

Knowledge, attitudes and acceptance of human papillomavirus vaccination among parents in Bahrain: a cross-sectional study

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Abstract

Background

Bahrain introduced human papillomavirus (HPV) vaccination for adolescent girls and boys through school campaigns in October 2023. Parents' decisions are central to uptake, yet their views have not been studied in Bahrain. We assessed parents' knowledge, attitudes and acceptance of the vaccine and the factors associated with willingness to vaccinate.

Methods

We conducted a cross-sectional, interviewer-administered survey between July and September 2025 in four governmental primary health care centres, one randomly selected from each governorate. Bahraini parents of children aged 6 to 14 years were recruited by convenience sampling after their consultation. The questionnaire covered sociodemographic characteristics, a 20-item knowledge score (for parents aware of the vaccine), eight attitude statements forming vaccine-confidence and vaccine-concern subscales, acceptance when offered, and willingness if offered. We used chi-square tests and multivariable logistic regression.

Results

Of 368 parents, 74.0% were mothers and 62.9% had a university education. Most knew that HPV affects women (83.1%) and causes cervical cancer (72.1%), but only 46.2% had heard of the vaccine. Just 22.0% had been offered it for a child, and 70.0% of those (56/80) accepted. Among the 285 parents not yet offered it, 60.4% were willing. In all, 80.6% said a recommendation from doctors and nurses would encourage them, and 54.6% said fear of side effects discouraged them. Willingness was 84.8% with positive and 37.9% with negative attitudes; vaccine confidence (adjusted OR 5.8 per SD, 95% CI 3.5–9.8) and fewer vaccine concerns (2.4, 1.7–3.6) independently predicted willingness. Among parents aware of the vaccine, mean knowledge was 14.0/20 (SD 3.9); willingness was 83.7% with good knowledge versus 57.1–58.1% otherwise ($p = 0.017$), but knowledge was not independently associated once attitude was included (adjusted OR 1.12 per point, 95% CI 0.94–1.33). Positive attitudes were more common among health-sector workers (74.5% vs 45.1–48.1%; $p = 0.002$).

Conclusion

Most parents in Bahrain are open to HPV vaccination, but awareness of the vaccine is low and concerns about side effects are common. Attitude, more than knowledge, distinguished parents who were willing to vaccinate. Recommendation by doctors and nurses, together with clear information about vaccine safety, is a practical way to turn openness into acceptance.

Introduction

Human papillomavirus (HPV) causes nearly all cervical cancers and a substantial share of anal, oropharyngeal, penile, vulvar and vaginal cancers; in 2018 it accounted for an estimated 690,000 new cancer cases worldwide [1]. HPV types 16 and 18 are found in about 70% of invasive cervical cancers, and the nonavalent vaccine covers types responsible for about 90% [2, 3]. Where vaccination programmes have run for several years, HPV 16/18 infections among adolescent girls have fallen by more than 80% and high-grade cervical lesions by about half [4]. The World Health Organization (WHO) cervical cancer elimination strategy calls for 90% of girls to be fully vaccinated by the age of 15, and WHO now recommends a one- or two-dose schedule for girls aged 9 to 14 years, with boys as a secondary target where feasible [5, 6]. Global first-dose coverage among girls in this age group was estimated at 56.9% in 2024, but only 19.5% in the Eastern Mediterranean Region, the lowest of the six WHO regions [7].

Because HPV vaccination is given to children and young adolescents, uptake depends on parents. Vaccine hesitancy, the delay in acceptance or refusal of vaccination despite available services, is shaped by confidence in vaccine safety and effectiveness, complacency about the disease, and convenience [8]. Across 79 studies, a physician's recommendation was the factor most strongly associated with parents' uptake of the HPV vaccine, followed by concerns about its safety [9]. In the Eastern Mediterranean Region, a 2025 meta-analysis of 33 studies estimated that 61% of parents were willing to vaccinate their children, but only 7% had done so [10].

Evidence from the Gulf Cooperation Council (GCC) countries points to the same gap. Systematic reviews of GCC and Saudi studies describe generally low knowledge, frequent safety concerns, moderate to high stated willingness and low uptake, with trust in health care providers as a key enabler [11–13]. Since Saudi Arabia added the vaccine to its school programme in 2022, studies of parents have reported acceptance of 56% to 66% and hesitancy of 34% to 49%, with fear of side effects the most common barrier [14–18]. Similar patterns have been reported among parents in Qatar and Kuwait [19, 20].

Bahrain introduced the HPV vaccine into its national immunization programme in October 2023, for girls and boys aged 12 to 13 years, as a two-dose schedule delivered through school campaigns [21]. Before the programme, only 13.5% of adults attending primary care in Bahrain had heard of HPV [22], and a community survey in 2021 to 2023 found that 23.8% of adults knew of the vaccine [23]. No study has examined the knowledge, attitudes and acceptance of parents, whose consent the school programme depends on. This study aimed to assess these among parents attending primary health care centres in Bahrain, and to identify factors associated with willingness to vaccinate their children.

Methods

Design and setting

This cross-sectional study was carried out in four governmental primary health care centres in the Kingdom of Bahrain between 29 July and 7 September 2025. The report follows the STROBE guidelines for observational studies [24].

Participants and sampling

One health centre was randomly selected from each of the four governorates: Yusuf Engineer (Southern), Halat Bu Maher (Muharraq), Jidhafs (Capital) and A'ali (Northern). The target sample was allocated to the centres in proportion to the population of each governorate. During the data collection period, members of the research team approached parents after their consultation, using convenience sampling, and invited those who were eligible to take part. Eligible participants were Bahraini parents with at least one child aged 6 to 14 years who gave written informed consent. Parents attending with an emergency complaint and those with a disability that prevented communication were excluded.

The sample size was calculated with the formula for a single proportion, $n = Z^2P(1 - P)/e^2$, assuming an expected prevalence of 40%, a 95% confidence level and a 5% margin of error, which gave 369 participants.

Questionnaire

The questionnaire was developed by the research team from the published literature, written in English and translated into Arabic by bilingual members of the team; the translation was reviewed by an independent expert. Its content was reviewed by five family medicine experts, and it was piloted with a small number of eligible parents before data collection. Trained members of the research team administered it face to face in a private consultation room.

The first section recorded the parent's age, sex, education, employment, marital status, monthly household income and the ages of their children. The knowledge section began with six questions on HPV (whether it infects men and women, whether symptoms appear immediately, and transmission) and seven statements on diseases HPV can cause, answered by all parents. Parents were then asked whether they had heard of the HPV vaccine; those who had answered further questions on who receives it, the target age group and its side effects, and on their sources of information.

Knowledge was scored only for parents who had heard of the vaccine, because only they answered the vaccine items. The score included 20 items answered yes, no or don't know; a correct answer scored 1 and an incorrect or don't-know answer 0, giving a total of 0 to 20 (Kuder–Richardson 20 = 0.80). True statements were scored correct when answered yes and false statements when answered no. The item on transmission through blood and body fluids was excluded because its correct answer is ambiguous, and the open 'other' transmission item and the age-group item were not scored. Knowledge was classified using Bloom's cut-offs as good (80% or more correct), fair (60% to 79%) or poor (below 60%).

Attitudes were measured with eight statements rated on a five-point Likert scale from strongly disagree to strongly agree. Three negatively worded statements (that the vaccine is not necessary, that fear of side effects prevents vaccination, and that experiences with other vaccines affected willingness) were reverse scored, giving a total of 8 to 40 (Cronbach's alpha = 0.77). Parents scoring at or above the median (27) were classified as having a positive attitude for descriptive purposes. To examine the structure of the scale, we carried out a principal component analysis with varimax rotation, retaining components with eigenvalues above 1.

The final section asked whether the vaccine had been offered for any of the parent's children. Parents who had been offered it were asked whether they had accepted, their reasons, and whether they had been given information about the vaccine. Parents who had not been offered it were asked whether they would accept it if it were offered, and their reasons.

Outcomes

Two outcomes were defined. Acceptance was the proportion of parents offered the vaccine for a child who accepted it. Willingness, the outcome for the analysis of associated factors, was the proportion of parents not yet offered the vaccine who said they would accept it if offered.

Statistical analysis

Categorical variables are reported as frequencies and percentages and continuous variables as means and standard deviations, or medians and interquartile ranges where skewed. Associations with willingness were examined using the chi-square test or Fisher's exact test. Knowledge scores were compared across groups with the Mann–Whitney U or Kruskal–Wallis test, and between attitude groups with the independent-samples t-test. Factors associated with willingness were examined with multivariable logistic regression. The main model included the two attitude subscales, each standardised so that odds ratios are expressed per standard deviation, together with age group, sex, education, employment in the health sector, household income, prior awareness of the vaccine and health centre, chosen in advance. Because knowledge was scored only for parents aware of the vaccine, its association with willingness was examined in a separate model restricted to these parents, with and without adjustment for the attitude subscales. Model discrimination was assessed with the area under the receiver operating characteristic curve (AUC), calibration with the Hosmer–Lemeshow test, and collinearity with variance inflation factors. Because some attitude statements are close in content to the decision itself, we carried out four sensitivity analyses: replacing the subscales with the median-split attitude classification, with the total attitude score, and with a score made of the four statements least related to the decision (timing, benefits and risks, social media and awareness campaigns; Cronbach's alpha = 0.67); and repeating the main model for a combined outcome that counted parents as positive if they had accepted the vaccine when offered or were willing if not. A two-sided p-value below 0.05 was considered statistically significant. Data were entered in Microsoft Excel and managed in IBM SPSS Statistics version 30; the analyses reported here were run in Python 3 (pandas, SciPy and statsmodels).

Ethical considerations

The study was approved by the Research and Ethics Committee of the College of Medicine and Health Sciences, Arabian Gulf University (reference E20-PI-04-25), the Primary Health Care Research Committee (PHCRC/TOR/0014/2025, 14 July 2025) and the Primary Health Care Ethics Committee, Ministry of Health, Kingdom of Bahrain (serial no. 43, 17 July 2025). All participants gave written informed consent. Participation was voluntary, interviews were held in private, and the data were anonymised.

Results

Participants

A total of 368 parents were interviewed: 128 at A'ali, 91 at Jidhafs, 78 at Yusuf Engineer and 71 at Halat Bu Maher. Their mean age was 38.6 years (SD 6.3; range 25–60), 271 (74.0%) were mothers, 231 (62.9%) had a university education and 47 (12.8%) worked in the health sector (Table 1).

Table 1
Characteristics of participating parents and willingness to vaccinate among those not yet offered the vaccine (n = 368)

Characteristic	All parents, n (%)	Willing, % (n not offered)	p
Age group (years)			0.090
<35	104 (28.3)	69.1 (94)	
35–44	192 (52.2)	54.9 (142)	
≥45	72 (19.6)	59.2 (49)	
Sex			0.878
Father	95 (26.0)	59.5 (74)	
Mother	271 (74.0)	60.5 (210)	
Education			0.838
Illiterate	4 (1.1)	66.7 (3)	
Primary or intermediate	18 (4.9)	71.4 (14)	
Secondary	114 (31.1)	59.1 (88)	
University or higher	231 (62.9)	59.8 (179)	
Employment			0.356
Not employed	158 (42.9)	59.2 (125)	
Employed, non-health sector	163 (44.3)	58.4 (125)	
Employed, health sector	47 (12.8)	71.4 (35)	
Marital status			0.480
Married	349 (95.1)	59.9 (269)	
Divorced	18 (4.9)	68.8 (16)	
Monthly household income (BD)			0.668
<500	100 (27.2)	60.3 (78)	
500–1000	162 (44.0)	57.9 (126)	
>1000	106 (28.8)	64.2 (81)	
Health centre (governorate)			0.009
Southern (Yusuf Engineer)	78 (21.2)	50.0 (58)	
Muharraaq (Halat Bu Maher)	71 (19.3)	53.6 (56)	

Characteristic	All parents, n (%)	Willing, % (n not offered)	p
Capital (Jidhafs)	91 (24.7)	76.0 (75)	
Northern (A'ali)	128 (34.8)	58.3 (96)	
Heard of the HPV vaccine			0.011
No	198 (53.8)	54.9 (184)	
Yes	170 (46.2)	70.3 (101)	
Attitude			< 0.001
Negative	182 (49.9)	37.9 (145)	
Positive	183 (50.1)	84.8 (138)	

Percentages exclude missing values. Willingness was asked of parents who had not been offered the vaccine ($n = 285$). Chi-square test unless marked; χ^2 Fisher's exact test.

Knowledge

Most parents knew that HPV infects women (305/367, 83.1%) and causes cervical cancer (72.1%), and 66.8% that it is sexually transmitted. Fewer knew that it infects men (60.5%), causes genital warts (64.9%) or that symptoms do not appear immediately (56.2%). Only 170 parents (46.2%) had heard of the HPV vaccine. Their most common sources of information were social media (54.4%), internet searches (51.5%), family or friends (41.9%) and doctors or hospitals (39.9%).

Among these 170 parents, the mean knowledge score was 14.0 of 20 (SD 3.9; median 15, IQR 12–17). Knowledge was good in 72 (42.4%), fair in 60 (35.3%) and poor in 38 (22.4%). Nearly all knew that the vaccine is given to girls, but fewer than half knew that HPV is transmitted through skin contact or causes mouth and throat cancer, and more than half believed, or were unsure whether, it causes colon cancer (Table 2). Knowledge scores were higher among parents with a university education (mean 14.5 vs 12.8 for secondary; $p = 0.003$), those working in the health sector (15.9 vs 13.2–13.7; $p < 0.001$), those with a household income above 1000 BD (15.4 vs 13.1; $p < 0.001$) and younger parents (15.6 below 35 years vs 12.8 at 45 or older; $p = 0.002$), but did not differ between mothers and fathers ($p = 0.55$).

Table 2
Knowledge items among parents who had heard of the HPV vaccine (n = 170), ordered by proportion correct

Item (correct answer)	Correct, n (%)
Side effect: nausea and dizziness (yes)	68 (40.0)
Transmitted through skin contact (yes)	73 (42.9)
Causes colon cancer (no)	74 (43.5)
Causes mouth and throat cancer (yes)	77 (45.3)
Causes breast cancer (no)	93 (54.7)
Symptoms appear immediately after infection (no)	109 (64.1)
Causes gastric ulcer (no)	114 (67.1)
Side effect: allergic reaction (yes)	117 (68.8)
Causes rheumatoid arthritis (no)	127 (74.7)
HPV infects men (yes)	128 (75.3)
Transmitted through food (no)	130 (76.5)
Side effect: fever (yes)	131 (77.1)
Causes genital warts (yes)	132 (77.6)
Vaccine is given to boys (yes)	132 (77.6)
Side effect: joint swelling (no)	132 (77.6)
Transmitted through sexual contact (yes)	135 (79.4)
Side effect: redness or pain at injection site (yes)	136 (80.0)
Causes cervical cancer (yes)	149 (87.6)
HPV infects women (yes)	163 (95.9)
Vaccine is given to girls (yes)	166 (97.6)

Don't-know answers were scored as incorrect.

Attitudes

Most parents agreed that awareness campaigns would increase acceptance (88.6%) and that a recommendation from doctors and nurses would encourage them to vaccinate (80.6%) (Table 3). About half agreed that the benefits of the vaccine outweigh its risks (47.6%), while 54.6% said that fear of side effects prevented them from vaccinating their children and 65.5% that their experiences with other vaccines had affected their willingness. The median attitude score was 27 (mean 26.5, SD 5.3), and 183

parents (50.1%) were classified as having a positive attitude. Positive attitudes were more common among parents working in the health sector (74.5%) than among those working in other sectors (45.1%) or not employed (48.1%; $p = 0.002$). Among parents aware of the vaccine, those with a positive attitude had higher knowledge scores (mean 14.8 vs 13.0; $p = 0.003$).

Principal component analysis (Kaiser–Meyer–Olkin = 0.78; Bartlett's test $\chi^2 = 883.0$, $df = 28$, $p < 0.001$) identified two components with eigenvalues of 3.24 and 1.53, together explaining 59.5% of the variance (Supplementary Table S1). The first, vaccine confidence, comprised six statements on timing, necessity, benefits, social media, recommendation by doctors and nurses, and awareness campaigns (Cronbach's $\alpha = 0.79$; mean 21.7, SD 4.3, range 6–30). The second, vaccine concerns, comprised fear of side effects and experiences with other vaccines ($\alpha = 0.71$; mean 4.8, SD 2.1, range 2–10, higher scores indicating fewer concerns).

Table 3
Parents' attitudes towards HPV vaccination

Statement	n	Agree, n (%)	Neutral, n (%)	Disagree, n (%)
It is better to give the HPV vaccine in adolescence than at premarital counselling	368	206 (56.0)	71 (19.3)	91 (24.7)
The HPV vaccine is not necessary to protect my children's health in the future	368	80 (21.7)	86 (23.4)	202 (54.9)
The health benefits of the HPV vaccine outweigh any potential risks	368	175 (47.6)	148 (40.2)	45 (12.2)
Information received through social media encourages me to vaccinate	368	180 (48.9)	92 (25.0)	96 (26.1)
Recommendations from doctors and nurses encourage me to vaccinate my children	366	295 (80.6)	34 (9.3)	37 (10.1)
Awareness campaigns about HPV will help increase acceptance of the vaccine	367	325 (88.6)	19 (5.2)	23 (6.3)
Fear of side effects prevents me from vaccinating my children	368	201 (54.6)	84 (22.8)	83 (22.6)
My experiences with other vaccines have affected my willingness to vaccinate against HPV	368	241 (65.5)	44 (12.0)	83 (22.6)

Agree combines agree and strongly agree; disagree combines disagree and strongly disagree.

Acceptance and willingness

Only 81 parents (22.0%) had been offered the vaccine for one of their children. Of the 80 who reported their decision, 56 (70.0%) had accepted it, most often because of the Ministry of Health's recommendation (53/56, 94.6%) or because they considered it important for their child's health (51/56, 91.1%). Among parents who had declined, the most common reasons were fear of side effects (22/23,

95.7%), the belief that the vaccine was not important for their child (16/23, 69.6%), a bad experience with a previous vaccine (15/23, 65.2%) and not having been told it was needed (13/23, 56.5%). Only 26 of 67 offered parents (38.8%) said they had been given information about the vaccine. Among the 184 parents with at least one child aged 12 to 17 years, 72 (39.1%) had been offered the vaccine, compared with 9 of the 184 (4.9%) whose children were all younger. Acceptance was 85.7% among fathers and 63.8% among mothers ($p = 0.095$).

Of the 285 parents who had not been offered the vaccine, 172 (60.4%) said they would accept it. Almost all of them cited trust in the Ministry of Health's recommendations (167/171, 97.7%) and the importance of the vaccine for their child's health (164/171, 95.9%). Among unwilling parents, concerns about side effects were nearly universal (103/110, 93.6%), followed by a bad experience with a previous vaccine (75/107, 70.1%) and the belief that the vaccine was not important (74/108, 68.5%) (Fig. 1).

Factors associated with willingness

On bivariate analysis, willingness was higher among parents with a positive attitude (84.8% vs 37.9%; $p < 0.001$), parents who had heard of the vaccine (70.3% vs 54.9%; $p = 0.011$) and parents attending the Jidhafs centre (76.0% vs 50.0%–58.3% elsewhere; $p = 0.009$). It did not differ by sex, education, employment, income or marital status (Table 1).

Among individual attitude statements, willingness was higher among parents who preferred vaccination in adolescence rather than at premarital counselling (81.4% vs 34.9%) and among those who said a recommendation from doctors and nurses would encourage them (71.0% vs 14.8%), and lower among those who said fear of side effects prevented them from vaccinating (45.9% vs 78.6%; all $p < 0.001$).

In the multivariable model (281 parents, 170 willing), both attitude subscales were independently associated with willingness: each standard deviation increase in vaccine confidence was associated with nearly six times the odds of willingness (adjusted OR 5.81 (3.45–9.77)), and each standard deviation of fewer vaccine concerns with more than twice the odds (adjusted OR 2.44 (1.66–3.58)) (Table 4). No sociodemographic factor was significantly associated with willingness after adjustment. Willingness tended to be higher at the Jidhafs centre (adjusted OR 2.43 (0.93–6.32); $p = 0.069$), and prior awareness of the vaccine was no longer associated with willingness (adjusted OR 1.38 (0.64–2.99)). The model discriminated well (AUC = 0.87; McFadden pseudo- $R^2 = 0.36$), was well calibrated (Hosmer–Lemeshow $\chi^2 = 7.58$, $df = 8$, $p = 0.48$) and showed no important collinearity (maximum variance inflation factor 2.03).

Among parents aware of the vaccine who had not been offered it, willingness was 83.7% in those with good knowledge, compared with 58.1% with fair and 57.1% with poor knowledge ($p = 0.017$). Each additional point on the knowledge score was associated with higher odds of willingness (OR 1.17 (1.04–1.31)), but this association was not significant after adjustment for the two attitude subscales (adjusted OR 1.12 (0.94–1.33); $p = 0.21$; $n = 98$).

Table 4

Factors associated with willingness to vaccinate among parents not yet offered the vaccine: logistic regression (n = 281; 170 willing)

Factor	Crude OR (95% CI)	Adjusted OR (95% CI)	p (adjusted)
Vaccine confidence (per SD)	5.47 (3.52–8.48)	5.81 (3.45–9.77)	< 0.001
Fewer vaccine concerns (per SD)	2.58 (1.89–3.51)	2.44 (1.66–3.58)	< 0.001
Age 35–44 years (vs < 35)	0.55 (0.32–0.96)	0.63 (0.30–1.30)	0.210
Age ≥ 45 years (vs < 35)	0.62 (0.30–1.29)	0.69 (0.24–1.99)	0.495
Mother (vs father)	1.06 (0.62–1.82)	0.85 (0.39–1.83)	0.672
University education (vs lower)	0.99 (0.61–1.63)	0.70 (0.32–1.54)	0.377
Works in health sector (vs other)	1.74 (0.80–3.78)	0.34 (0.11–1.08)	0.066
Income 500–1000 BD (vs < 500)	0.88 (0.50–1.57)	0.63 (0.29–1.35)	0.233
Income > 1000 BD (vs < 500)	1.27 (0.66–2.43)	1.20 (0.44–3.29)	0.726
Had heard of the vaccine	1.93 (1.15–3.26)	1.38 (0.64–2.99)	0.414
Halat Bu Maher (vs Yusuf Engineer)	1.20 (0.57–2.51)	1.62 (0.57–4.61)	0.367
Jidhafs (vs Yusuf Engineer)	3.06 (1.46–6.41)	2.43 (0.93–6.32)	0.069
A'ali (vs Yusuf Engineer)	1.44 (0.74–2.77)	1.14 (0.48–2.74)	0.763

OR, odds ratio; CI, confidence interval; SD, standard deviation. Attitude subscales are standardised; higher concern-subscale scores indicate fewer concerns. AUC = 0.87; McFadden pseudo- R^2 = 0.36; Hosmer–Lemeshow p = 0.48.

Sensitivity analyses

The association between attitude and willingness was consistent across all sensitivity analyses (Supplementary Table S2). It was strongest when attitude was dichotomised at the median (adjusted OR 9.72 (5.20–18.20)) or entered as the total score (adjusted OR 8.94 (5.07–15.77) per SD) and remained strong when only the four statements least related to the decision were used (adjusted OR 4.37 (2.85–6.70) per SD). For the combined outcome, 224 of 359 parents (62.4%) had accepted or were willing, and both vaccine confidence (adjusted OR 6.06 (3.83–9.59)) and fewer concerns (adjusted OR 2.69 (1.91–3.80)) remained associated. The higher willingness at the Jidhafs centre reached statistical significance only in the median-split model and the combined-outcome model, and the lower willingness among parents aged 35 to 44 years, seen in the median-split model (adjusted OR 0.51 (0.26–0.98)), was not present in any other model.

Discussion

This is the first study of parents' knowledge, attitudes and acceptance of HPV vaccination in Bahrain since the vaccine was added to the national programme. Most parents were open to vaccination: seven in ten of those offered the vaccine had accepted it, and three in five of those not yet offered said they would. Fewer than half had heard of the vaccine, many held misconceptions about HPV, and fear of side effects was the dominant reason for hesitancy. Vaccine confidence and the absence of safety concerns were the strongest and most robust correlates of willingness, while knowledge, although associated with willingness, was not independently associated once attitude was taken into account. Parents placed considerable trust in the Ministry of Health and in doctors and nurses, which our companion study suggests is underestimated by primary care physicians.

Acceptance and willingness in context

The willingness we observed (60.4%) is almost identical to the pooled estimate of 61% for the Eastern Mediterranean Region [10] and to recent Saudi studies reporting 56% to 66% [15, 16, 25]. It is also close to the 60% reported among parents in northern Morocco after a national programme was introduced [26] and the nearly two-thirds of Omani adults who said they would accept the vaccine [27]. Globally, parental acceptance varies widely, from 12% to 98% across 86 studies [28], so the Gulf figures sit in the middle of the range. Acceptance among parents who had actually been offered the vaccine (70.0%) was of a similar order. Elsewhere in the region, high stated willingness has coexisted with low uptake [10, 13]. Bahrain appears to be an exception: country estimates list first-dose coverage among girls at 74% in 2024 [7], suggesting that a school-based programme can convert willingness into uptake.

Only 22.0% of our parents had been offered the vaccine. Half had no child old enough to have been included, but even among parents with a child aged 12 to 17 years, only 39.1% reported an offer. This may reflect children who had not yet reached the target grade, recall error, or consent being handled through the school in a way that parents did not register as an offer. Whatever the reason, it suggests that many parents do not experience the school programme as a decision they were asked to make, which limits the opportunity to inform and reassure them.

Awareness and knowledge

Awareness was the clearest gap. Only 46.2% of parents had heard of the vaccine, a figure similar to that among parents in Riyadh (41.3%) [25] and higher than the 23.8% reported among Bahraini adults before or around the time of introduction [23]. In Morocco, too, parental awareness of a new national HPV programme remained very low even where acceptability was high [26]. A school-based programme reaches children efficiently but may leave parents with little information: fewer than two in five parents who had been offered the vaccine in our study said they had received information about it, and lack of information was a common reason for declining.

Among parents who had heard of the vaccine, knowledge was moderate, with a mean of 70% of items answered correctly, but the pattern of errors is informative. Most knew that HPV infects women and causes cervical cancer, but fewer than half knew that it is transmitted through skin contact or causes

mouth and throat cancer, and more than half believed, or were unsure whether, it causes colon cancer. Similar gaps, with HPV understood mainly as a women's infection linked to cervical cancer, have been reported among parents and adults in Riyadh, Jazan and Kuwait [20, 25, 29]. Because Bahrain vaccinates boys as well as girls, it matters that about a quarter of these parents did not know that HPV infects men and a similar proportion did not know that boys receive the vaccine. Parents who see HPV as a female disease may see less reason to vaccinate their sons: in Makkah, only about 40% of parents were highly willing to vaccinate sons, and willingness depended on perceived susceptibility and cues to action [30], and across studies worldwide parents are more accepting of vaccination for daughters than for sons [28]. Knowledge of expected side effects was also incomplete; fewer than half recognised that nausea or dizziness can follow vaccination. Explaining in advance which mild reactions are common may prevent them from being interpreted as harm when they occur.

Knowledge was higher among parents with more education or a job in health care, as in other Gulf and Arab studies [18, 25, 31], and among parents with a higher income and younger parents. These gradients suggest that information campaigns relying on written or online material may widen existing differences unless they are complemented by direct communication in health centres and schools.

Safety concerns and previous vaccine experiences

Concern about side effects was the main barrier. More than half of all parents agreed that fear of side effects kept them from vaccinating, willingness among these parents was 45.9% compared with 78.6% among the others, and nearly all parents who were unwilling gave side effects as a reason. Saudi parents report the same concern at similar or higher rates [17, 18, 32], as do Omani adults (71.5%) [27], and safety concern is the second strongest correlate of parents' uptake after a physician's recommendation [9]. About two-thirds of our parents said that their experiences with other vaccines had affected their willingness. We did not ask which vaccines, but confidence in routine childhood vaccines declined in some settings after the COVID-19 pandemic [33], and in Saudi Arabia parental hesitancy has been highest for newer, non-mandatory vaccines, including the HPV vaccine, with fathers more hesitant than mothers [34]. The HPV vaccine was introduced in Bahrain soon after the COVID-19 vaccination campaign, and parents' views of it may be coloured by that experience.

Timing, culture and religion

More than half of the parents preferred vaccination in adolescence rather than at premarital counselling, and this preference was strongly associated with willingness (81.4% vs 34.9%). In 2019, adults attending primary care in Bahrain more often preferred vaccination before marriage (41.7%) than at school age (34.1%) [22]; although the populations differ, the balance may have shifted since the programme was introduced. The view that HPV vaccination belongs at marriage reflects the belief that children are not at risk until then, which Saudi parents have also given as a reason for refusal [35]. A few parents in our study wrote that the vaccine was unnecessary in an Islamic or conservative society. A scoping review of studies from Islamic countries found that beliefs about promiscuity, infertility and religious incompatibility contribute to hesitancy [36], yet Omani parents and adults showed high acceptance and

supported vaccinating both boys and girls [27]. Presenting the vaccine as cancer prevention that works best before any possible exposure, and involving trusted religious and community voices, may help to address these concerns [36].

Attitude rather than knowledge

Attitude rather than knowledge distinguished willing from unwilling parents. Knowledge was higher among parents with a positive attitude and was associated with willingness on its own, but its association disappeared after adjustment for attitude. The attitude scale had two separate components, confidence in the vaccine and concerns about its safety, and each was independently associated with willingness. This distinction matters for practice: building confidence through trusted recommendation and addressing safety concerns directly are complementary tasks, and neither can substitute for the other. The association held when the statements closest to the decision itself were removed, so it is unlikely to be explained simply by overlap between the attitude items and the outcome. This fits a broader body of evidence that what people think and feel about vaccines predicts vaccination more consistently than factual knowledge, and that interventions which only provide information rarely change behaviour [37]. Studies of parents in Saudi Arabia and Kuwait using the Health Belief Model similarly found that perceived benefits, perceived susceptibility and cues to action, rather than knowledge alone, predicted willingness [20, 30]. In practical terms, telling parents more facts about HPV is unlikely to be enough; communication needs to address their concerns about safety and their sense of whether the vaccine is necessary for their child.

Sources of information and trusted messengers

Social media and internet searches were parents' main sources of information about the vaccine, and fewer than two in five had heard about it from doctors or hospitals, which is consistent with Saudi reports [15, 32]. Half the parents said that information on social media encouraged them to vaccinate, but this was not associated with willingness (64.0% vs 56.8%; $p = 0.26$). Social media can carry both accurate and misleading information, and expert groups recommend that health authorities provide culturally appropriate material in local languages and coordinate the information that reaches both professionals and the public [38].

Parents placed considerable trust in health professionals and in the Ministry of Health. Four in five said that a recommendation from doctors and nurses would encourage them; willingness was 71.0% among these parents and 14.8% among the rest. Almost every willing parent cited trust in the Ministry's recommendations, and most parents who had accepted the vaccine said they did so on the Ministry's advice. Provider recommendation is consistently the strongest predictor of HPV vaccine uptake [9, 39], and in Saudi Arabia a recommendation from the Ministry of Health was associated with six times the odds of acceptance [16]. Lack of a doctor's recommendation was also a leading reason for not vaccinating among Lebanese parents [40].

Our companion survey of primary care physicians in Bahrain found that fewer than one in three believed parents usually accept the vaccine, and only about a third recommended it regularly [41]. Taken together,

the two studies suggest that physicians underestimate parents' openness, a pattern also described in the United States [42]. Sharing local evidence of parental acceptance with physicians may correct this impression. A brief, presumptive recommendation, which assumes that parents will agree, increases HPV vaccine initiation [43], and many parents who initially decline later accept after follow-up counselling [44]. Because students who miss the school campaign are referred to health centres for their doses, primary care is also where hesitant parents are most likely to be seen.

Mothers and fathers, health centres and age

Three-quarters of the participants were mothers. Knowledge did not differ between mothers and fathers, and willingness among parents not yet offered the vaccine was similar (60.5% vs 59.5%). Among parents who had been offered it, fathers accepted more often than mothers (85.7% vs 63.8%), but the difference was not significant and rests on 21 fathers. Studies in Saudi Arabia and Lebanon have found mothers more knowledgeable or more accepting than fathers [18, 35, 40], and a Saudi review reported greater hesitancy among fathers [34]. Since either parent may make the decision, information should be designed to reach both.

Differences between health centres and age groups were not robust. Willingness tended to be higher at the Jidhafs centre, but this reached statistical significance in only two of five models and may reflect local outreach, the interviewer or unmeasured characteristics of the catchment population. The lower willingness among parents aged 35 to 44 years appeared only when attitude was dichotomised and disappeared when attitude was measured in full, suggesting that it reflected residual differences in attitude rather than an effect of age. Neither finding should be interpreted without confirmation in a larger, probability-based sample.

Implications for practice and research

Our findings have practical implications. Information for parents should accompany the school consent process and address safety directly, describing the common mild reactions and using the Ministry of Health's name, which parents trust. The message should make clear that the vaccine protects boys as well as girls and that it works best before any possible exposure. Primary care doctors and nurses, whom parents also trust, should be briefed on the programme, made aware of how often parents accept it, and encouraged to raise the vaccine during routine visits and catch-up appointments. Educational interventions designed to change attitudes increased mothers' intention to vaccinate in a Saudi randomised trial [45], and structured parent education improved acceptability in Makkah [46]; such approaches could be adapted for Bahrain and evaluated.

Further research should explore the reasoning of hesitant parents through qualitative interviews, include fathers and non-Bahraini families, examine whether parents' willingness differs for sons and daughters, and link survey responses to vaccination records so that actual uptake, rather than reported acceptance, can be measured.

Strengths and limitations

The study included parents from all four governorates, used interviewer administration with a validated Arabic questionnaire, distinguished actual acceptance from hypothetical willingness, examined knowledge and attitudes together in a multivariable framework, and tested the main finding in several sensitivity analyses. Its limitations should be considered. The cross-sectional design does not allow causal conclusions. Parents were recruited by convenience sampling at one centre per governorate, only Bahraini parents were included, and parents who do not attend primary care were not represented, so the findings may not generalise to all parents in Bahrain. Face-to-face interviews may have encouraged socially desirable answers. Acceptance was self-reported and could not be verified against vaccination records, and willingness does not always translate into vaccination. Knowledge was assessed only among parents who had heard of the vaccine, limiting the analysis of knowledge to a subgroup. The number of parents who had been offered the vaccine was small, so comparisons among them, such as between mothers and fathers, are imprecise. Willingness was not analysed separately for sons and daughters. The attitude statements were developed for this study, and some are close in content to the decision itself, although the association persisted when these statements were excluded. Finally, the number of outcome events per model parameter was about nine, slightly below the conventional ten, so adjusted estimates for the smaller covariate groups are imprecise.

Conclusions

Parents in Bahrain are generally willing to have their children vaccinated against HPV, but fewer than half know that the vaccine exists and fear of side effects is common. Attitude, not knowledge alone, separated parents who were willing from those who were not. Clear, parent-directed information on safety, delivered alongside the school programme, and active recommendation by primary care doctors and nurses are practical steps to sustain and extend uptake.

Declarations

Data availability statement

The datasets generated and analysed 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 studies involving humans were approved by the Research and Ethics Committee of the College of Medicine and Health Sciences, Arabian Gulf University (reference E20-PI-04-25), the Primary Health Care Research Committee (PHCRC/TOR/0014/2025) and the Primary Health Care Ethics Committee, Ministry of Health, Kingdom of Bahrain (serial no. 43). The studies were conducted in accordance with the local

legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

JAM: Investigation, Data curation, Formal analysis, Project administration, Writing – original draft. FAA: Investigation, Data curation, Formal analysis, Writing – original draft. MAw: Investigation, Data curation, Formal analysis, Writing – original draft. AA: Investigation, Data curation, Formal analysis, Writing – original draft. ZH: Investigation, Data curation, Formal analysis, Writing – original draft. ABS: Conceptualization, Methodology, Supervision, Writing – review & editing. MAAl: Methodology, Resources, Writing – review & editing. AAm: Methodology, Writing – review & editing. SC: Methodology, Data curation, Writing – review & editing. FH: Methodology, Writing – review & editing. BM: Conceptualization, Methodology, Project administration, Supervision, Writing – review & editing. MHS: Conceptualization, Methodology, Formal analysis, Supervision, Writing – review & editing. BM and MHS share senior authorship. All authors 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.

Generative AI statement

The authors declare that Generative AI was used in the creation of this manuscript. Claude (Anthropic, PBC; model Claude Opus 5.5) was used to re-run the statistical analysis in Python from the study dataset, check the knowledge-score key against the raw responses, assist with drafting and language editing, and verify and organise the reference list. It was not used to generate or alter data. The authors checked and verified all analyses, content and citations and take full responsibility for the work.

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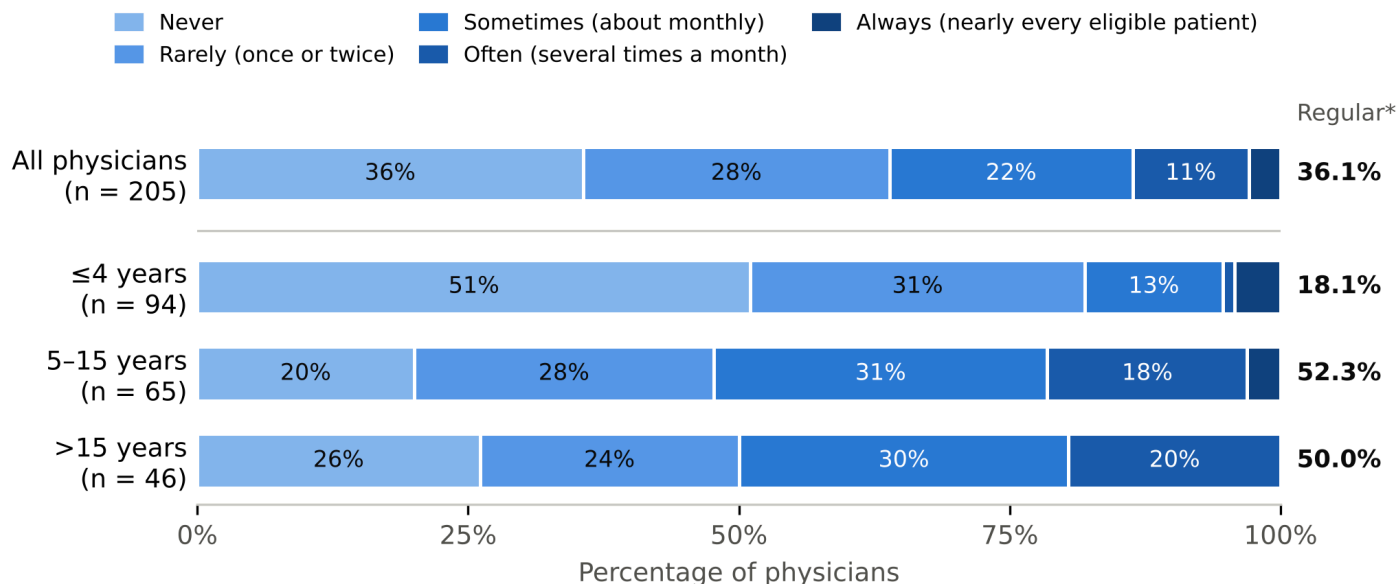
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Figures



*Regular recommendation = sometimes, often or always.

Figure 1

Acceptance and Willingness

(A) Acceptance among parents who had been offered the HPV vaccine for a child and willingness among parents not yet offered it. (B) Reasons given by parents who declined the vaccine and by those who would not accept it if offered; parents could give more than one reason. The question on not being told the vaccine was needed was asked only of parents who had declined.

Supplementary Files

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