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Original Article



# Cervical screening among Chinese females in the era of HPV vaccination: a population-based survey on screening uptake and regular screening following an 18-year organized screening program

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## ABSTRACT

**Objective:** China has a substantial disease burden of cervical cancer. To further understand preventive measures for reducing cervical cancer in China, this study aimed to correlate screening attendance and regular screening with human papillomavirus (HPV) vaccination among Chinese females.

**Methods:** This prospective questionnaire-based survey recruited Chinese females aged 25 or above in Hong Kong by random digit dialing telephone interviews in 2022. The survey studied women's practice of cervical screening and adherence to regular screening. Variables including HPV vaccination status and attendance of physical check-ups were involved in the questionnaire. Screening uptake and screening adherence were the main outcomes, which were measured as the proportion of women who reported having attended a cervical screening and screened regularly, respectively.

**Results:** Out of 906 valid respondents, the reported cervical screening uptake was over 70% among females aged 30 or above and particularly over 80% among women aged 35–59; however, the uptake was only 46% among those aged 25–29. Adherence to regular screening was 50%–60% across ages 25–59 years and dropped to approximately 40% for women older than 60 years. Both screening uptake and adherence were associated with HPV vaccination, with adjusted odds ratios of 2.37 and 2.23, respectively. A large proportion of regularly screened women may be overscreened for screening more frequently than recommended.

**Conclusion:** Responded Chinese females showed good cervical screening uptake but were moderately adherent to regular screening. Policymakers should emphasize the importance of regular screening and the recommended screening frequency by HPV vaccination status for better healthcare resource use.

**Keywords:** Cervical Cancer; Screening; Vaccination; Human Papillomavirus Viruses; Chinese

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### Conflict of Interest

No potential conflict of interest relevant to this article was reported.

### Author Contributions

Conceptualization: C.H.C.; Data curation: C.H.C.; Formal analysis: C.H.C.; Funding acquisition: C.H.C.; Investigation: C.H.C.; Methodology: C.H.C.; Project administration: C.H.C.; Resources: C.H.C.; Software: C.H.C.; Supervision: C.H.C.; Validation: C.H.C.; Visualization: C.H.C.; Writing - original draft: C.H.C., L.K., W.J.T.; Writing - review & editing: C.H.C., L.K., W.J.T.

### Synopsis

Cervical screening among Chinese females in the era of human papillomavirus (HPV) vaccination: a population-based survey on screening uptake and regular screening following an 18-year organized screening program. Over 70% of respondents attended cervical screenings, reaching the World Health Organization's initiative. Adherence to regular screening was moderate, and overscreening was observed among ever-screened women. HPV-vaccinated females were more likely to attend and adhere to cervical screening. Policymakers should monitor screening adherence for better resource use.

## INTRODUCTION

Cervical cancer is a common cancer among females worldwide, with estimates of over 600,000 new cases and 340,000 deaths in 2020 [1]. Cervical screening which detects precancerous cervical lesions and vaccination against high-risk oncogenic human papillomavirus (HPV) infection, which is the etiological cause of cervical cancer, are effective approaches to reducing cervical cancer incidence [2,3]. In 2020, the World Health Organization (WHO) proposed an initiative to eliminate cervical cancer that aimed to lower cervical cancer incidence to below 4 per 100,000 woman-years [4]. The initiative proposed to meet the targets of 90% HPV vaccination coverage among females by the age of 15 years, 70% screening uptake among women aged 35 and 45 years, and 90% treatment access after diagnosis by 2030.

China suffered from approximately one-sixth of cervical cancer cases globally in 2020 [1]. The estimated age-standardized cervical cancer incidence rate was 10.7 per 100,000 women, which is far higher than the WHO's target (below 4 per 100,000) for cervical cancer elimination [4]. Cervical screening uptake in mainland China was not optimal. In a survey conducted in 2018–2019 [5], approximately 40% of women aged 30–49 years had attended cervical screening (which is an indicator defined by the WHO's noncommunicable disease Global Monitoring Framework) [6]. HPV vaccine uptake was low in mainland China as well; HPV vaccines were not available on the market until 2017–2018 when foreign HPV vaccines were imported [7]. Based on a multicity online survey conducted in 2019, approximately 11% of female college students reported having received HPV vaccines [8]. In 2020, the first Chinese domestic bivalent HPV vaccine was approved for availability on the market in mainland China [9]. The supply of HPV vaccines in mainland China is likely to increase, and the cost of vaccination is expected to decrease. Furthermore, although a nationwide HPV vaccination program is not yet available in mainland China, many provinces/cities (such as Guangdong, Hainan and Fujian provinces) have started regional HPV vaccination schemes for female adolescents [10]. Thus, the uptake of HPV vaccines among females in mainland China will likely increase in the coming years. In 2023, the Chinese government outlined an action plan to speed up the elimination of cervical cancer [11]. The government targets screening 50% of eligible women by 2025 and 70% by 2030. A reliable reference for cervical screening practice in the era of HPV vaccination and the correlation with HPV vaccination status among Chinese women would be worthwhile to investigate for policymakers to establish appropriate public health policies.

Although the use of HPV vaccines was in an early phase in mainland China, HPV vaccines were available in Hong Kong (a special administrative region in Southern China) in 2006

soon after the vaccines were on the markets overseas [12]. Opportunistic HPV vaccination among females or pilot vaccination schemes were available before the implementation of a school-based HPV vaccination for primary five/six schoolgirls in 2019 [13,14]. Moreover, the Department of Health (DH) launched an organized cervical screening program for females aged 25–64 in 2004. A recent household survey conducted by the DH reported that over 53% of women aged 30–49 had attended cervical screenings [15]. Given the moderate cervical screening uptake and that HPV vaccines have been available on the market for more than 15 years in Hong Kong, HPV-vaccinated women may have attended cervical screenings. This may be less likely observed in other mainland China cities where HPV vaccines were on the market for only approximately 5 years. Therefore, we considered the case from Hong Kong to understand the practice of cervical screening in the presence of HPV vaccination among Chinese females. We believed that cervical screening practices among Chinese women in Hong Kong would provide important information for policymakers in China to establish efficient measures for eliminating cervical cancers. In this study, we aimed to correlate screening attendance and adherence to regular screening with demographic characteristics and HPV vaccination status among Chinese females aged over 25 years in the general population of Hong Kong.

## MATERIALS AND METHODS

This cross-sectional study surveyed Chinese females living in Hong Kong in June–August 2022. We recruited eligible women using random-digit dialing of all land-based residential telephone lines. Females who speak Cantonese (attributed to approximately 90%–95% of Chinese females in Hong Kong) [16] were approached. Telephone numbers were randomly generated using known prefixes assigned to telecommunication services providers under the Numbering Plan provided by the Office of the Communications Authority (<https://www.ofca.gov.hk>). Invalid numbers were eliminated according to computer and manual dialing records to produce the final sample. We split the targeted population into eight 5-year age groups, namely, 25–29, 30–34, ..., and 60–64, and ages 65 or above. One hundred women were targeted in each age group for a total sample size of approximately 900 females. The maximum margin of error at a 95% confidence level with a sample size of 100 respondents was 9.8%.

We adopted a questionnaire that we previously used for studying women's practice of cervical screening with telephone interviews [17]. In that survey, 65% and 74% of women aged 25–44 and 45–64 years, respectively, reported having attended cervical screening. The questionnaire included items on the knowledge of cervical cancer and cervical screening, attendance of cervical screening, and personal sociodemographic information. We modified the questionnaire to include items regarding HPV vaccination. The questionnaire was prepared in both English and Chinese. Both sets of questionnaires were back-translated and compared against the original version in the corresponding language, and no major discrepancies were found.

The telephone interview was conducted by an external survey organization. The survey organization also reviewed and piloted the questionnaires and trained interviewers on using the questionnaire. During the calls, interviewers first stated the study information and that the study had been approved by the ethics committee (see **Data S1** and **S2**). Participants usually replied whether to join the survey shortly. However, they could request more time (e.g., 1–3 days) to make the decision and interviewers would call them back later. Participants did not read the questionnaire before the survey started. Participants could

skip the questions or quit the survey if they wished to. The questionnaire was hosted on an online platform (Qualtrics.com) to provide data validation upon data entry. Participants did not have access to the online platform. During telephone interviews, interviewers keyed in participants' responses on the online platform. Interviewers were supposed not to assist or provide opinions that may affect participants' responses.

### 1. Statistical analysis

We stratified respondents into screened and unscreened groups according to their cervical screening practice. We compared respondents' characteristics by screening practice using a  $\chi^2$  test or Fisher's exact test for categorical variables whenever appropriate. We used logistic regression models to quantify the impacts of the determinants on screening attendance and regular screening adherence separately. When multiple potentially statistically significant variables existed, we used the backward elimination approach to select factors to be included in the multivariable model. We considered  $p < 0.05$  to indicate statistical significance. All statistical analyses were performed using R version 4.0.3.

We referred to the Checklist for Reporting of Survey Studies when reporting the findings (**Table S1**) [18].

### 2. Ethics approval

This study was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (reference number UW 22-237). We obtained verbal consent from respondents during telephone interviews.

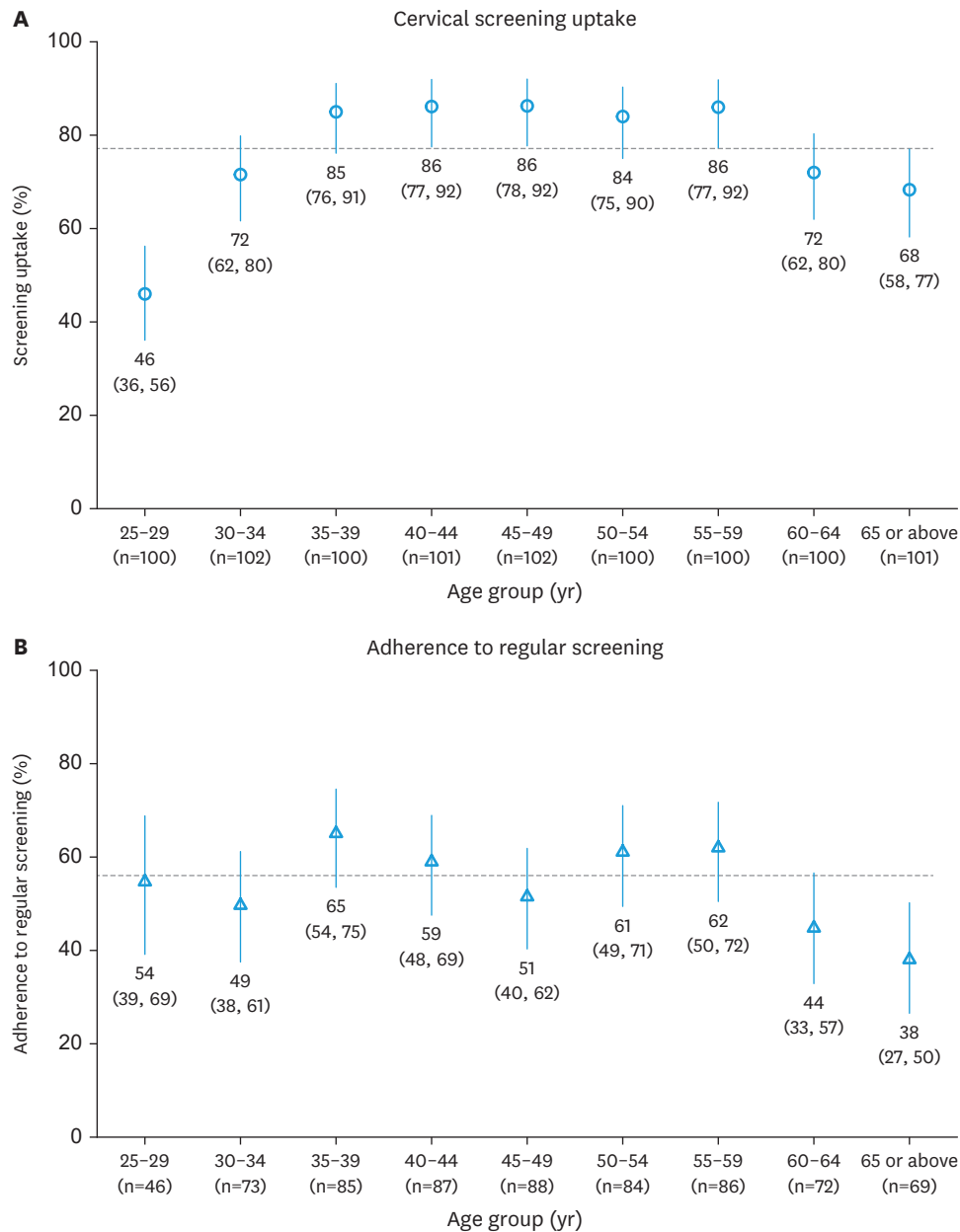
## RESULTS

### 1. Data collection

During the recruitment period, 1,496 eligible ethnic Chinese women aged 25 years or above were approached. Overall, a total of 906 women completed the entire questionnaire. The response rate was 60.6%. Each age group included 100 to 102 eligible women. The data showed good representativeness of the general population (**Table S2**).

### 2. Screening attendance

Out of 906 responding women, 690 reported that they had attended cervical screenings. The corresponding screening uptake was 76.2% (95% confidence interval [CI]=73.2%–78.9%). Screening uptake was the lowest at 46% in the age group 25–29 years, attained a peak at approximately 85% in the age range 35–59 years, and dropped to 70% for ages 60 years or above (**Fig. 1**). The screening uptake among women aged 25–64 years for the ages in the current screening recommendation was 77.1% (95% CI=74.1%–80.0%). The uptake was 82.2% (95% CI=78.1%–85.8%) among respondents aged 30–49 years (the age range for the WHO's monitoring target). Higher screening uptake was reported among women who had experienced sexual activities, had married (including divorced or widowed women), had attended regular physical check-ups, and had higher monthly earnings (**Table 1**). Women who had a family history of cervical cancer ( $n=27$ ) were more likely to attend cervical screening than those who did not (89% vs. 76%), but the difference did not reach statistical significance ( $p=0.18$ ). **Table 1** presents the screening uptake by demographic variable.



**Fig. 1.** Uptake of cervical screening and regular screening by age group. The markers present the estimated screening uptake or adherence to regular screening. The error bars present the corresponding 95% CIs. The gray dashed line presents the overall uptake or regular screening among respondents aged 25–64 years. The numbers below the error bar present the estimated (A) screening uptake or (B) adherence to regular screening; the numbers within the parentheses present the corresponding 95% CIs. The numbers in square brackets at the bottom present the number of (A) valid cases and (B) women who have attended cervical screening in the corresponding age groups. CI, confidence interval.

### 3. Adherence to regular screening

Among women who reported having attended cervical screenings, 374 or 54.2% (95% CI=50.3%–58.0%) of them replied that they had attended screening regularly (**Fig. 1**). The corresponding proportion was approximately 50%–60% among women aged 25–59 years but dropped to 44% and 38% in ages 60–64 and 65 or above, respectively. Monthly income, receipt of HPV vaccines, attendance of physical check-ups, and education level were other factors associated with adherence to regular screening (**Tables S3 and S4**). For women

**Table 1.** Characteristics of respondents by screening uptake

Variables	Overall	Screened (n=690)*	Unscreened (n=216)*	p-value <sup>†</sup>
<b>Age group (yr)</b>				<0.001
25–29	100	46 (46)	54 (54)	
30–34	102	73 (72)	29 (28)	
35–39	100	85 (85)	15 (15)	
40–44	101	87 (86)	14 (14)	
45–49	102	88 (86)	14 (14)	
50–54	100	84 (84)	16 (16)	
55–59	100	86 (86)	14 (14)	
60–64	100	72 (72)	28 (28)	
65 or above	101	69 (68)	32 (32)	
<b>Marital status</b>				<0.001
Unmarried	198	92 (46)	106 (54)	
Married	574	497 (87)	77 (13)	
Widowed/divorced/separated	116	89 (77)	27 (23)	
<b>Education level (highest attained)</b>				0.022
Primary (P1–6) or lower secondary (S1–3)	200	143 (72)	57 (28)	
Upper secondary (S4–6/7) or post-secondary sub-degree	386	311 (81)	75 (19)	
Tertiary (degree) or above	318	234 (74)	84 (26)	
<b>Monthly income (HKD)<sup>‡</sup></b>				0.006
<\$10,000	230	161 (70)	69 (30)	
\$10,000 to <\$25,000	350	263 (75)	87 (25)	
≥\$25,000	293	240 (82)	53 (18)	
<b>Employment status<sup>§</sup></b>				0.041
Working	514	378 (74)	136 (26)	
Non-working	392	312 (80)	80 (20)	
<b>Family history of cervical cancer</b>				0.18
Yes	27	24 (89)	3 (11)	
No	870	659 (76)	211 (24)	
<b>Ever had sex</b>				<0.001
Yes	802	657 (82)	145 (18)	
No	87	22 (25)	65 (75)	
<b>Received HPV vaccines</b>				0.39
Yes	211	166 (79)	45 (21)	
No	694	524 (76)	170 (24)	
<b>Attended physical check-up</b>				<0.001
Yes	517	440 (85)	77 (15)	
No	389	250 (64)	139 (36)	
<b>Born in Hong Kong</b>				0.14
Yes	582	453 (78)	129 (22)	
No	309	226 (73)	83 (27)	

Values are presented as number (%).

HKD, Hong Kong Dollar (1 United States Dollar = 7.8 Hong Kong Dollar); HPV, human papillomavirus.

\*The total percentage may not sum to 100 due to rounding; <sup>†</sup>p-values present the comparison of screening attendance by category for each demographic variable using the  $\chi^2$  test or Fisher's exact test whenever appropriate; <sup>‡</sup>Monthly income included living expenses that were given by family members; <sup>§</sup>Working women (persons with employment) included full-time/part-time employment, self-employed or freelancer.

who reported having regular cervical screening, most attended cervical screening visits at intervals of one and two years (33% and 35%, respectively) and one-fourth (25%) attended cervical screening every three years (the recommended frequency for cytology screening in Hong Kong).

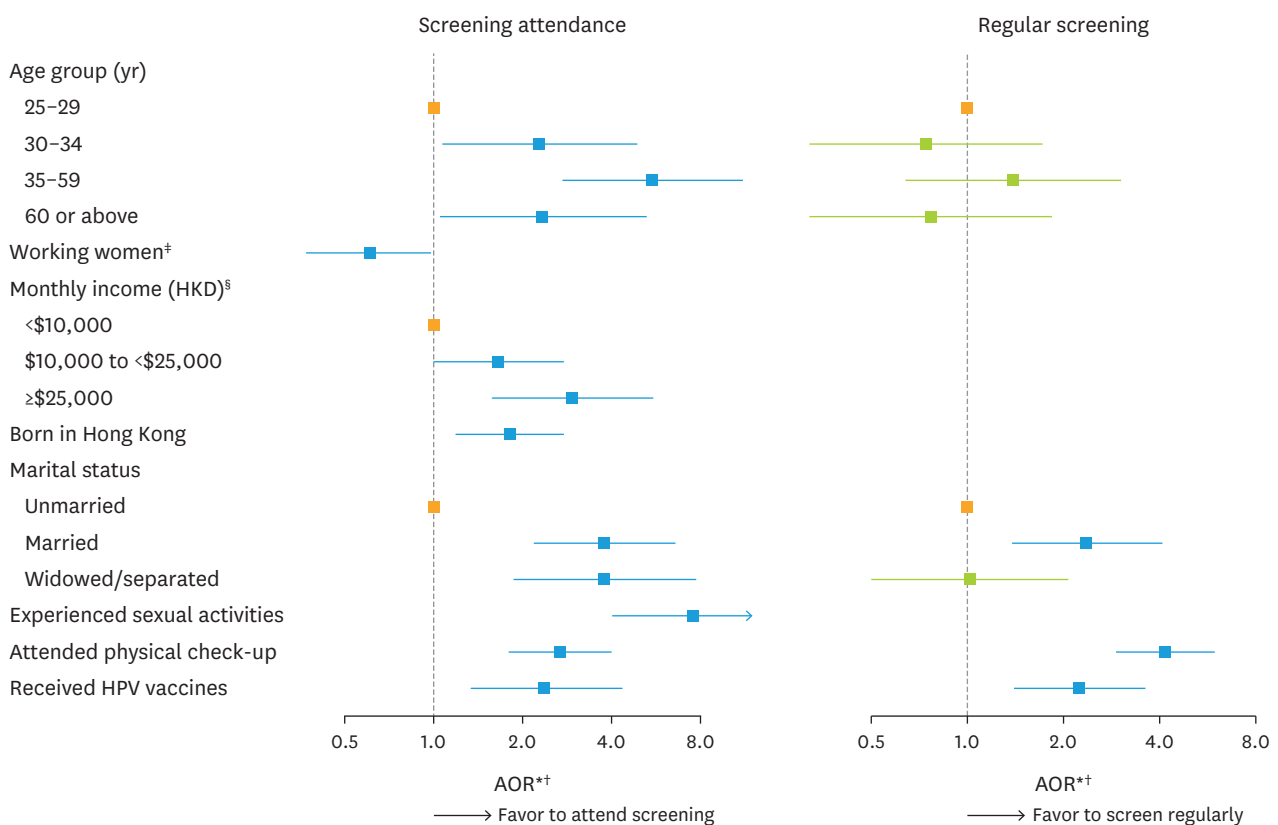
#### 4. Receipt of HPV vaccines

Among all responding women, 23% reported that they had received HPV vaccines. Vaccine uptake was approximately 64% in women aged 25–29 years and gradually decreased to 11% in women aged 50–54 years ( $p < 0.001$ ). Women's cervical screening practice was correlated with

their HPV vaccination status. Among respondents aged 25–34 years (with a vaccine uptake of 55%), 67% of the vaccinated women reported having attended a cervical screening, which was substantially higher than the unvaccinated women (49%), with an odds ratio (OR) of 2.1 (95% CI=1.2–3.9,  $p=0.010$ ). Among respondents of the same age range who had attended screenings, vaccinated women likely screened more regularly (60% vs. 36%; OR=2.6, 95% CI=1.4–6.1,  $p=0.014$ ). However, the regular screening intervals didn't show a significant difference between vaccinated and unvaccinated women ( $p=0.72$ ).

### 5. Predictors of screening attendance and adherence to regular screening

Multivariable logistic regression models (with adjustment for the age of respondents and the use of backward elimination for variable selection) suggested that women who received HPV vaccination and attended physical check-ups were more likely to attend cervical screening and screening regularly (Fig. 2). Among women who received HPV vaccination, the adjusted ORs (AORs) were 2.37 ( $p=0.004$ ) for attending cervical screening and 2.23 ( $p<0.001$ ) for screening regularly (Table S5). Among those who attended physical check-ups, the corresponding AORs were 2.67 ( $p<0.001$ ) and 4.16 ( $p<0.001$ ). Women who were married or widowed/separated were also more likely to attend cervical screening when compared with



**Fig. 2.** Factors influencing (left) cervical screening attendance and (right) regular screening. AOR, adjusted odds ratio; HKD, Hong Kong Dollar (1 United States Dollar = 7.8 Hong Kong Dollar); HPV, human papillomavirus. \*Multivariable logistic regression models were used to estimate the AORs. The models included statistically significant variables that were selected through backward elimination. Left: The model for screening attendance included all respondents. Right: The model for screening adherence to regular screening included respondents who had attended cervical screenings. Working women, monthly income, birthplace, and experience of sexual activities were not statistically significant (with  $p$ -value  $\geq 0.05$ ) in the model for regular screening and therefore were not shown in the plot; <sup>†</sup>Square points and lines represent the AORs and corresponding 95% confidence intervals. Blue and green present AORs that were statistically significant ( $p$ -value  $< 0.05$ ) and insignificant ( $p$ -value  $\geq 0.05$ ), respectively. Orange square points indicate the reference categories for categorical variables. An AOR over 1 indicates that the factor was more favorable to screening attendance or regular screening; <sup>†</sup>Working women included full-time/part-time employment and self-employed/freelancer; <sup>§</sup>Monthly income included living expenses given by family members.



unmarried women, with AORs of 3.78 and 3.76, respectively. However, while married women were also more likely to attend screening regularly (AOR=2.36,  $p<0.001$ ), widowed/separated women did not show a difference in regular screening (AOR=1.02,  $p=0.96$ ) when compared with unmarried women. Employment status, monthly income, and place of birth were other factors that affected attendance at cervical screening but had no statistically significant effect on screening adherence (**Table S5**). The findings of multivariable logistic regression models with all variables considered are presented in **Fig. S1**.

## DISCUSSION

Our study analyzed cervical screening attendance and adherence to regular screening among Chinese females aged 25 years or above in Hong Kong with a representative sample. The reported cervical screening uptake was over 70% among women aged 30 or above, reaching the WHO's initiatives on cervical cancer elimination.[4] However, the screening uptake in women aged 25–29 was only 46%. The estimated screening uptake in our telephone survey (over 80% among women aged 35–64) was higher than the recent household-based survey conducted by the DH (over 55% in the same age range) [15]. Despite different recruitment approaches, both surveys observed a lower screening uptake in younger women (approximately 60% and 30% among aged 25–34 in our and the DH's surveys, respectively) [15]. Furthermore, among those ever-screened women, only 54% reported that they had attended screening regularly. We also found that females who had received HPV vaccines were more likely to attend cervical screening and undergo screening regularly.

Our study provides several insights into policy planning for reducing cervical cancer in the female population in China. First, surveillance of both screening uptake and adherence to regular screening should be implemented. In response to the Sustained Development Goals (SDG) proposed by the United Nations to “ensure healthy lives and promote well-being for all at all ages” (SDG3) [19], it is important to promote not only participation in cervical screening (screening initiation) but also adherence to subsequent screening (regular screening). In Hong Kong, cervical screening uptake increased from approximately 40% (per a population-based survey in 2003) [17] to over 75% (observed in our study) after the organized screening program was commenced for nearly two decades. This supports the effectiveness of implementing and continuing organized screening programs in mainland China for facilitating women to initiate screening [5]. However, regular cervical screening among Chinese females was generally low, at approximately 50%–60% in our study or 35% in a recent meta-analysis of studies of mainland China [20]. In China, the age-specific incidence of cervical cancer attained its maximum of approximately 30 per 100,000 among women aged 45–49 years and remained above 20 per 100,000 for women aged 50–74 years [21]. If women initiated cervical screening at young ages (e.g., at 30–40 years) and did not screen (regularly) afterward, they remained at a high risk of developing cervical cancer or precancerous lesions. This is particularly important when cytology smears are used for cervical screening, which has a sensitivity of approximately 65%–75% in detecting precancerous cervical lesions and cancer cases [22]. High-risk oncogenic HPV testing has a higher corresponding sensitivity of over 90%. HPV-based testing likely detects more precancerous abnormalities and thus prevents more cancer cases when timely treatments are given. The feasibility of self-sampling HPV tests shows the potential to increase screening coverage in China [23]. Health economic analyses also indicated that using HPV-based testing as primary screening would be cost-effective in China [24,25]. Furthermore, following

the implementation of the action plan to improve screening uptake and province-wide HPV vaccination [11], screening and vaccine uptake are expected to increase in China shortly. For example, Guangdong province implemented school-based, free-of-charge HPV vaccination for Secondary 1 girls aged 14 years or below in the fall of 2022 using the domestic bivalent HPV vaccines, with uptake of the first dose over 90% by April 2023 [26,27]. As such, HPV-based testing would be a good alternative screening approach in Chinese settings. In Hong Kong, starting in April 2023, women aged 30-64 would receive HPV testing as primary screening when they attend cervical screening services in clinics operated under the DH [28]. The Chinese government should promote and consider switching to the use of high-risk HPV testing for primary cervical screening in response to WHO's initiative [4].

Second, Chinese policymakers should optimize the integration of electronic healthcare record platforms for assessing cervical screening coverage in the country, where people may be mobile across the country for working and studying. In Hong Kong, women were suggested to register with the Cervical Screening Information System (CSIS) upon attending cervical screening. CSIS is a system for the population-based cervical screening program that helps send reminders to registrants for subsequent screening visits. However, the registration rate was low; only 21% of women aged 25–64 years registered in the CSIS by 2021 [29]. This may be a reason for the suboptimal regular screening adherence found in our study and further efforts should be made to investigate the low screening adherence. On the other hand, our study found that a substantial proportion of women may be screened more frequently than recommended. Overscreening would affect the efficiency, such as resource and human capacity allocation, of an organized screening program and may introduce unnecessary psychological discomfort and financial burdens to screenees. Using electronic healthcare record platforms could help clinicians review previous screening results to provide suitable advice on subsequent screening management for screenees. This could be particularly impactful when screening with high-risk HPV tests in which the recommended screening interval was prolonged to 5 years for screenees who received negative HPV testing results [29]. Therefore, optimization of electronic healthcare record platforms would help clinicians across the entire country to accessible screening history when females shift to work or study in different provinces.

Third, HPV vaccine uptake among screening cohorts should be reviewed to update cervical screening strategies. HPV vaccination was only available locally in mainland China from 2017–2018. Opportunistic HPV vaccine uptake among females was low in mainland China [8]. Given the availability of domestic HPV vaccines in mainland China in 2020, HPV vaccine uptake is expected to increase across the country. A high proportion of vaccinated women will soon reach the age of cervical screening. The current screening recommendation is generally based on the assessment of women regardless of their vaccination status. Our survey found that vaccinated women were more likely to have attended cervical screening and screened regularly than unvaccinated women. As illustrated in our recent cost-effectiveness study, the optimal screening strategies were likely different by vaccination coverage in the age cohort [30]. Among women who have received HPV vaccines, a longer screening interval following negative screening results would likely remain cost-effective on top of HPV vaccination in the vaccinated cohort. Policymakers in China should promote more efficient screening practices to the public based on vaccination coverage in the cohorts. This again highlights the importance of optimizing the implementation of a centralized electronic health record platform for efficiently and accurately recording females' screening practices and subsequently providing more appropriate screening recommendations and management.

In addition to optimizing infrastructure for cervical screening, it is always a high priority to boost screening uptake for cervical cancer elimination, especially in China which has suboptimal screening coverage. We found a substantially lower uptake among younger women aged 25–29 years, most of whom were not yet married. This indicates the need to increase their awareness and knowledge of cervical screening (e.g., women should be screened as long as after sexual debut), which applies to both the Hong Kong and Chinese settings. Our results also suggested that working women were less likely to attend screening or screen regularly. To facilitate screening among them, policymakers may provide incentives to employers to encourage eligible female staff to attend cervical screenings. Moreover, our findings can also serve as evidence support for stakeholders (e.g., non-governmental organizations on women's health) to refer to when they propose their plan to policymakers.

To our knowledge, this is the first study that correlated both cervical screening uptake and adherence to regular screening with HPV vaccination status among Chinese females. Previous studies mostly focused on screening attendance and were usually conducted in the US and European countries [31]. We also estimated HPV vaccine uptake among Chinese female adults who have reached the age of cervical screening, where vaccine uptake in the corresponding age range is generally lacking in the literature. The optimal cervical screening strategy likely correlated with HPV vaccination uptake among screening females. Specifically, a longer screening interval may be preferred in cohorts with high HPV vaccine uptake [30,32]. Our findings provide information for policymakers to consider when updating switching screening recommendations. Moreover, we used a representative sample to study cervical screening practices among women in the general population.

Our study has some limitations. First, the screening practice and HPV vaccination status were based on self-reporting, which may be affected by reporting bias. We recruited women via land-based telephone interviews. The attitudes toward cervical screening among respondents and nonrespondents may be different. Currently, the registration rate for CSIS was only approximately 21% [29]. When compared to self-reporting, a centralized healthcare record system with the integration of various data sources may help provide reliable data to examine the efficiency of screening strategies. This could be more important in mainland China because residents may be more mobile to work or study across distant provinces or cities upon which health records may be lost to follow-up without good management. Second, some factors that may affect women's screening practices were not checked in our survey. For example, clinicians' recommendations and the inclusion of cervical screening in health plans or insurance packages may affect the uptake as well as the frequency of attending cervical screening visits. We didn't ask about obstetrical outcomes among respondents who were mothers or had ever been pregnant. Monti et al. [33] conducted a systematic review and concluded that women treated with cervical intraepithelial neoplasia (CIN) were likely associated with a higher risk of obstetrical outcomes (such as preterm delivery and lower birth weight). The analysis suggested that cervical screening is important to both the general women population and pregnant females who were treated for CIN lesions and clinicians should be careful when reviewing the medical history of these women. Additionally, based on a five-year follow-up study, Giannini et al. [34] found that patients who had positive endocervical margins after CIN treatment may experience a higher risk of recurrence of high-grade lesions. Our cross-sectional survey did not provide sufficient data to analyze the temporal relation between cervical screening/treatment and the recurrence of cervical lesions. This highlights the importance of linking the centralized database of medical records to provide a more complete assessment.

In conclusion, cervical cancer is a common but preventable cancer among females. Our study found that cervical screening uptake has been improved in Chinese women in Hong Kong following population-based organized screening, which was launched 18 years ago. However, the responding women demonstrated only moderate adherence to regular screening. To maximize the health benefits among women in the population, both screening and vaccine uptake should be boosted. In response to the sustainable goal of the United Nations, policymakers should emphasize the importance of screening initiation and adherence. A timely review of screening recommendations, especially when the cohorts that received routine HPV vaccination reach the ages of screening, would be needed.

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## SUPPLEMENTARY MATERIALS

### Table S1

CROSS

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### Table S2

Comparison of the distribution of marital status to the 2021 Population Census\*

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### Table S3

Characteristics of respondents by screening adherence

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### Table S4

Characteristics of respondents by screening performance (unscreened, regularly screened and not regularly screened)

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### Table S5

Multivariable logistic regression models for cervical screening attendance and adherence to regular screening

[Click here to view](#)

**Fig. S1**

Multivariable logistic regression models for cervical screening attendance and adherence to regular screening with all variables considered regardless of statistical significance.

[Click here to view](#)

**Data S1**

Telephone script template

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**Data S2**

Questionnaire

[Click here to view](#)

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