

ORIGINAL RESEARCH ARTICLE

Human papillomavirus vaccination readiness, uptake, and perceived barriers among university students in the Pearl River Delta Region: A cross-sectional study

Supplementary File

Table S1. Factor loadings from exploratory factor analysis of the 9 perceived barrier Items (Polychoric correlation matrix, principal axis factoring, oblimin rotation; $n = 275$)

Barrier item	F1	F2
Opposition from family or partner	0.87	–
Belief that men do not need HPV vaccination	0.84	–
Belief that age is not appropriate	0.69	–
Belief that vaccination is unnecessary with a regular partner	0.51	–
Difficulty making appointments or long waiting time	–	0.74
High cost or unaffordability	–	0.72
Concern about vaccine safety or side effects	–	0.53
Insufficient vaccine information or not knowing where to get vaccinated	–	0.42
^a Belief that vaccination is unnecessary without sexual experience	0.11	0.05

Notes: Loadings are shown as absolute values (factor sign orientation is arbitrary). Factor 1 = perceived necessity and social norm barriers; Factor 2 = structural and practical access barriers. ^aItem excluded from the 8-item primary barrier index, which showed low loadings on both factors. Sampling adequacy: KMO = 0.71; Bartlett's test of sphericity $\chi^2 = 705.90$, $df = 36$, $p < 0.001$. Factor correlation $r = 0.23$. Variance explained: Factor 1 = 24.6%, Factor 2 = 17.1%, total = 41.7%.

Table S2. Sex-stratified multivariable multinomial logistic regression for human papillomavirus vaccination readiness and uptake (reference category: no definite short-term intention)

Predictor	Male students (<i>n</i> = 175)		Female students (<i>n</i> = 254)	
	Intending within 6 months	Vaccinated	Intending within 6 months	Vaccinated
Medical vs. non-medical major	1.66 (0.72–3.81), <i>p</i> = 0.236	3.12 (1.24–7.82), <i>p</i> = 0.015*	1.52 (0.64–3.65), <i>p</i> = 0.344	3.66 (1.94–6.92), <i>p</i> < 0.001*
Senior undergraduate/postgraduate vs. junior undergraduate	2.18 (0.94–5.08), <i>p</i> = 0.070	1.95 (0.76–5.03), <i>p</i> = 0.168	1.33 (0.56–3.15), <i>p</i> = 0.514	2.05 (1.08–3.89), <i>p</i> = 0.029*
Sexually active with a regular partner vs. no sexual experience	3.04 (1.31–7.05), <i>p</i> = 0.009*	3.09 (1.14–8.41), <i>p</i> = 0.027*	5.43 (2.10–14.06), <i>p</i> < 0.001*	3.32 (1.54–7.15), <i>p</i> = 0.002*
Sexually active without a regular partner vs. no sexual experience	1.94 (0.52–7.28), <i>p</i> = 0.326	0.93 (0.18–4.90), <i>p</i> = 0.933	6.04 (1.14–32.00), <i>p</i> = 0.034*	5.41 (1.38–21.21), <i>p</i> = 0.016*
Monthly living expenses 2,001–3,000 vs. ≤2,000 RMB	0.65 (0.29–1.45), <i>p</i> = 0.291	3.66 (1.31–10.24), <i>p</i> = 0.013*	0.56 (0.23–1.31), <i>p</i> = 0.179	0.57 (0.30–1.09), <i>p</i> = 0.088
Monthly living expenses >3,000 vs. ≤2,000 RMB	0.82 (0.18–3.66), <i>p</i> = 0.795	10.83 (2.56–45.92), <i>p</i> = 0.001*	0.76 (0.15–3.97), <i>p</i> = 0.749	0.94 (0.27–3.31), <i>p</i> = 0.923
Human papillomavirus knowledge score (13-item, continuous)	1.10 (0.94–1.27), <i>p</i> = 0.227	1.11 (0.93–1.32), <i>p</i> = 0.237	1.09 (0.93–1.27), <i>p</i> = 0.285	1.04 (0.93–1.16), <i>p</i> = 0.464

Notes: Adjusted odds ratios (aORs) are adjusted for all predictors shown in the table. Male and female models exclude the sex variable. The reference outcome category is “no definite short-term vaccination intention.” *Significant associations (*p* < 0.05). The estimate for monthly living expenses >3,000 RMB among male students (OR = 10.83, 95% CI: 2.56–45.92) is based on a small number of students in this stratum (14 of 175) and should be interpreted cautiously. These stratified analyses were exploratory and based on reduced subsample sizes (male, *n* = 175; female, *n* = 254); estimates in sparse strata should be interpreted with caution.

Table S3. Descriptive statistics and internal consistency of the two barrier dimensions identified by exploratory factor analysis (*N* = 275 unvaccinated students)

Barrier dimension	Items	Mean ± standard deviation (1–5 scale)	Cronbach's α
Factor 1: Perceived necessity and social norm barriers	Belief that men do not need human papillomavirus vaccination; family or partner opposition; perceived age inappropriateness; belief that vaccination is unnecessary with a regular partner	2.02 ± 0.84	0.76
Factor 2: Structural and practical access barriers	Difficulty making appointments; high cost; safety concerns; insufficient vaccine information	3.52 ± 0.79	0.67

Notes: Dimension scores were computed as the mean of the constituent items (5-point Likert scale; higher scores indicate stronger perceived barriers). Internal consistency was assessed with Cronbach's α in the same sample used for the exploratory factor analysis (*N* = 275 unvaccinated students with complete barrier-item data). Because the dimensions and their statistics were derived in the same sample, the estimates may be sample-specific and require confirmation in independent samples.

Table S4. Post hoc factor-level multivariable binary logistic regression for definite intention to vaccinate within 6 months among unvaccinated students (*N* = 264)

Barrier dimension (mean score, 1–5)	Adjusted odds ratio	95% confidence interval	<i>p</i> -value
Factor 1: Perceived necessity and social norm barriers	1.13	0.78–1.64	0.530
Factor 2: Structural and practical access barriers	0.58	0.40–0.83	0.003

Notes: Each dimension was entered into a separate multivariable binary logistic regression model adjusted for the same covariates as the primary model (sex, academic major, sexual status, 13-item human papillomavirus knowledge score, grade level, and monthly living expenses). The outcome was coded as 1 = definite intention to vaccinate within 6 months and 0 = no definite short-term intention. These factor-level analyses were post hoc and exploratory; the two dimensions and their scores were derived in the same sample, and the results require confirmation in independent samples.