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HPV vaccination coverage and willingness to be vaccinated among 18–30 year-old students in Italy

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ABSTRACT

Objectives: In Italy, free HPV vaccination has been offered to 12 years-old girls since 2007, while for males only since 2015. The aims of our study were: to measure HPV vaccination coverage among young women; to assess willingness to receive HPV vaccination among unvaccinated males and females; to evaluate the association of coverage and attitudes with knowledge regarding HPV and with sexual behavior.

Methods: A cross-sectional survey was conducted in an Italian region among 18–30 year-old students attending medical and healthcare professions schools. Participants completed a self-administered questionnaire exploring knowledge, attitudes and behaviors related to HPV infections, sexually transmitted diseases and their prevention. Information on vaccination status was also verified for each student through the immunization records provided by the participants during the occupational medical visit.

Results: 517 students were enrolled, with a 97% response rate. Of female participants, 40.5% had received at least one dose of HPV vaccine, while among unvaccinated participants, 60.5% stated their willingness to be vaccinated. A negative attitude towards HPV vaccination was associated with an older age, whereas a correct knowledge that both sexes are at risk of HPV infection, and the knowledge that vaccine protects against cervical cancer were confirmed to be associated to a willingness to receive HPV vaccination.

Conclusions: Our results showed low HPV vaccination coverage among young women and high reported willingness to receive vaccination among both sexes. More active education on the link between HPV and all related cancers could be beneficial to help prevent significant burden of the HPV-related diseases.

1. Introduction

Human papillomavirus (HPV) infection is the most common sexually transmitted disease (STD) worldwide [1] and it has been estimated that at least 50% of sexually active people acquire genital HPV infection during their lifetime [2]. Oncogenic types of HPV are associated with different cancers including oropharyngeal, anal, cervical, vaginal, vulvar, and penile cancers [3].

Vaccination against HPV has been associated with the reduction of HPV-related diseases, HPV-related cancers, and of the prevalence of HPV vaccine genotypes [4–6], and its administration has been an indispensable measure in reducing the incidence of cervical cancer [4]. In Italy HPV vaccination is provided by the National Health Service through the Local Health Units and their Prevention Department. In particular, HPV vaccination has been offered to 12 years-old girls since 2007, and was also introduced for 12 years-old males in 2015 [7]. The vaccine is offered for free to the aforementioned target cohorts, whereas it is offered at a reduced price or at full payment to other age groups, according to the vaccination strategies proposed by each Italian region [8]. Since 2014, the HPV vaccine is given in 2 or 3 doses depending on the type of vaccine used and the age groups to which it is administered. The interval between doses is 6 months in the case of a 2 dose administration, while the intervals for a 3 dose schedule are set at 1 or 2 and 6 months from the first dose [8]. The National Immunization Program has set a target coverage for the full vaccination course at $\geq$ 70% for 12 year-old females born up to 2001, $\geq$80% for those born in 2002 and $\geq$ 95% for those born since 2003 [7]. In Italy coverage among the targeted population is below the threshold, being barely above 70% only for cohorts born in 2001 [9].

Even if vaccination of adolescents before their sexual debut is recognized to be a priority for vaccination programs [10], many sexually active adults could also benefit from vaccination since

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only a subset of them would have been previously exposed to HPV types covered by the vaccine [11]. However, in order for the vaccination programmes to be successful, a high uptake rate is needed.

Knowledge and attitudes regarding HPV infection and prevention have been widely evaluated as determinants for vaccine acceptance [12] and vaccine uptake [13], and numerous studies in different countries have assessed individuals' knowledge, attitudes, and practices toward vaccination [14–18], In Europe, only a few studies have assessed the knowledge of parents of young males [19], as well as of young males and females, regarding HPV [20–24].

Therefore, we have conducted a study in one Italian region (Calabria) with the following objectives: (1) to measure HPV vaccination coverage among women 18–30 years of age; (2) to assess willingness to receive vaccination among unvaccinated individuals of both sexes; (3) to verify whether coverage and willingness to receive HPV vaccination are associated with knowledge regarding HPV infection and prevention and with sexual behavior.

2. Methods

2.1. Study population

A cross-sectional survey was conducted among 18–30 years-old students (undergraduate and postgraduate), attending medical and healthcare professions schools, undergoing occupational health surveillance at the University Magna Græcia of Catanzaro (Southern Italy). In Italy, health and safety at work are regulated by Legislative Decree 81/2008. All workers, students included, who are at risk of occupational exposure to biological, chemicals, or physical agents, are required to periodically undergo a medical examination in order to establish that they meet the standard of physical fitness necessary to perform the required duties [25].

All students undergoing an occupational medical visit from February to June 2017 were asked to participate in our study; informed consent for study participation was obtained. An anonymous structured self-administered questionnaire was provided to all participants by the occupational doctor and completed before the occupational medical visit, to gather information about knowledge, attitudes and behaviors related to HPV infections, STDs and their prevention measures. Answering the questionnaire lasted an average of 15 min. There were no incentives offered for participation. Before collecting data, a pilot test was conducted to ensure question clarity, format and sequence, and refinements were made to improve flow and clarity. This study was approved by the Institutional Ethical Committee ("Mater Domini" Hospital of Catanzaro, Italy) (2016/09/21).

2.2. Survey instrument

The questionnaire was developed by two researchers and was based upon an extensive review of the relevant literature [26–28]. It included 54 questions divided into 6 sections. Each section elicited responses in a variety of formats: closed-ended questions with multiple answers possible, 5-point Likert scale options, "yes" or "no" answers and open ended questions.

The six sections of the questionnaire were focused on: (1) sociodemographic characteristics of the participants; (2) knowledge regarding STDs and their causes, HPV transmission route, HPV-related diseases in both sexes, vaccination schedules, cervical cancer prevention, sources and need of further information on HPV infection and vaccination; (3) attitudes towards vaccination overall and specifically on HPV prevention; (4) specific risky behaviors among sexually active participants, including age at first sexual intercourse, number of partners, use of condom or other contraceptives, whether they had had any diagnosis of an STD in their life; (5) specific questions for girls, to know whether they had been vaccinated against HPV and reasons for having received or not having received vaccination; (6) specific questions for unvaccinated participants exploring willingness to receive HPV vaccination. Specific questions about vaccine uptake were addressed only to female students because HPV vaccination for 12 years-old males was introduced in Italy only in 2015 [7], and therefore no potentially vaccinated males were included in our sample.

A series of vaccination was considered complete for subjects born in 1999 after having received 3 doses of the HPV vaccine, whereas students born since 2000 were considered to have received a complete series of HPV vaccine with a two-dose schedule [8]. Information about male and female HPV vaccination status was also verified through the immunization records provided by the participants during the occupational health surveillance visit.

2.3. Statistical analysis

Data were summarized using frequencies and percentages for categorical data and mean and standard deviations for continuous data.

We explored willingness to receive HPV vaccination with a yes or no question. Then, the reasons why the responders were willing to receive or not to receive the vaccination were assessed through multiple choice responses, which included an "other reasons" open ended option, that they could fill with other reasons, if these were not included among the ones given.

Correct knowledge about HPV-related diseases was explored. Seven diseases were listed as possible HPV-related diseases (genital warts, cervical cancer, anal cancer, penile cancer, oral cancer, urinary tract infections, intestinal cancer) and participants could select which ones they thought were HPV-related. Participants that correctly selected at least 3 out of 5 HPV-related diseases (genital warts, cervical cancer, anal cancer, penile cancer, oral cancer), leaving out the 2 non HPV-related diseases (urinary tract infections, intestinal cancer) were classified as having a correct knowledge.

Concerning sexual activity, we considered currently sexually active subjects, those who declared having had at least one sexual intercourse during the previous three months [29]. In particular, sexual intercourse was defined as a sexual contact between individuals involving penetration, i.e. vaginal or anal sex.

Univariate and stepwise multivariate logistic regression analyses were performed to determine the independent association of general characteristics with the following outcomes of interest: HPV vaccine uptake in females, measured as having received at least one dose of HPV vaccine (Model 1) (0 = unvaccinated, 1 = vaccinated), and willingness to receive HPV vaccination in unvaccinated males and females (Model 2) (0 = unwillingness to receive HPV vaccine, 1 = willingness to receive HPV vaccine). The analysis related to the first outcome was restricted to women, and that related to the second outcome was restricted to males and unvaccinated women.

Age-adjustment was performed in the univariate analysis when we analyzed whether HPV vaccine uptake and willingness to receive HPV vaccination were associated with knowledge regarding HPV infection and prevention and with sexual risky behavior.

In all models the explanatory variables included were the following: age (continuous), education level (0 = undergraduate; 1 = graduate), correct knowledge about HPV-related diseases (0 = incorrect, 1 = correct), knowledge that both sexes are at risk of HPV infection (0 = incorrect, 1 = correct), knowledge that antibiotics are not effective against HPV (0 = incorrect, 1 = correct), knowledge that HPV infections are generally symptomless (0 = incorrect, 1 = correct), knowledge that HPV vaccine protects against cervical cancer (0 = incorrect, 1 = correct), knowledge that

HPV infection usually goes away without any treatment (0 = incorrect, 1 = correct), knowledge that having multiple sex partners increases a person's risk for acquiring HPV infection (0 = incorrect, 1 = correct), knowledge that HPV cancers affect both sexes (0 = incorrect, 1 = correct), knowledge that if a woman receives HPV vaccine, she still needs to get a pap test (0 = incorrect, 1 = correct), number of sexual partners lifetime (0 = <3 partners, 1 = ≥3 partners). Sex-adjustment was performed in Model 2.

Stepwise logistic regression models were developed according to the Hosmer and Lemeshow strategy [30] that includes the following steps: univariate analysis of each variable considered, using the appropriate test statistic (chi-square test or *t* test); inclusion of any variable whose univariate test has a *p*-value < 0.25; ways to include independent variables in the model (continuous, ordinal or categorical) took into account how each of these ways better fitted the data at the univariate analysis and we chose that way in the multivariate analysis. We also added the variable education level, since it might have been confounded by age in the age-adjusted univariate analysis. Adjusted odds ratio and 95% confidence intervals were calculated, and a two-tailed *p*-value of less than 0.05 was considered statistically significant for all analyses. The data were analyzed using Stata, version 14.1 (StataCorp, 2015; College Station, Texas, USA).

3. Results

3.1. Study population

Of the 533 students that were approached, a total of 517 agreed to participate with a 97% response rate. The mean age of responders was 22.6 years (SD ± 2.9), 61% were females, 1.6% were married and 1% had at least one child. 60% were undergraduates, while 40% were post-graduates. More than two-thirds of the respondents (71%) were nursing and medical school students.

3.2. Knowledge about HPV infection and vaccination

Table 1 reports the results on knowledge regarding STDs and HPV. The responses on knowledge of STDs showed that most participants correctly identified HPV infection (89.8%) as an STD, but only 20% were aware that cervical cancer may be the consequence of a sexually transmitted infection. 37.9% of the participants had a correct knowledge about HPV-related diseases. In particular, 91.3% of the responders correctly identified cervical cancer as an HPV-related disease, but less than half were aware that HPV can cause genital warts (40.3%), penile (35.1%), oral (30.7%), and anal (22.8%) cancer. More than two thirds (77.2%)

Table 1
HPV knowledge among the students participating in the study and its association with HPV vaccine coverage in females and with willingness to be vaccinated in unvaccinated males and females.

	Total (n = 517)		Vaccine coverage in females (n = 304)		Willingness to be vaccinated in all unvaccinated males and females (n = 384)	
	N	%	Vaccinated females n (%)[a]	Unvaccinated females n (%)[a]	Yes n (%)[a]	No n (%)[a]
HPV infection is an STD (517)[b]	464	89.8	108 (91.2)	168 (90.3) $p = 0.795$	243 (89.4)	103 (92) $p = 0.443$
Cervical cancer is an STD (517)[b]	103	19.9	23 (19.7)	39 (20.8) $p = 0.843$	48 (17.8)	29 (25.4) $p = 0.097$
Correct knowledge about HPV-related diseases[c] (515)[b]	195	37.9	31 (37.1)	87 (40) $p = 0.651$	113 (43)	47 (39.2) $p = 0.471$
HPV is transmitted by sexual intercourse (517)[b]	450	87	104 (89.2)	169 (90.5) $p = 0.738$	238 (87.7)	100 (88.9) $p = 0.739$
Both sexes are at risk of HPV infection (517)[b]	399	77.2	86 (75.4)	150 (79.6) $p = 0.451$	227 (83.7)	78 (67.7) **p = 0.001**
Having multiple sex partners increases a person's risk for acquiring HPV infection (515)[b]	441	85.6	100 (84.4)	163 (89) $p = 0.319$	236 (87.3)	99 (88.7) $p = 0.698$
Antibiotics are not effective against HPV (511)[b]	263	51.5	52 (52.4)	105 (52) $p = 0.951$	148 (56.4)	57 (48.3) $p = 0.139$
HPV is not rare (517)[b]	386	74.7	90 (76.6)	148 (79.7) $p = 0.583$	209 (77)	81 (71.6) $p = 0.266$
HPV-related cancers affect both sexes (514)[b]	331	64.4	75 (66.1)	125 (65.9) $p = 0.978$	185 (69.3)	64 (55.3) **p = 0.009**
HPV infection usually goes away without any treatment (513)[b]	43	8.4	4 (4.2)	21 (10.3) $p = 0.124$	33 (12.7)	6 (4.9) **p = 0.024**
HPV infections are generally symptomless (513)[b]	379	73.9	74 (67.5)	143 (76.2) $p = 0.144$	210 (78.2)	88 (78.9) $p = 0.887$
HPV vaccination protects against cervical cancer (513)[b]	406	79.1	102 (85.9)	153 (83.8) $p = 0.667$	219 (81.3)	78 (69) **p = 0.01**
HPV vaccination does not protect against all STDs (514)[b]	432	84.1	105 (88.2)	166 (91.3) $p = 0.455$	231 (85.7)	91 (81.2) $p = 0.257$
If a woman receives HPV vaccine she still needs to get a Pap test (517)[b]	426	82.4	112 (92.8)	158 (85.1) $p = 0.064$	221 (81.2)	87 (77.7) $p = 0.439$
HPV vaccination is available for both sexes (517)[b]	245	47.4	69 (54.8)	82 (46.2) $p = 0.222$	133 (48.6)	39 (35.5) **p = 0.021**

HPV: Human Papillomavirus; STD: sexually transmitted disease.
Statistically significant results are in bold.
[a] Age-adjusted frequencies.
[b] In brackets the number of students responding to the question.
[c] Knowledge on HPV related diseases was assessed with the correct identification of at least 3 out of 5 HPV-related diseases (genital warts, cervical cancer, anal cancer, penile cancer, oral cancer) and 2 non HPV-related diseases (urinary tract infections, intestinal cancer).

of the participants knew that both sexes can acquire HPV infection and that having many sexual partners increases the risk of getting HPV (85.6%).

When assessing knowledge regarding therapy for HPV, 51.5% of the participants knew that HPV infection cannot be treated with antibiotics, and only 8.4% knew that HPV infection usually goes away without any treatment. Poor knowledge was also observed concerning HPV vaccination, with less than half of the participants (47.4%) knowing that HPV vaccination is available for both sexes.

3.3. Risky behaviors

Table 2 reports the results on respondents' sexual activity: 14.9% of the responders declared that they had never had a sexual intercourse in their lifetime. Among the sexually experienced, 20.5% were ≤ 15 years old at their first sexual intercourse, and 60.8% had ≥ 3 lifetime partners. Eighty four point three percent of the participants had at least one partner in the previous three months and, among them, 37% declared to have never or rarely used condoms during that period of time. Six (1.4%) of the responders reported having been diagnosed with an STD in the previous year. Moreover, 14 students have also reported having been diagnosed with Candidiasis, defined as a vaginal yeast infection [31], incorrectly indicated by them as an STD.

3.4. Vaccine uptake

Among female participants, 123 (40.5%) had received an HPV vaccine and, of these, 67.8% had completed the vaccination series. On average, those vaccinated against HPV received their first dose at 13.8 years of age (SD ± 2.9).

Age-adjusted knowledge about HPV infection and prevention did not significantly differ between vaccinated and non-vaccinated women (Table 1), whereas vaccinated women were significantly more likely to have had at least one sexual partner in the previous three months compared with non-vaccinated women ($p = 0.001$) (Table 2).

Results of the multivariate logistic regression are shown in Table 3. Factors independently associated with having received an HPV vaccine were a higher education level (OR = 6.54, 95% CI = 1.84–23.18), knowledge that antibiotic therapy is not effective for HPV infection (OR = 2.92; 95%CI = 1.15–7.44), knowledge that HPV vaccine is available for both sexes (OR = 2.23, 95%CI = 1.00–4.95), and having had at least one sexual partner in the previous three months (OR = 6.29, 95%CI = 1.40–28.17), whereas the likelihood of having received an HPV vaccine was 62% lower for each additional year of age (OR = 0.38, 95%CI = 0.27–0.52).

3.5. Willingness to receive HPV vaccination

Responders who were not vaccinated against HPV included students of both sexes. When asked whether they would be willing to get an HPV vaccine, among unvaccinated participants, 60.5% stated their willingness to do so (61.9% of females and 79% of males). The main reasons were: the belief that the vaccination reduces the risk of contracting HPV infection (72.5%), the feeling that it is a useful vaccination (36.6%), the efficacy against cancer (26%), and the recommendation of a physician (11.7%).

By contrast, for those who stated that they would not consider the HPV vaccine, the most common reasons were: the feeling of not being at risk of HPV infection (37.8%), the belief that the vaccine is not useful (14.4%), the feeling of being poorly informed about the vaccine (14.4%), advice against HPV vaccination (13.5%), the belief that HPV infection affects only women (6.3%), the feeling that the vaccination is dangerous (5.4%), and lack of confidence in vaccines (4.5%).

Age-adjusted willingness to receive HPV vaccination was significantly associated with a higher knowledge that both sexes are at risk of HPV infection ($p = 0.001$), HPV-related cancers affect both sexes ($p = 0.009$), HPV infection usually goes away without any treatment ($p = 0.024$), HPV vaccine protects against cervical cancer ($p = 0.01$), HPV vaccination is available for both sexes ($p = 0.021$) (Table 1), and this positive attitude was not associated with any sexual risk behavior (Table 2).

Results of the sex-adjusted multivariate stepwise logistic regression analysis (Table 4) showed the association of the unwillingness to receive HPV vaccination with an older age (OR = 0.84, 95%CI = 0.76–0.94), whereas a correct knowledge that both sexes

Table 2
Sexual risk factors amongst sexually active students participating in our study and their association with HPV vaccine coverage in females and with willingness to be vaccinated in unvaccinated males and females.

Variable	Total (n = 517)		Vaccine coverage in females (n = 299)		Willingness to be vaccinated in all unvaccinated males and females (n = 380)	
	n	%	Vaccinated females n (%)[a]	Unvaccinated females n (%)[a]	Yes n (%)[a]	No n (%)[a]
Experience of sexual intercourse (509)[b]	433	85.1	91 (82.2)	156 (83.2) $p = 0.838$	243 (90)	92 (82.9) $p = 0.055$
Age of sexual debut (425)[b] ≤15 years old	87	20.5	11 (11.1)	26 (18.5) $p = 0.184$	60 (24.8)	14 (16.1) $p = 0.098$
Number of sexual partners, lifetime (423)[b] ≥3 partners	257	60.8	43 (53.8)	101 (64.8) $p = 0.155$	149 (62.8)	64 (71.7) $p = 0.141$
Currently sexually active[c] (421)[b]	355	84.3	81 (94)	119 (76.1) **$p = 0.001$**	197 (83.1)	72 (80.8) $p = 0.635$
Frequency of condom use, previous 3 months (406)[b] Sometimes/Often/Always	256	63	63 (70)	76 (56.1) $p = 0.084$	139 (60.4)	48 (58.7) $p = 0.783$
STDs diagnosis/es, previous year (424)[b]	6	1.4	1 (5.2)	3 (1.4) $p = 0.325$	1 (0.5)	5 (2.5) $p = 0.257$

STD: sexually transmitted disease.
Statistically significant results are in bold.
[a] Age-adjusted frequencies.
[b] In brackets the number of students responding and/or eligible to the question.
[c] Had sexual intercourse with at least one person during the 3 months before the survey.

Table 3
Multiple logistic regression analysis results for estimates of associations of vaccine coverage among female participants with several variables.

Variable	OR	95% CI	p
Model: ***Vaccine coverage*** *Log likelihood = −83.6; χ^2 = 129.31 (13 df); p < 0.0001, No. of observations = 223*			
Age, years (continuous)	0.38	0.27–0.52	**<0.001**
Education level			
Undergraduate	1.00[a]		
Postgraduate	6.54	1.84–23.18	**0.004**
Antibiotics are not effective against HPV			
Incorrect	1.00[a]		
Correct	2.92	1.15–7.44	**0.024**
HPV vaccination is available for both sexes			
Incorrect	1.00[a]		
Correct	2.23	1.00–4.95	**0.050**
Cervical cancer is an STD			
Incorrect	1.00[a]		
Correct	2.01	0.75–5.40	0.166
HPV vaccination protects against cervical cancer			
Incorrect	1.00[a]		
Correct	2.21	0.65–7.49	0.202
If a woman receives the HPV vaccine she still needs to get a Pap test			
Incorrect	1.00[a]		
Correct	4.01	0.79–20.44	0.095
HPV is not rare			
Incorrect	1.00[a]		
Correct	0.44	0.15–1.31	0.141
HPV infection are generally symptomless			
Incorrect	1.00[a]		
Correct	0.61	0.23–1.64	0.326
HPV infection usually goes away without any treatment			
Incorrect	1.00[a]		
Correct	0.26	0.05–1.29	0.099
HPV vaccination does not protect against all STDs			
Incorrect	1.00[a]		
Correct	0.23	0.04–1.30	0.096
Number of sexual partners, lifetime			
<3 partners	1.00[a]		
≥3 partners	0.41	0.18–1.91	0.208
Currently sexually active[b]			
No	1.00[a]		
Yes	6.29	1.40–28.17	**0.016**

HPV: Human Papillomavirus; STD: sexually transmitted disease.
Statistically significant results are in bold.
[a] Reference category.
[b] Had sexual intercourse with at least one person during the 3 months before the survey.

Table 4
Multiple logistic regression analysis results for estimates of associations of willingness to receive HPV vaccination in unvaccinated males and females with several variables.

Variable	OR	95% CI	p
Model: Willingness to receive HPV vaccination[a] *Log likelihood = −162.86; χ^2 = 49.38 (12 df); p < 0.0001, No. of observations = 321*			
Age, years (continuous)	0.84	0.76–0.94	**0.002**
Both sexes are at risk of HPV infection			
Incorrect	1.00[b]		
Correct	3.46	1.44–8.32	**0.005**
HPV vaccine protects against cervical cancer			
Incorrect	1.00[b]		
Correct	2.82	1.43–5.53	**0.003**
Correct knowledge about HPV-related diseases			
Incorrect	1.00[b]		
Correct	0.49	0.24–0.98	**0.043**
Having multiple sex partners increases a person's risk for acquiring HPV infection			
Incorrect	1.00[b]		
Correct	0.56	0.23–1.37	0.205
HPV-related cancers affect both sexes			
Incorrect	1.00[b]		
Correct	1.66	0.79–3.49	0.181
If a woman receives the HPV vaccine she still needs to get a Pap test			
Incorrect	1.00[b]		
Correct	1.42	0.71–2.84	0.327
Antibiotics are not effective against HPV			
Incorrect	1.00[b]		
Correct	1.59	0.88–2.87	0.121
HPV infection usually goes away without any treatment			
Incorrect	1.00[b]		
Correct	2.66	0.94–7.52	0.066
HPV infections are generally symptomless			
Incorrect	1.00[b]		
Correct	0.52	0.25–1.07	0.077
Number of sexual partners, lifetime			
<3 partners	1.00[b]		
≥3 partners	0.64	0.35–1.15	0.137

Statistically significant results are in bold.
[a] Sex-adjusted model.
[b] Reference category.

are at risk of HPV infection (OR = 3.46, 95%CI = 1.44–8.32), and the knowledge that the HPV vaccine protects against cervical cancer (OR = 2.82, 95%CI = 1.43–5.53) were confirmed to be associated with the willingness to receive HPV vaccination.

4. Discussion

To our knowledge, this is one of the first studies assessing vaccination coverage in females and the willingness to receive HPV vaccination in both sexes, after the introduction in Italy of the vaccination for adolescent males.

Our study showed that less than half of the young women we surveyed reported having received HPV vaccination, while more than half of those who were not vaccinated stated their willingness to receive HPV vaccination. As expected, the percentage of females willing to be vaccinated was lower than that of males, since we compared all males to a subset of women who were more likely to be unwilling to be vaccinated compared with women who had been vaccinated, due to the fact that they had already refused the chance to be vaccinated.

In Italy HPV vaccination is strongly recommended and offered free of charge for girls aged 12 years since 2007, and for 12 years-old boys since 2015 [7].

Since 2006, international recommendations have also included additional age cohort target groups, i.e. not only females aged 11 or 12 years, but also those aged 13 through 26 years not previously vaccinated. Furthermore HPV is now recommended not only for males aged 11 or 12 years but also for those aged 13 through 21 years not previously vaccinated and those 22 through 26 years with special circumstances or who desire to protect themselves from the disease [5,32]. Moreover, several clinical trials have shown that 18–30 years-old women also achieve a strong immune response to the HPV vaccine, inducing high virus neutralizing antibody titers [33,34]. Consequently, implementation of catch-up programs that improve the levels of HPV vaccine uptake among older girls and women could also be very beneficial and help prevent a significant burden of HPV related diseases.

Acceptability of the HPV vaccine has already been measured among parents, showing variable willingness to vaccinate their children that ranged from 48% to 65% [19,35,36]. A high level of willingness to receive vaccination was also found in adolescents and young women, whose willingness to receive vaccination was

associated with a higher level of knowledge about HPV and the perception of being at risk for HPV or cervical cancer; whereas a lower acceptability was associated with an older age and being married [37]. Liddon et al. investigated acceptability of HPV vaccination among males by reviewing 23 published articles, and found that willingness to receive HPV vaccination was 74–78% among college/university students and was much lower in a community sample of males (33%) [38]. As expected, the findings of our study showed a higher level of willingness to receive vaccination associated with a correct knowledge that both sexes are at risk of HPV infection, and development of HPV-related diseases and that HPV vaccine protects against cervical cancer, as already reported in previous studies [22,23,39].

When we measured the association between several variables and HPV vaccination coverage, a younger age and a higher education level were independently associated with vaccine uptake. These findings underline, in effect, that younger cohorts, included in the active vaccination program, have a higher probability to have received HPV vaccination. Furthermore, the association between HPV vaccine uptake with a higher education level highlights the importance of a higher awareness in the vaccination decision making.

We also assessed the association between HPV vaccine uptake and willingness to receive vaccination with participants' sexual behavior. Consistent with previous studies [26,40], we found, although from a cross-sectional point of view, that the receipt of HPV vaccine did not have any influence on sexual behavior. In particular, it is of interest that no significant difference in the frequency of condom use, that is one of the most effective measures for the prevention of all STDs, was found between vaccinated and unvaccinated women, thus suggesting that the role of HPV vaccination has been properly understood by our population.

Of note, among this sample population, our results showed a high level of knowledge that cervical cancer is associated with HPV infection, but relatively lower level of knowledge about other HPV-related diseases. Previous studies that have investigated knowledge of non-cervical HPV-associated health outcomes also suggested that most individuals know little about the association between HPV and non-cervical cancers [41–43]. Increased efforts are necessary to address knowledge deficiencies about risk factors for HPV-related cancers and general benefits of the HPV vaccine by establishing easy access to effective information, since perceptions of personal risk could also influence vaccination decision making. Previous studies have already shown that students who do not perceive general or specific benefits in receiving the HPV vaccine are less likely to be vaccinated [22], and that males who do not believe to be at risk for contracting HPV do not perceive the need to obtain the vaccine [44], thus affecting vaccination intention and potentially vaccination coverage.

4.1. Limitations of the study

Limitations of the study are related to the cross-sectional design, that does not imply any cause-effect relationship since data on "risk factors" and "outcomes" are assessed at the same time, and to the self-reporting of practices, only a proxy of real practice. Questions about sexual experiences are sensitive and some students may have stated more or less experience than they had actually had. However, we believe that confidentiality and anonymity reduced the risk of the "socially desirable" responses. Recall bias was also a risk especially when the students were asked to recall events occurred several years ago. Furthermore, willingness to receive the HPV vaccine was assessed in unvaccinated women and men, that are subject to different national vaccination policies. As a consequence, we could not compare the willingness to be vaccinated in these subpopulations as if men had been given the same opportunity to be vaccinated as women.

Another limitation is linked to the inclusion in the study of only students attending medical and healthcare professions schools, typically more concerned in general with health-related problems and, in this case, with prevention-related issues, thus reducing generalizability to all the young adult population.

Despite these limitations, this survey had a very high response rate (97%). This reflects strong interest in this topic and supports the internal validity of the results of the study. The achievement of a high response rate could also be attributed to the setting used for the recruitment. Students periodically undergo medical visit and discuss matters related to healthcare and prevention with the occupational doctor. Therefore they generally establish a trusting relationship with the occupational doctor that facilitates and supports their motivation to participate in the survey.

4.2. Conclusions

In conclusion, our results showed a relatively low HPV vaccination coverage among young women attending medical and healthcare schools when compared with the National Immunization Plan thresholds, whereas a high reported willingness to receive HPV vaccination in both sexes was found in this population. Implementation of catch-up programs, and a more active education on the link between HPV and related cancers could be very beneficial in young adults helping to reduce the burden of HPV related diseases.

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Declarations of interest

None.

Contributors

Valentina Mascaro made substantial contributions to the conception and design of the study, to the data analysis and interpretation, and wrote the paper. Angela Currà and Aida Bianco collected the data, contributed to the data analysis and drafting the paper. Claudia Pileggi and Maria Pavia made substantial contributions in the design of the study, were responsible for the data analysis and revising the paper critically for important intellectual content. All authors approved the final paper as submitted and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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