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Determinants of Human Papilloma Virus (HPV) Vaccine Uptake Among Female Medical Students in the University of Port Harcourt, Rivers State, Nigeria

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Abstract

Background: Human Papilloma Virus (HPV) is a leading cause of Sexually Transmitted Infection (STI), including cervical cancer, which is a very common gynecological cancer globally, yet uptake of the preventive vaccine remains sub-optimal in many developing countries. Despite increasing awareness, socio-demographic, structural, and psycho-social barriers continue to limit vaccination uptake. This study aimed to identify the factors affecting HPV vaccine uptake, exploring the role of knowledge and other influencing factors among female medical students in the University of Port Harcourt, Rivers State, Nigeria.

Methods: A descriptive cross-sectional study with two-stage sampling was employed. An online self-administered questionnaire was completed by 367 undergraduate female medical students at the institution. Data was analyzed using IBM Statistical Product and Service Solutions (SPSS) version 27. Data were summarized using means, frequency, proportions, chi-square and regression analysis; p-values ≤ 0.05 were considered statistically significant.

Results: Knowledge of HPV vaccination was not a significant predictor of vaccine uptake among the respondents. Instead, age and academic level were associated with good knowledge, while accessibility, willingness, and peer influence were the strongest determinants of HPV vaccine

uptake. Logistic regression further confirmed that accessibility and absence of reasons to refuse the vaccine were powerful predictors, underscoring that structural, social, and attitudinal factors outweigh knowledge alone in determining HPV vaccine uptake.

Conclusion: HPV vaccine uptake was influenced more by accessibility, willingness, and peer-related factors than by knowledge alone. Addressing structural and attitudinal barriers alongside health education is critical to improving HPV vaccine uptake.

Keywords: human papillomavirus, uptake, medical students, nigeria, vaccine.

Introduction

Human Papilloma Virus (HPV) is one of the most common sexually transmitted infections (STIs) and remains a major global public health concern, with an estimated annual mortality of about three hundred and fifty thousand (Al Ghamdi, 2022). It remains the fourth most common cancer among women worldwide (Al Ghamdi, 2022; Anni et al., 2024). HPV is associated with several cancers, including cervical, vulvar, anal, penile, and oropharyngeal cancers and approximately seventy five percent of sexually active individuals are likely to acquire HPV at some point in their lives (Anni et al., 2024; Lakneh et al., 2022). Of the more than one hundred HPV genotypes identified, at least thirteen are considered high-risk (Lakneh et al., 2022). Most HPV infections are asymptomatic or subclinical, which facilitates rapid transmission and spread (Lakneh et al., 2022).

According to the World Health Organization (2024), HPV accounted for an estimated seventy thousand new cancer cases in men and six hundred and twenty thousand in women in 2019 globally. Over ninety percent of HPV-related cancers in women are cervical cancers (World Health Organization, 2024). The prevalence of cervical HPV infection is highest in Sub-Saharan Africa (24%), followed by Southeast Asia (14%), Eastern Europe (14%), and Latin America and 16% in the Caribbean (World Health Organization, 2024). In Nigeria, the pooled prevalence of HPV infection is estimated at 32% (CI: 23–41%), but accurate national estimates are limited due to population heterogeneity and variations in diagnostic methods (Anoruo et al., 2022). This high burden is further aggravated by social and economic disparities, poor access to screening and treatment services, and limited national HPV vaccination programs (World Health Organization, 2024).

Vaccination remains one of the most effective strategies for preventing HPV-related diseases, particularly among women who have never been infected (Lakneh et al., 2022). Currently, four prophylactic vaccines exist, targeting high-risk strains: the HPV 16 monovalent, HPV 16/18 bivalent, HPV 16/18/6/11 quadrivalent, and the most recent HPV nonavalent vaccine (HPV 16/18/6/11/31/33/45/52/58) (Patel et al., 2016). The bivalent and quadrivalent vaccines were licensed in 2006 and 2007, respectively, and have significantly reduced the incidence of genital warts and high-grade cervical lesions globally (Patel et al., 2016). Prophylactic HPV vaccines

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have demonstrated high efficacy against high-risk HPV genotypes, and the World Health Organization (WHO) recommends vaccinating girls aged 9–14 years as the primary target group, with females aged 15 years and above as the secondary group (Lakneh et al., 2022; Patel et al., 2016). However, uptake rates vary widely across countries, ranging from less than five percent to as high as eighty-six percent (Patel et al., 2016). In Nigeria, poor vaccine uptake is influenced by multiple factors, including inadequate knowledge, cultural misconceptions, and poor access to vaccination services (SABIN, 2024).

Emerging international evidence demonstrates that HPV vaccine uptake is shaped not only by knowledge but also by structural accessibility, social influence, and attitudinal readiness (Wang et al., 2024). Systematic reviews and multi-country studies conducted between 2016 and 2025 show that accessibility, healthcare system integration, social norms, perceived susceptibility, and vaccine confidence are consistently stronger predictors of uptake than awareness in isolation (Dawud et al., 2023; Den'o et al., 2025). Research across sub-Saharan Africa and Asia further indicates that intention to vaccinate is significantly shaped by peer influence, perceived barriers, and institutional availability of services, highlighting the role of structural and interpersonal factors (Kutz et al., 2023; Agimas et al., 2024; Shi et al., 2025). These findings align with behavioural models such as the Health Belief Model and the 5C model of vaccine hesitancy, which emphasize the importance of perceived barriers, confidence, social norms, and structural constraints in determining vaccination behaviour (Betsch et al., 2018).

University students, particularly female medical undergraduates, represent an important population for study because they fall within the recommended vaccination age group, are often sexually active, and serve as future health advocates. While several Nigerian studies have examined awareness of HPV, limited research has systematically explored the effect of knowledge and other influencing factors on the uptake of HPV vaccine among female undergraduates in South-South, Nigeria. Understanding the determinants of HPV infection and vaccine uptake can guide the development of effective interventions to improve vaccination coverage and reduce HPV-related disease burden.

The study, therefore, examined determinants of HPV vaccine uptake, with particular emphasis on the role of knowledge and other influencing factors among female undergraduate medical students in the University of Port Harcourt, Rivers State, Nigeria.

Methods

Study Design

A descriptive, cross-sectional study design was employed for this study.

Study Setting

The study was carried out at the University of Port Harcourt, a tertiary institution located between latitude 4.09069°N and longitude 6.9170°E in Choba, Rivers, Nigeria (Wikipedia

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contributors, 2022). It is surrounded by the Aluu community, Alakahia community, and Choba community (Wikipedia contributors, 2022). The University of Port Harcourt has 3 campuses (Abuja, Delta, and Choba respectively), 14 faculties, and over 60 departments, with over 60,000 students (Wikipedia contributors, 2022).

Study Participants

The participants for this study included female undergraduate medical students of the University of Port Harcourt.

Sample Size

In order to get the minimum sample size, a prevalence rate (p) of knowledge of HPV infection (33.6%) was estimated from a previous study that was carried out among female undergraduate students in Rivers State, Nigeria (Ojimah & Omosivie, 2017). The minimum sample size was determined using Cochran's formula (Asenahabi & Ikoha, 2023): $n= (Z^2 P.q) / e^2$

Where n=sample size; e=error tolerance (level) or margin of error set at 0.05; p = sample proportion = 0.336; q = 1-p = 0.64; z-score value found on the z-score table (1.96).
The estimated sample size after adjusting for non-response using a rate of 10% was 367.

Sampling Techniques

This study employed a two-stage sampling technique to select participants from the College of Medicine at the University of Port Harcourt. The College of Medicine at the University of Port Harcourt comprised 518 female undergraduate medical students out of a total of 1056 students across 100 to 600 levels.

In the first stage, a proportional allocation type of stratified random sampling technique was utilized to select the female students from each class. The female students were stratified by their respective classes, with the number of female students in each class being 61 in the 100 level, 85 in the 200 level, 157 in the 300 level, 64 in the 400 level, 51 in the 500 level, 43 in the 600A level, and 57 in the 600B level. To determine the sample size for each stratum, the formula (number of female students in the class/total number of female students) x sample size was applied. This calculation yielded the following expected sample sizes: 43 students from the 100 level, 60 from the 200 level, 111 from the 300 level, 45 from the 400 level, 36 from the 500 level, 32 from the 600A level, and 40 from the 600B level.

The second stage involved the random selection of participants from each class. An online random number generator was used for this purpose. The serial numbers of all female undergraduate medical students in each class were obtained, and the range of serial numbers (from the lowest to highest) was inputted into the generator along with the expected sample size for each class. The generator then randomly selected the required number of serial numbers, and the students corresponding to these serial numbers were chosen for the study. This process was

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repeated for each class, ensuring a representative and random sample of female undergraduate medical students.

Study Instruments

The instrument was a semi-structured self-administered questionnaire. The questionnaire, developed in English language, underwent expert validation for clarity and completeness. A pretest among 20 female non-medical students identified errors and areas for modification, informing the final version of the questionnaire. The questions to assess knowledge were derived from questions from previous related studies. The questionnaire was divided into three sub-sections with a brief introduction of the study and the principal investigators. The first section covered the sociodemographic information of the participants, the second section covered the level of knowledge of HPV infection and vaccination, and the third section assessed the uptake of HPV vaccine among the respondents. The questionnaire was designed using Google Forms and distributed online. The aim of the research was explained to the students, as well as instructions on how to fill out the questionnaire. The link was then sent to each respondent, and each respondent was followed up until all the responses were received.

Data Analysis

The data were cleaned by inspecting the questionnaires for completeness and analyzed using IBM Statistical Product for Service Solutions (SPSS) version 27. Numerical variables were summarized as means and standard deviations, while categorical data was summarized using proportions and percentages. The association between categorical variables was analyzed using the chi-square test (or Fischer's test, when necessary) and bi-variate logistic regression analysis to characterize the dependence of each response variable on the explanatory variable and also describe the outcome or response variable. A P value < 0.05 was considered statistically significant.

Study Duration

The study was carried out from July 2024 to December 2024

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Results

Table 1: Socio-demographic characteristics of the respondents (N = 367)

Variables	Frequency (n)	Percentage (%)
Age (Years)		
15-20	164	44.7
21-25	182	49.6
26-30	20	5.4
>30	1	0.3
Level		
100	43	11.7
200	60	16.3
300	111	30.2
400	45	12.3
500	36	9.8
600A	32	8.7
600B	40	10.9
Religion		
Christian	364	99.2
Islam	1	0.3
Polytheist	1	0.3
None	1	0.3
Ethnicity		
Edo	10	2.7
Igbo	136	37.1
Ijaw	36	9.8
Ikwerre	48	13.1
Isoko	5	1.4
Ogoni	23	6.3
Urhobo	21	5.7
Yoruba	19	5.2
Others	69	18.8
Marital Status		
Married	1	0.3
Single	366	99.7

A total of 367 undergraduate medical students participated in the study. The majority were aged 21-25 years (182, 49.6%), followed by 15-20 years (164, 44.7%). The table showed that 364 (99.2%) of respondents were Christians, 1 (0.3%) was Muslim, and 1 (0.3%) was polytheist, and 1 (0.3%) was neither Christian nor Muslim. The table also illustrates the ethnicity of the respondents, of which majority, 37.1% (136), were Igbos, followed by the Ikwerre (48, 13.1%), with the Isoko tribe having the least population (5, 1.4%). The majority of the respondents were

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single (366, 99.7%), while only one respondent was married (1, 0.3%). Regarding academic level, the highest proportion was in the 300 level (111, 30.2%), followed by the 200 level (60, 16.3%).

Table 2: Association between Knowledge of HPV Vaccination and Vaccine Uptake

Vaccine Uptake	Good Knowledge n (%)	Poor Knowledge n (%)	X^2	p-value
No	128 (38.0)	209 (62.0)	0.254	0.615
Yes	10 (33.3)	20 (66.7)		

Note. P < 0.05 considered statistically significant.

The table shows that there is no statistically significant association between knowledge of HPV infection and vaccination and uptake of the HPV vaccine.

Table 3: Descriptive factors related to HPV Vaccine Uptake

Variables	Frequency (n)	Percentage (%)
Provider of HPV vaccines		
Government	300	81.7
Health workers	61	16.6
Parents	9	2.5
School authority	34	9.3
Individual	11	3.0
Awareness of HPV vaccination location		
No	179	48.8
Yes	188	51.2
Willingness to receive HPV vaccine		
No	85	23.2
Yes	282	76.8
Any reason for refusing HPV vaccine		
No	260	70.8
Yes	107	29.2
Influence of recommendations on HPV vaccine reception		
Health workers	176	48.0
Parents	174	47.4
Friends	7	1.9
Religious leaders	5	1.4
Teachers	5	1.4

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Most respondents believe that the government (300, 81.7%) and health workers (61, 16.6%) should provide the vaccines. The majority of the respondents (282, 76.8%) are willing to receive the vaccine. Health workers (176, 48.0%) and parents (174, 47.4%) were the most frequently reported influential sources of recommendation. More than half of respondents (188, 51.2%) reported awareness of vaccination location.

Table 4: Association between Sociodemographic Characteristics and Knowledge of HPV Vaccination

Variables	Good Knowledge n (%)	Poor Knowledge n (%)	X^2	p-value
Age				
15-20	44 (26.8)	120 (73.2)	19.30	0.000*
21-25	80 (44.0)	102 (56.0)		
26-30	13 (65.0)	7 (35.0)		
>30	1 (100.0)	0 (0.0)		
Level				
100	14 (32.6)	29 (67.4)	47.25	0.000*
200	11 (18.3)	49 (81.7)		
300	28 (25.2)	83 (74.8)		
400	22 (48.9)	23 (51.1)		
500	17 (47.2)	19 (52.8)		
600A	25 (78.1)	7 (21.9)		
600B	21 (52.5)	19 (47.5)		
Religion				
Christian	137 (37.6)	227 (62.4)	2.86	0.413
Islam	0 (0.0)	1 (100.0)		
Polytheist	1 (100.0)	0 (0.0)		
None	0 (0.0)	1 (100.0)		
Marital status				
Married	0 (0.0)	1(100.0)	0.604	0.437
Single	138 (37.7)	228 (62.3)		

Note. P < 0.05 considered statistically significant.

Age and level of study of the respondents were significantly associated with knowledge of HPV infection and vaccination ($p < 0.001$). Religion and marital status were not significantly associated with knowledge.

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Table 5: Logistic Regression Analysis of Association between Knowledge of HPV vaccine and the Socio-demographic characteristics of the respondents

Variables	Coefficient (B)	OR	95% CI	p-value
Age				
>20years	0.821	2.273	1.300 - 3.974	0.004*
≤20years *(Reference)*		1		
Level				
100-300	0.396	1.485	0.829 - 2.660	0.183
400-600 *(Reference)*		1		

Note. OR = Odds Ratio; CI = Confidence Interval.

Participants above 20 years were significantly more likely to have good knowledge of HPV vaccination compared to those below 20years of age (OR = 2.273, 95% CI [1.300 – 3.974], p = 0.004). Level of study was not a significant predictor in the adjusted model.

Table 6: Logistic Regression Analysis of Factors Influencing HPV Vaccine Uptake

Variables	Coefficient (B)	OR	95% CI	p-value
Provider of HPV vaccines				
Others	0.137	1.147	0.305 - 4.306	0.839
Government (Reference)		1		
Awareness of HPV vaccination location				
No	2.498	12.154	3.203 - 46.117	0.0001*
Yes (Reference)		1		
Willingness to receive HPV vaccine				
No	2.110	8.246	1.622 - 41.913	0.011*
Yes (Reference)		1		
Previous HPV vaccine status of individuals				
Classmates	1.556	4.741	1.671 - 13.452	0.003*
Friends/Family (Reference)		1		
Reason for refusal of HPV vaccine				
Yes	3.480	32.455	10.960-96.106	0.0001*
No (Reference)		1		

Awareness of vaccination location, willingness to receive the vaccine, prior vaccination and absence of reasons for refusal of HPV vaccine were significant predictors of HPV vaccine uptake; however, provider of the vaccine was not.

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Participants who were aware of vaccination location had higher odds of uptake (OR = 12.154, 95% CI [3,203 - 46.117], p = 0.0001). Those willing to receive the vaccine had higher odds of uptake (OR = 8.246, 95% CI [1.622 - 41.913], p = 0.011). Absence of refusal reasons also demonstrated a strong association (OR = 32.455, 95% CI [10.960 – 96.106], p = 0.0001).

Discussion

The study aims to identify the determinants of HPV vaccine uptake by exploring the role of knowledge and other influencing factors among female medical students in the University of Port Harcourt, Rivers State, Nigeria.

Although knowledge was not independently associated with uptake of HPV vaccine in this study, this finding highlights the limitation of purely informational interventions and supports behavioural models suggesting that cognitive awareness alone rarely translates into preventive action. The absence of association between knowledge and uptake may reflect the dominance of perceived barriers over perceived benefits, a core construct of the Health Belief Model (Wang et al., 2024).

Instead, socio-demographic factors such as age and academic level were more strongly associated with knowledge. Older students and those in higher academic levels were significantly more likely to have good knowledge, most likely due to increased academic exposure and more years of interaction with medical curricula. This finding aligns with studies conducted in Lagos State, Ekpoma in Edo State, which reported that age and level of study were significant determinants of knowledge of HPV and its vaccine (Oluwole et al., 2019; Isara & Osayi, 2021). Similarly, a study conducted in a Southwestern Nigerian university found that older age and level of study were strongly associated with good knowledge, further reinforcing that maturity and advanced academic exposure enhance awareness (Lawal et al., 2025). These findings suggest that academic progression plays a critical role in shaping awareness, and that younger or lower-level students may require targeted interventions to close this gap.
On the other hand, accessibility, willingness, and peer influence were identified as more influential predictors of actual vaccine uptake.

Accessibility emerged as a strong predictor of uptake, aligning with the “constraints” domain of the 5C model, which emphasizes structural barriers as key determinants of vaccination behaviour (Betsch et al., 2018). Peer influence identified in this study further supports constructs within both the Theory of Planned Behaviour (subjective norms) and the 5C model (collective responsibility) (Wang et al., 2024).

Students who knew where to be vaccinated were 12 times more likely to have received the vaccine, highlighting the importance of clear information on service availability. Similarly, willingness to receive the vaccine and having classmates or family members who had been vaccinated significantly predicted uptake, emphasizing the role of social norms and peer reinforcement. These findings are consistent with the Ugandan study, which demonstrated that

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having a healthcare provider parent, good knowledge, and positive perceptions were associated with uptake, as well as the Ethiopian study which showed that positive attitude and exposure to HPV-related information were strongly associated with vaccination (Bitanho et al., 2023; Lakneh et al., 2022). Systematic reviews across sub-Saharan Africa and East Asia have similarly identified structural access and health system integration as consistent predictors of HPV vaccine uptake (Kutz et al., 2023; Agimas et al., 2024; Shi et al., 2025; Dawud et al., 2023; Den'o et al., 2025). Collectively, these suggest that beyond knowledge, social determinants and attitudinal readiness remain central drivers of vaccine behavior.

The logistic regression in our study further confirmed that accessibility and peer-related factors are crucial. Students without reasons for refusal were more than 30 times more likely to receive the vaccine, underlining the significance of psycho-social and attitudinal barriers. The magnitude of association observed for absence of refusal reasons (OR > 30) suggests a potentially strong attitudinal barrier effect; however, the wide confidence interval indicates possible imprecision, warranting cautious interpretation. This resonates with the study conducted in North Central Nigeria, where sexual activity, prior STI history, and low knowledge levels were predictors of uptake (Onasoga et al., 2025). It also mirrors findings from studies conducted in Rivers State and Ogun State, where marital status, parity, and place of residence were important determinants (Ojimah & Omosivie, 2017; Olubodun et al., 2024). Although the exact predictors vary across contexts, the recurring theme is that structural access, social positioning, and personal attitudes weigh heavily in determining uptake.

An interesting divergence in our findings compared with others is the lack of association between knowledge and uptake. For instance, studies conducted in Uganda and Ethiopia emphasized that good knowledge was positively correlated with uptake (Bitanho et al., 2023; Lakneh et al., 2022). This difference may be explained by the specific study population; as medical students, respondents in our study may have already been exposed to HPV information, thus narrowing knowledge differentials, and leaving other barriers such as access and attitudes to play a stronger role. In contrast, among non-medical populations, variations in knowledge may exert a more pronounced effect on uptake.

These findings support institutional vaccination integration within university health systems and align with WHO's global strategy to eliminate cervical cancer as a public health problem.
Taken together, this study's findings reinforce that determinants of HPV vaccine uptake are multi-layered. Knowledge is essential but not sufficient; accessibility, willingness, peer and family influence, as well as absence of negative perceptions, are stronger predictors of vaccine uptake among female medical undergraduates in Port Harcourt. This underscores the need for a holistic approach to HPV vaccination strategies that integrates awareness with measures to address psycho-social, attitudinal, and structural barriers.

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Limitation of the study

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional study design precludes causal inference. Because exposure and outcome variables were measured simultaneously, it is not possible to establish temporal relationships between determinants and HPV vaccine uptake. Reverse causation cannot be excluded; for instance, students who had already received the vaccine may have subsequently sought additional information, thereby influencing their knowledge level.

Second, the use of a self-administered online questionnaire introduces potential measurement bias. Self-reported vaccination status may be subject to recall bias or social desirability bias, particularly among medical students who may feel professionally inclined to report favorable health behaviours. This may have resulted in overestimation of vaccine uptake or knowledge levels.

Finally, the study was conducted in a single tertiary institution and only included female medical undergraduates. As such, the findings may not be generalizable to non-medical students, male students, adolescents outside university settings, or the broader Nigerian population. External validity should therefore be interpreted within this context.

Despite these limitations, the study provides valuable insight into structural and psycho-social determinants of HPV vaccine uptake among future healthcare professionals in a region with a high cervical cancer burden.

Implication of the findings of the study

The implications of this study are significant for public health and medical education. First, the finding that knowledge alone does not translate into vaccine uptake highlights the need for interventions that go beyond information provision. Educational campaigns should be complemented by strategies that directly address attitudinal and psycho-social barriers, such as fear of side effects, cultural beliefs, and vaccine hesitancy. Second, accessibility emerged as a strong predictor of uptake, underscoring the need for institutional and governmental stakeholders to ensure that HPV vaccination services are readily available, affordable, and visible within university health systems. Third, peer and family influences were shown to be critical; this suggests that leveraging peer educators, student groups, and parental involvement may improve vaccine acceptance. Finally, given that older students and those in higher levels demonstrated better knowledge, medical curricula should integrate HPV education earlier in training to ensure younger students are adequately informed. Overall, the study implies that HPV vaccination strategies targeting medical students—and by extension the wider youth population—should adopt a multidimensional approach that integrates awareness, accessibility, attitudinal change, and social reinforcement to improve uptake rates.

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Conclusion

This study revealed that knowledge alone was not a significant determinant of vaccine uptake; rather, accessibility, willingness, peer influence, and absence of refusal reasons were the strongest predictors of uptake. The findings underscore that structural and social determinants play a more significant role than mere awareness.

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Conflict of interest: None declared

Ethical clearance

Ethical clearance was obtained from the ethical committee of University of Port Harcourt following the laid down protocol. Informed consent was obtained from each of the respondents before proceeding with data collection.

Authors' contributions

All authors were involved in conceptualizing, planning and implementation of the study. All authors contributed to the interpretation of the results, read and approved the final manuscript.

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