related CME	2.65 (1.42–4.94)	1.82 (0.87–3.78)	0.11
Knowledge score (per point, 0–24)	1.04 (0.93–1.15)	1.04 (0.92–1.18)	0.54
Personal endorsement (per point, 4–20)	1.19 (1.07–1.32)	1.11 (1.00–1.24)	0.054
Perceived parental and community acceptance (per point, 2–10)	1.36 (1.13–1.63)	1.33 (1.07–1.65)	0.010

Model fit: Hosmer–Lemeshow $\chi^2 = 11.86$, $p = 0.16$; AUC = 0.79; McFadden pseudo- $R^2 = 0.19$.

Sensitivity analyses

The associations with experience and perceived acceptance were consistent across the sensitivity analyses. With cluster-robust standard errors, the odds ratio for perceived acceptance was 1.33 (95% CI 1.01–1.76); CME attendance (aOR 1.82, 95% CI 1.04–3.19) and female gender (aOR 2.45, 95% CI 1.31–4.59) also became statistically significant, although these estimates should be interpreted with caution because there were only ten clusters. In the ordinal model of the five-level outcome, the odds ratios were 4.38 for 5–15 years of experience ($p < 0.001$), 3.93 for more than 15 years ($p < 0.001$), 1.23 for perceived acceptance ($p = 0.019$) and 1.10 for personal endorsement ($p = 0.029$). When confidence was added to

the main model, it was strongly associated with regular recommendation (aOR 1.90 per point; $p < 0.001$), and the associations with experience remained (aOR 4.70 and 5.62).

Discussion

To our knowledge, this is the first study of HPV vaccine recommendation practices among primary care physicians in Bahrain. Physicians had good knowledge of HPV and its vaccine and held favourable views of the vaccine, yet more than a third had not recommended it at all in the previous six months and only about one in three recommended it regularly. This should be read in the context of school-based delivery: physicians have few routine opportunities to recommend the vaccine and are consulted mainly by parents who are hesitant and seek counselling. Regular recommendation was associated with clinical experience and with the physician's perception of how parents and the community would respond, but not with knowledge.

Most physicians in a survey in Qatar were also classified as having sufficient knowledge, although that study used a different cut-off (a score above the sample mean) [13]. Knowledge was not associated with recommendation in either the bivariate or the multivariable analysis, which suggests that educational activities focused on general knowledge are unlikely, on their own, to change practice. This differs from Lebanon, where physicians with higher knowledge scores recommended the vaccine more often [15]; there, however, the vaccine was not part of the national schedule, so vaccination depended entirely on the physician's initiative. In a nationwide survey of Hungarian general practitioners, attitudes were positive and nearly 90% knew that HPV causes cervical cancer, but only 56% knew the schedule recommended for adolescents who start vaccination after the age of 15, and familiarity with WHO and national guidelines independently predicted proactive recommendation [20]. The gaps in our sample were similarly practical. Many physicians were unsure of the vaccine type, target age and schedule used in the national programme, and some were unaware of common minor side effects. This is the kind of information a physician needs in order to give a clear and specific recommendation, and it could be covered in short updates on the national programme. A gap between attitudes and practice has also been described among physicians in the United Arab Emirates, where 95% agreed that vaccines are safe but nearly half of family physicians did not regularly review their patients' immunization status [21].

The attitude most closely linked to recommendation was not the physician's own opinion of the vaccine but their expectation of how parents and the community would respond. Fewer than one in three physicians agreed that parents usually accept the vaccine, and 40% combined strong personal support with low expected acceptance. Similar findings have been reported elsewhere. Perceiving parents as hesitant is a well-documented reason why providers recommend the HPV vaccine less often [5, 6], and 38.4% of Hungarian general practitioners described parental hesitancy as a common barrier [20]. Providers may also misjudge parents: in a survey of parents and providers in Houston, providers underestimated how important parents considered vaccines to be, particularly the HPV and influenza vaccines [22]. In Bahrain, physicians' expectations may likewise be more pessimistic than the reality. In the companion survey of 368 Bahraini parents, 80.6% said that a recommendation from doctors and

nurses would encourage them, and 70.0% (56 of 80) of parents who had been offered the vaccine accepted it; 60.4% of those not yet offered said they would [17]. The 2019 Bahraini study also found that 76% of adults would accept the vaccine if it were recommended [16]. It is therefore possible that some physicians are not recommending the vaccine to parents who would accept it. An initial refusal need not be final either: in a national US sample, 45% of parents who had declined HPV vaccination later accepted it, and follow-up counselling by a provider was associated with about twice the odds of later acceptance [23].

The research team suggested that this pessimism may partly reflect public resistance encountered during the COVID-19 vaccination campaign. There is some evidence that the pandemic affected attitudes to routine vaccines. In three national surveys in the United Kingdom between 2020 and 2022, parents who had received fewer than three COVID-19 vaccine doses were more likely to report declining confidence in childhood vaccines [24], and in the United Arab Emirates, 80.8% of physicians surveyed in 2022 and 2023 named safety concerns as the most common reason their patients refused vaccines [21]. Whether experience of COVID-19 vaccine hesitancy has shaped Bahraini physicians' expectations of parents could be explored in a qualitative study.

Physicians with more than four years of experience in primary care had about five times the odds of recommending the vaccine regularly, and this association remained after adjustment for knowledge, attitudes and CME. A study from Saudi Arabia similarly reported that physicians with more than four years of experience were five to six times more likely to have positive attitudes and better knowledge [14], and in a survey of 208 paediatricians and family physicians, at least five years of experience as a specialist was associated with a more positive attitude towards COVID-19 vaccination of children [25]. More experienced physicians may be more skilled at discussing sensitive topics, more familiar with the national programme, or better known to the families they see. Since almost half of the participants had four years of experience or less, this group offers the greatest scope for improvement.

These findings have several practical implications. Training physicians to use a brief, presumptive recommendation that assumes parents will agree has been shown to work: in a randomised trial in 30 clinics, this approach increased HPV vaccine initiation by 5.4 percentage points, whereas training in open-ended conversations did not [26]. In another cluster randomised trial in 16 primary care practices, communication training in presumptive recommendation, followed by motivational interviewing for hesitant parents and supported by fact sheets and a decision aid, increased series initiation by 9.5 percentage points (adjusted OR 1.46), although the effect was smaller in family medicine than in paediatric practices [27]. Such an approach may be particularly useful for physicians who expect parents to refuse, and the recommendation itself should be strong, encourage vaccination at the earliest opportunity and present the vaccine as cancer prevention [7]. Sharing local data on parental acceptance with physicians, such as the finding that seven in ten parents offered the vaccine accepted it, may also help to correct their expectations. Communication about HPV vaccination and practical details of the national programme could be included in residency training and induction for newly appointed physicians. CME attendance was associated with regular recommendation in the bivariate analysis, but

fewer than a third of physicians had attended any. There is a local precedent for this kind of training: during the COVID-19 vaccination campaign, a quality-improvement project in Bahraini primary care that combined physician reminders with training in tailored communication raised the rate of physicians' vaccine advice from 1% to 51% over 19 weeks [28]. Finally, reminders in the electronic health record could prompt physicians to recommend the vaccine at eligible visits. Even in high-income settings, 28% of practitioners have been classified as ambivalent recommenders who delayed or did not recommend the vaccine [29], which suggests that system-level prompts are needed in addition to training. Such changes may take time to show an effect. In a cluster randomised trial in 20 US paediatric practices, a multicomponent strategy did not significantly increase vaccination by age 13 at 24 months, although its effect on initiation grew over the following year [30].

Strengths and limitations

The study included physicians from all four governorates, used a five-level measure of practice over a defined period, and analyzed attitudes using subscales with good internal consistency. The multivariable model was specified in advance, and the main findings were consistent across three sensitivity analyses.

The study also has limitations. Its cross-sectional design does not allow causal conclusions. Recommendation practice was self-reported and may have been overestimated. We did not record how many eligible adolescents or parents each physician saw, so infrequent recommendation may partly reflect fewer opportunities, because the vaccine is delivered through school campaigns and physicians are mainly consulted by parents who are hesitant. Perceived acceptance was measured with only two items. The internal consistency of the knowledge scale was modest ($KR-20 = 0.61$), and the item on skin cancer is open to debate because only some HPV types are associated with cutaneous cancers. Only physicians in governmental centres were included, so the results may not apply to private practice. The high proportion of women reflects the composition of the primary care workforce in Bahrain. The cluster-robust estimates were based on only ten health centres. Finally, we did not have data on actual vaccine uptake among the physicians' patients.

Conclusions

Primary care physicians in Bahrain have good knowledge of HPV vaccination and a favourable view of the vaccine. Because the vaccine is delivered through school campaigns, physicians have few routine opportunities to recommend it, and their role is mainly to counsel parents who are hesitant. Among physicians, recommendation was associated with clinical experience and with expectations of parental acceptance, which appear to be more pessimistic than parents' actual responses. Brief updates on the national program, training in presumptive recommendation and counselling for early-career physicians, and feedback on local parental acceptance are practical and inexpensive ways to prepare physicians for this role.

Declarations

Data availability statement

The datasets generated and analyzed for this study are available from the corresponding author on reasonable request, subject to the approvals of the relevant research and ethics committees.

Ethics statement

The study involving human participants was reviewed and approved by the Research and Ethics Committee of the College of Medicine and Health Sciences, Arabian Gulf University (reference number E21-PI-04-25), and by the Primary Health Care Research Committee, Ministry of Health, Kingdom of Bahrain (serial number 44, approved 22 July 2025). All participants provided written informed consent before participation.

Author contributions

FAY, MAAb, ZAA, and ZSK contributed to the conception and design of the study, data collection, analysis and interpretation of the data, and drafting of the manuscript. BM contributed to the study design, supervised the data collection and part of the analysis, and critically reviewed the manuscript. FH contributed to the conception and design of the study, data collection, analysis and interpretation, and drafting and critical revision of the manuscript. RA, MAAl, SC, ABS, and MHS contributed to the conception and design of the study, interpretation of the data, and critical revision of the manuscript. FH, ABS, and MHS supervised the project; FH supervised the trainees from protocol development to submission. FH and MHS share senior authorship. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Figures

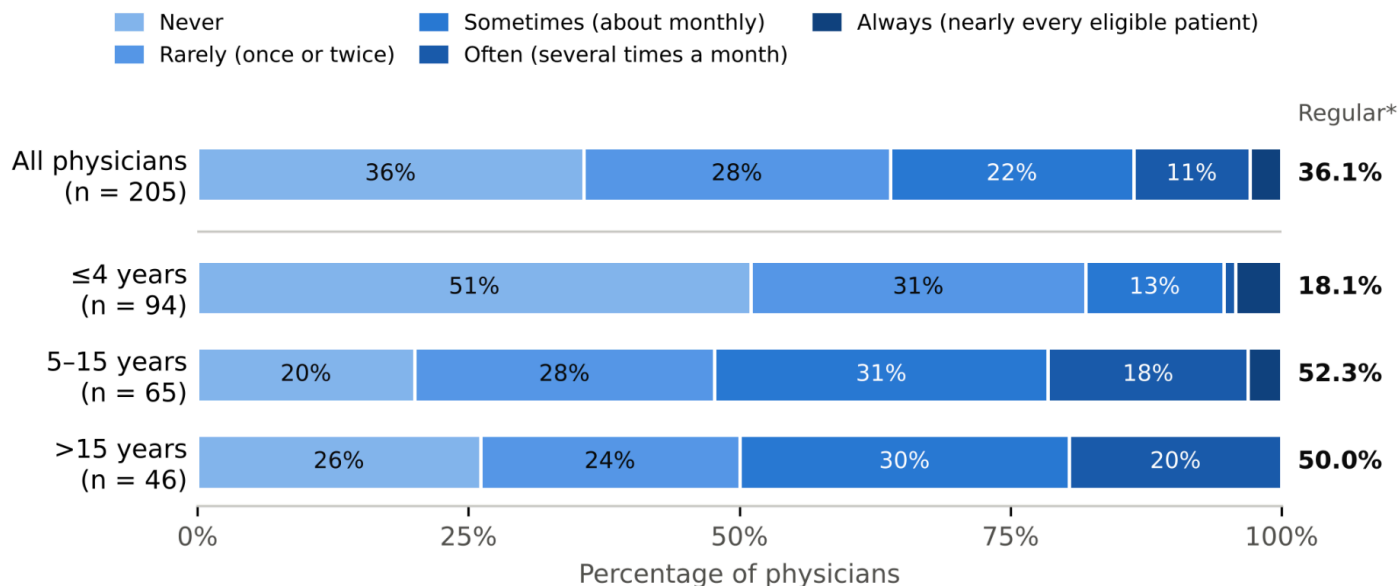


Figure 1

Frequency of HPV vaccine recommendation by primary care physicians in the previous six months, overall and by years of experience in primary care (n = 205). Regular recommendation was defined as sometimes, often or always.

Supplementary Files

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- [Additionalfile1Questionnaire.docx](#)