

# 子どもの性別による保護者のHPVワクチン知識・接種意思の格差と 予防政策の公平性への示唆

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## Disparities in Parental Knowledge and Intention to Vaccinate Against HPV by Children's Sex: Implications for Equitable Prevention Policy

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### Abstract

Human papillomavirus (HPV) infection is a leading cause of cancers and genital warts in men and women. Although HPV vaccination programs for all genders are widely implemented internationally, limited research has examined parental intention to vaccinate after the Japanese government's reinstatement of active vaccination recommendations for girls and introduction of voluntary vaccination for boys. A cross-sectional survey was conducted between November and December 2024, among parents of 511 junior high school students at a single school, yielding 200 valid responses. Chi-square tests and binary logistic regression analysis were employed to identify factors associated with vaccination intention (previously vaccinated or intention to vaccinate versus negative intention or undecided). Significant predictors of vaccination intention included sibling composition (only sons); information from pediatricians; prior vaccination of daughters' or acquaintances' children; recognition of vaccine effectiveness; the belief that screening alone is sufficient; and recognition of follow-up systems for adverse events. Parental vaccination intention was influenced by trusted medical information, social networks, recognition of vaccine effectiveness/safety, HPV-related knowledge, and child's sex. These findings highlight the importance of gender-neutral information and preventive measures to ensure equitable support for all parents regardless of child's sex.

**Keywords:** HPV vaccination; parental intention; gender differences; vaccine acceptance; Japan

### Introduction

Human papillomavirus (HPV) infection is a leading cause of several types of cancer and genital warts among men and women<sup>1)</sup>. Many countries have implemented gender-neutral HPV vaccination programs to prevent HPV-related diseases among boys and adult men and mitigate HPV transmission to their partners<sup>2,3)</sup>. Especially for adolescents, parental intention plays a critical role in determining vaccination uptake<sup>4)</sup>. Several systematic reviews and meta-analyses have been conducted on factors associated with parental intention to vaccinate adolescent sons against HPV<sup>5,6)</sup>.

Commonly identified determinants include parental knowledge about HPV, perceived benefits of vaccination, and recommendations from health care providers<sup>7-10)</sup>. Research also highlights a persistent gender gap, with lower levels of awareness and intention reported among parents of sons compared with parents of daughters<sup>11)</sup>.

In Japan, evidence on the effectiveness of preventive measures against HPV infection has been increasing. Domestic studies have reported that women are generally more knowledgeable about HPV compared with men, and recommendations from health care providers and vaccination experiences of acquaintances

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are key factors that determine vaccination<sup>12-18</sup>). Furthermore, differences in knowledge, perception, and vaccination intention according to the gender of parents have been observed in the context of HPV prevention for children<sup>19-21</sup>). However, little is known about parental intention to vaccinate adolescent boys in Japan. In 2020, approval was granted for boys to receive the quadrivalent vaccine on a voluntary basis followed by the reinstatement of the active recommendation for girls in 2022. In 2023, the nonavalent vaccine was included in a publicly funded program. Nevertheless, vaccination for boys remains voluntary, with levels of implementation, financial support, and public outreach varying across municipalities<sup>22, 23</sup>). Although a number of municipalities provide partial or complete subsidies, others offer no financial assistance, which results in regional disparities in access to the vaccine<sup>24-26</sup>). Additionally, the lack of effective screening methods for boys leads to concerns that gender differences in preventive interventions may exacerbate health inequities.

Thus, understanding the influence of these policy changes — the reinstatement of the active recommendation for girls and initiation of a voluntary vaccination program for boys — on parental decision-making is critical from a public health perspective. The current study aims to investigate the impact of these policy shifts on parents' intention to vaccinate their sons and daughters in junior high school. It intends to analyze the influences of the resumption of the active recommendation for girls on parental decision-making, and parental responses to the introduction of voluntary vaccination for boys. This study aims to address a crucial research gap and inform future public health interventions and policy recommendations tailored to the Japanese context.

## Method

### 1. Study Design

This cross-sectional observational study aimed to identify factors that influence parents' knowledge and perceptions of HPV infection and their intention to vaccinate their children against it.

### 2. Participants and Data Collection

After obtaining approval from the School Education Division of the A Town Board of Education, an invitation letter introducing the study was distributed to the

parents or guardians of the 511 junior high school students (all grades and sexes) attending School A. Responses were collected using an online questionnaire tool (SurveyMonkey Inc., San Mateo, CA, USA). A total of 205 responses were received (40%), 200 (39%) of which were considered valid and included in the analysis. No financial support for the HPV vaccination of boys was provided in A Town.

### 3. Study Period

November–December 2024.

### 4. Survey Questionnaire

The questionnaire, which was developed specifically for this study and with reference to previous research, covered the following topics:

- 1) **Demographic characteristics:** Parents' age and sex, child's grade, and sibling composition (i.e., only sons, only daughters, or sons and daughters).
- 2) **Sources of HPV-related information:** Public media, websites, health care professionals, social networking services (SNS), local governments, and other sources (multiple responses).
- 3) **Knowledge and perceptions of HPV:** Intention to vaccinate, routes of transmission, populations at risk, vaccine effectiveness, management of adverse events, awareness of cervical cancer screening, and perceived risk of infection; and
- 4) **Experience with and discussion on vaccination:** Experience with HPV vaccination among the respondents' children, siblings, or friends' children, and whether the respondents discussed HPV vaccination with their partner.

### 5. Statistical Analysis

This study used binary logistic regression analysis to identify factors associated with parents' intention to vaccinate against HPV (positive versus negative/undecided). First, Chi-square ( $\chi^2$ ) tests were conducted to determine the association between vaccination intention (dependent variable) and each independent variable; variables with statistically significant differences ( $p < .05$ ) were selected. For analysis, the dependent variable (vaccination intention) was dichotomized: the responses "vaccinated" or "intend to vaccinate in the future" were coded as

positive (1). Meanwhile, the responses “do not intend to vaccinate” or “undecided” were coded as negative/undecided (0), as both indicate the absence of a positive intention to vaccinate. In addition to variables identified using  $\chi^2$  tests, approximately 20 candidate variables were selected for inclusion in logistic regression analysis based on their theoretical relevance as determined by previous studies and the objectives of the current study.

These variables were then assessed for multicollinearity, and only those with a variance inflation factors of  $< 5$  were retained as the independent variables. Furthermore, following the rule of thumb proposed by Peduzzi et al.<sup>27</sup>, variables with the strongest associations based on the significance level in the  $\chi^2$  tests and Cramér’s V were prioritized and subsequently included in the logistic regression model using the forced-entry method. Sibling composition was designated as a categorical variable (i.e., only sons, only daughters, sons and daughters) and converted into two dummy variables, with “sons and daughters” as the reference category. All statistical analyses were performed using SPSS Statistics (Version 30), with significance set at  $p < .05$ <sup>28</sup>.

## 6. Ethical Considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki and approved by the Research Ethics Committee of Ehime Prefectural University of Health Sciences (Approval No. 24-006). All data were collected anonymously. Prior to participation, respondents were provided with written information about the objectives and methods of the study, including the policy for protecting personal information. Informed consent was obtained electronically by having participants check a consent box on the online survey form before proceeding with the questionnaire. The study was implemented in compliance with the relevant ethical principles.

## Results

### 1. Demographic Characteristics of Respondents

Analysis included a total of 200 valid responses. In terms of family composition, 41 (20%), 41 (20%), and 118 (60%) had only sons, only daughters, and sons and daughters, respectively. The majority of respondents were mothers ( $n = 194$ , 97%), followed by fathers ( $n = 4$ , 2%) and grandmothers ( $n = 2$ , 1%). Table 1 presents the

participants’ characteristics (Table 1).

### 2. Intention to Vaccinate Children Against HPV

Among the respondents, 88 (44%) expressed a positive intention to vaccinate their children against HPV (vaccinated at least once or intended to do so in the future), whereas 27 (14%) reported a negative intention to do so (do not wish to vaccinate), and 85 (42%) were undecided (Table 2).

### 3. Sources of Information on HPV Vaccination

The most frequently identified sources of information on HPV vaccination were public media, such as television, newspapers, magazines, and radio ( $n = 139$ , 69.5%), followed by public health centers or educational materials ( $n = 64$ , 32%). Other sources included acquaintances, friends, or family members ( $n = 59$ , 29.5%), notifications from municipalities ( $n = 59$ , 29.5%), school teachers or school health newsletters ( $n = 42$ , 21%), websites (Internet;  $n = 41$ , 20.5%), children’s primary care physicians ( $n = 28$ , 14%), SNS ( $n = 19$ , 9.5%), parents’ primary care physicians ( $n = 16$ , 8%), other health care professionals ( $n = 16$ , 8%), and other sources ( $n = 3$ , 1.5%) (Table 3).

Table 1. Characteristics of Respondents ( $n = 200$ )

Family composition (Children's siblings)	Only sons	41 (20%)
	Only daughters	41 (20%)
	Both	118 (60%)
Grade level of child(ren)	1st grade	77 (35%)
	2nd grade	67 (31%)
	3rd grade	73 (34%)
Age of parents	31~35 years	5 (2%)
	36~40 years	34 (17%)
	41~45 years	67 (33%)
	46~50 years	60 (30%)
	51~55 years	31 (16%)
Questionnaire respondents	56 years and above	3 (2%)
	Mother	194 (97%)
	Father	4 (2%)
	Grand mother	2 (1%)

Table 2. Intention of junior high school students' parents to have their children vaccinated against HPV (n = 200)

		Only sons (n = 41)		Only daughters (n = 41)		Sons and daughters (n = 118)	Total(%)
Positive intention	Vaccinated at least once	0	3	14	24	40	88 (44%)
	Plans to vaccinate	3		10		21	
Negative intention	No intention to vaccinate	5		7		15	27 (14%)
Undecided	No decision	33		10		42	85 (42%)

Table 3. Sources of information on HPV vaccination : Multiple responses (n = 200)

Mass media (TV, newspapers, magazines, radio)	139 (69.5%)
Public health center bulletins or educational materials	64 (32%)
Acquaintances, friends, and family	59 (29.5%)
Individual notifications from municipalities	59 (29.5%)
School teachers or school health newsletters	42 (21%)
Websites	41 (20.5%)
Children's primary care physicians	28 (14%)
SNS (social media)	19 (9.5%)
Parents' primary care physicians	16 (8%)
Healthcare professionals other than primary care physicians	16 (8%)
Others (workplace and neighbors)	3 (1.5%)

Table 4. Knowledge and perceptions regarding HPV (n = 200)

Men can contract HPV infection	Correct	74 (37%)
	Incorrect	126 (63%)
HPV is transmitted through sexual contact	Correct	123 (61%)
	Incorrect	77 (39%)
HPV can cause cancers other than cervical cancer	Correct	37 (18%)
	Incorrect	163 (82%)
HPV infection can cause health problems other than cancer	Correct	71 (35%)
	Incorrect	129 (65%)
HPV vaccine is effective in preventing infection	Agree	105 (52%)
	Non-agree	95 (48%)
HPV-related diseases can be prevented by screening alone, without vaccination	Agree	54 (27%)
	Non-agree	146 (73%)
My children may be at risk of HPV infection	Agree	57 (28%)
	Non-agree	143 (72%)
Adverse events after HPV vaccination are properly managed	Agree	19 (9%)
	Non-agree	181 (91%)

#### 4. Knowledge and Perceptions of HPV and HPV Vaccination

The correct responses to questions on HPV-related knowledge provided by the participants were as follows: men can contract HPV infection (n = 74, 37%), HPV is transmitted through sexual contact (n = 123, 61%), HPV can lead to cancers other than cervical cancer (n = 37, 18%), and HPV can cause other health problems in addition to cancer (n = 71, 35%).

Regarding perceptions, the respondents expressed the beliefs that HPV vaccination can effectively prevent infection (n = 105, 52%), diseases caused by HPV can be

prevented by screening without vaccination (n = 54, 27%), their children are a future risk of HPV infection (n = 57, 28%), and adequate follow-up is available in the case of adverse events following HPV vaccination (n = 19, 9%). (Table 4).

#### 5. Logistic Regression Analysis

##### 1) Overall Model Performance

The binary logistic regression model was statistically significant ( $\chi^2 = 127.900$ ,  $df = 11$ ,  $p < .001$ ) and exhibited high explanatory power (Cox-Snell  $R^2 = 0.472$ ; Nagelkerke  $R^2 = 0.634$ ). The result of the



vaccination were markedly more likely to display a positive intention to vaccinate their children (OR = 62.272, 95% CI: 5.230–741.407,  $p = .001$ ) (Table 5).

#### 4) Differences by Sibling Composition

In terms of sources of information, HPV-related knowledge, and perceptions according to the sex composition of children (only sons versus daughters), several significant differences were observed. Parents of only sons were more likely to report never having obtained information on HPV vaccination ( $p < .05$ ) and were less likely to have received information from their children's primary care physicians ( $p < .05$ ), public health center bulletins or educational materials ( $p < .05$ ), or notifications from municipalities ( $p < .01$ ).

Furthermore, parents of only sons were significantly less likely to be aware that men can be infected with HPV, and HPV is transmitted through sexual contact ( $p < .05$ ). Similarly, they were less likely to perceive that their children may be at risk of HPV infection in the future ( $p < .01$ ) (Table 6).

## Discussion

This study used binary logistic regression analysis and Chi-square tests to identify the factors that influence the intention of parents of junior high school students to have their children vaccinated against HPV. Sources of information, vaccination experiences of acquaintances, perceptions of infection prevention, and children's sex were significantly associated with parental attitudes, which is consistent with the findings of previous studies abroad<sup>7, 29-32</sup>. In particular, understanding of the effectiveness of vaccines, awareness of existing follow-up systems in the case of adverse events, and sibling composition significantly influenced the formation of parents' vaccination intention.

### 1. Trusted Sources of Information and Parental Intention

Parents who received information from their children's primary care physicians tended to exhibit positive attitudes toward HPV vaccination. This finding implies that access to reliable medical information can support parental decision-making, while accurate information may help reduce anxiety and uncertainty. These findings are consistent with those of previous studies demonstrating that information from trusted health care professionals, including primary care

physicians, influences vaccine uptake<sup>33-35</sup>. However, only 14% of the respondents reported receiving information from their children's primary care physicians. This finding underscores importance of strengthening communication with local pediatric practices. In contrast, information from public media sources, such as television, exerted no significant effect on vaccination intention. However, the findings suggest that the effectiveness of information dissemination regarding vaccination may be enhanced when health care professionals utilize public media. Furthermore, the vaccination experiences of close contacts, such as daughters or children of acquaintances, were also significantly associated with the positive attitudes of parents toward HPV vaccination. These results suggest that credible information and experiential knowledge from health care professionals and within reliable social networks can strongly influence parents' trust and motivation to act regarding the vaccination of their children. This trend is consistent with those reported in previous studies abroad and has also been observed in studies conducted in Japan<sup>36</sup>.

### 2. Perceived Effectiveness of Vaccines and Awareness of Follow-up Systems

Parents who acknowledged the effectiveness of the HPV vaccine were significantly more likely to intend to have their children vaccinated. This finding confirms those of previous studies, which indicates that an in-depth understanding of the scientific basis of vaccines plays a crucial role in promoting vaccination behavior<sup>37</sup>. Additionally, parents who perceived that a follow-up system is in place after vaccination are more likely to feel reassured and to express positive attitudes toward vaccination, which indicates that disseminating information on institutional support is also vital. In the present study, only 19 respondents (9%) perceived follow-up systems as adequate, which highlights that low levels of awareness of follow-up measures for adverse events remain a significant challenge.

### 3. Inadequate Understanding of Vaccination as a Primary Measure of Prevention

Conversely, parents who believed that HPV-related diseases can be prevented through screening and perceived vaccination as unnecessary were significantly more likely to hold negative attitudes or be undecided toward HPV vaccination. This finding highlights a misunderstanding of the respective roles of screening and vaccination and a partial understanding of the role

of the HPV vaccination as a primary measure of prevention against HPV infection. While prior research has described misconceptions about the roles of screening and vaccination <sup>38)</sup>, few studies have quantitatively examined this relationship. The current findings underscore the need to prioritize the dissemination of information on the distinct roles of screening and vaccination in public health educational campaigns in the future.

#### **4. Insufficient Information and Awareness Among Parents of Only Sons**

The sex composition of children was also significantly associated with parental vaccination intention. Specifically, parents of only sons were substantially less likely to express a positive intention to vaccinate their sons. This finding is consistent with those of previous international studies reporting that parents of boys are generally less likely to initiate HPV vaccination compared with parents of girls <sup>31, 39)</sup>. Given that the majority of respondents were mothers, it is unlikely that the sex of parents or their relationship with children could explain this trend. Instead, it is plausible that mothers of only sons receive fewer opportunities to access information about HPV <sup>40)</sup>. In fact, mothers of only sons are significantly more likely to report never having received information on HPV vaccination, while fewer of them obtain information from trusted sources such as their children's primary care physicians, public health centers, or local governments. Levels of knowledge about HPV transmission routes and its impact on men were also significantly lower, which is similar to their levels of understanding of their children's potential risk of HPV infection. These findings indicate that parents of only sons may have relatively limited exposure to HPV-related information, which results in an underdeveloped perception of the risk of infection and prevention. This trend typically reflects the continued influence of previous public health policies and education efforts that have primarily focused on girls as the target population for HPV prevention. Consequently, the lack of widespread dissemination of information on HPV among parents of boys, such as the fact that men are also at risk for HPV-related diseases and that vaccines are effective, may limit the current understanding of the need for vaccination within this group.

However, a number of municipalities have recently implemented proactive policies for prevention, such as

subsidizing the costs of HPV vaccination for boys and actively providing information to men and women, which may result in differences in attitudes toward vaccination. Additionally, levels of access to information in these municipalities may be higher than those in regions similar to the one where the survey was conducted, because routine vaccination for boys is not recommended. Therefore, ensuring equitable information dissemination and addressing regional disparities in preventive interventions are critical challenges for public health and policy.

#### **Limitation**

The survey was conducted at one junior high school. Therefore, the geographic coverage was limited, which may affect the generalizability of the results. Given that measures against HPV prevention vary across municipalities, the proposed model may not be universally applicable. Additionally, with a response rate of 39%, potential differences in characteristics or attitudes between respondents and nonrespondents cannot be ruled out, thus indicating potential nonresponse bias. However, given that financial support for HPV vaccination for men in many municipalities in Japan remains uncommon, the data can be likely applied to many other municipalities with similar circumstances. Thus, future studies should conduct surveys on parents from other regions and schools to yield results with greater external validity.

#### **Conclusion**

The findings indicate that parental intentions to vaccinate children against HPV are influenced by individual knowledge and beliefs, including factors such as sources of information, vaccination experiences of acquaintances, dissemination of information by health care professionals, and gender-based disparities in access to information. In particular, the results revealed that, in Japan, parents with only sons displayed significantly low levels of understanding and awareness about the prevention of HPV infection compared with parents with daughters. This result adds to previous studies that underscored gender differences in knowledge and perception, as well as distinct approaches to HPV prevention policies. This disparity may serve to further widen the existing gender differences in the current

preventive measures against HPV infection.

In addition to promoting comprehensive awareness-raising activities that include boys, establishing systems that ensure equitable access to accurate and reliable information for all parents is critical. These extensive and multifaceted approaches are considered indispensable for establishing a system for equitable preventive measures regardless of children's sex. Furthermore, future challenges include the need to continue identifying effective methods for disseminating information to parents of boys and developing approaches for increasing awareness that consider diverse backgrounds such as regional differences and family composition.

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## 要 旨

ヒトパピローマウイルス (HPV) 感染は、男女双方のがんや尖圭コンジローマの主な原因である。多くの国でジェンダーニュートラルな HPV ワクチン接種が進む一方、日本における女子への積極的勧奨再開と男子への任意接種導入後の保護者の接種意思は十分に明らかにされていない。本研究は2024年11～12月に、中学校1校の保護者511名を対象に調査を行い、200名を分析した。 $\chi^2$ 検定および2項ロジスティック回帰分析を実施し、接種意思(接種済み/予定と否定的/未定)に関連する因子を分析した。有意因子はきょうだい構成(男子のみ)、小児科医からの情報、姉妹・知人の子どもの接種経験、ワクチンの有効性の認識、検診のみで十分との認識、接種後フォロー体制の認識であった。保護者の接種

意思是、信頼できる医療情報、社会的ネットワーク、ワクチンの有効性と安全性認識、HPVの知識、子どもの性別に関連しており、ジェンダーニュートラルな情報提供と感染予防対策の整備が重要である。

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### **Conflict of Interest Statement**

The authors declare no conflict of interest.

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### **Data Availability Statement**

The data sets generated and analyzed during the current study are not publicly available due to ethical and privacy restrictions, in accordance with the approval conditions of the institutional ethics committee.