**A survey of knowledge, attitudes and awareness of the human papillomavirus among healthcare professionals across the UK**

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**Abstract**

Background

Human papillomavirus (HPV) is a common sexually transmitted infection implicated in 5% of cancers worldwide including most cervical cancer cases. In the UK, the HPV vaccine has been offered routinely to girls aged 11-13 since 2008 while cervical screening is offered to women aged 25-64. HPV testing will soon replace cytology as the primary screening method. This research evaluates what healthcare professionals across the UK know about HPV.

Methods

A total of 643 UK-based HCPs from primary and secondary care took part in an anonymous cross-sectional survey between March and April 2018. The survey measured general HPV knowledge; HPV triage and test of cure (TOC) knowledge; HPV vaccine knowledge; attitudes to the HPV vaccine, and self-perceived adequacy of knowledge.

Results

Participants had a generally good understanding of HPV and the vaccination but there were gaps in detailed knowledge of the NHS HPV testing processes. There were some gaps in knowledge about the health sequelae of HPV for males. Years since HPV training was associated with triage and TOC and vaccine knowledge scores. Furthermore, nurses and doctors in colposcopy clinics had much greater odds of having higher knowledge across all domains than other roles. In total, 76.2% of participants felt adequately informed about HPV and 35.6% made suggestions for improvements in training, many of which requested additional frequency and topics.

Conclusion

Our results suggest that additional training is needed to ensure HCPs are equipped to deal with the changing landscape of HPV screening and vaccination in the UK.

Keywords: cervical screening, HPV vaccination, healthcare professionals, HPV knowledge

**Introduction**

Human papillomavirus (HPV) is a common infection transmitted by skin-to-skin contact. Some low-risk types can cause genital warts while annually, 630,000 (4.5%) of cancers worldwide are attributable to high-risk HPV types1. Cervical cancer is the most frequently occurring of these (530,000 cases per year) with 100,000+ additional cases occurring in other sites: the anus, vulva, vagina, penis, head and neck (oropharynx) and throat (oral cavity)1. In the UK, there were 3126 new cases of cervical cancer and 8833 new cases of head and neck cancers attributable to HPV in 20152.

There are two main medical interventions for preventing HPV attributable diseases; HPV vaccination, which aims to prevent the spread of HPV, and cervical screening, which aims to identify and treat precancerous cell changes in the cervix and thus reduce the risk of cervical cancer developing.

**HPV Vaccination**

In 2008, the UK introduced school-based HPV vaccination programmes for girls aged 11-13 with a catch-up programme for girls born on or after 1st September 1990 using a bivalent vaccine (Cervarix, Glaxo-Smith Kline). Since 2012, the programme has used a quadrivalent vaccine (Gardasil, Merck) which protects against two low-risk HPV types (6 & 11) responsible for around 90% of cases of genital warts and two high-risk types (16 & 18) responsible for around 70% of cervical cancer cases3. Types 16 and 18 are also responsible for most other HPV-related cancers, including 82.3% of those in men1. Following a recent recommendation by the Joint Committee on Vaccination and Immunisation, the HPV vaccination programme will be extended to boys aged 11-13 across the UK4.

Currently, uptake of the school-based vaccination programme is good, with 83.1% of Year 9 females in England completing the two-dose schedule in 2016-175 and similarly high statistics reported across the rest of the UK. Public knowledge about HPV however remains low. Marlow et al found that 61.6% of UK women and 39.2% of UK men surveyed had heard of HPV; those individuals scored just 8.53 and 7.74 respectively from 15 questions about HPV6.

**Cervical screening**

In 1988, the National Health Service (NHS) introduced a national cervical screening programme (NHSCSP). Currently cytology-based screening is offered every three years to women aged 24.5-49, and every 5 years to those aged 50-647. Since 2012, the NHSCSP has been supplemented by a triage stage across the UK (except Scotland), in which cytological samples which reveal borderline and low-grade changes undergo high-risk HPV testing to determine whether women should be called to colposcopy or continue with routine screening. In 2018, Wales introduced HPV testing as the primary screening method and the NHS is planning to introduce this in England by the end of 2019, Scotland from 2020, and Northern Ireland, dates to be confirmed8. HPV testing is also used as test of cure for women who have previously been referred to colposcopy and received treatment.

Despite its crucial role in the prevention of cervical cancer, uptake of cervical screening in the UK is dropping. At March 2017, 72% of eligible women in England were adequately screened, down from 75.4% in March 2012. This decline is consistent across all age groups9. Research suggests that many women get information about cervical smears, colposcopy and HPV from healthcare professionals (HCPs)10. As HPV testing replaces cytology as the primary screening test, it is essential that minimise the stigma and concerns attached to undergoing testing for a sexually transmitted infection and help women understand the implications of HPV test results. Testing positive for HPV can be associated with negative social and psychological consequences relating to the sexually transmitted nature of the virus and its relationship to cervical cancer11 and more recent research identified implications for long-term engagement with screening, with women in monogamous relationships querying the need for screening once they have tested negative for HPV12. Well-informed HCPs are vital to ensuring there is no further decrease in screening attendance once HPV primary testing is introduced.

**Current training**

Currently, training is provided for cervical screening sample takers, with refreshes offered every three years thereafter. Since October 2017, there has been a new online refresher training module available in Wales and England and this is now compulsory In England. In Scotland and Northern Ireland the refresher is face-to-face. Training focusses on an overview of the programme, causes of cervical cancer and the role of HPV, and best practice around taking a sample, duty of care and safeguarding.

A previous survey of Leicestershire nurses found that although basic HPV knowledge was adequate, there were significant gaps with 62.8% erroneously stating that HPV requires treatment for example. Furthermore, there was confusion over the role of TOC, and up-to-date vaccine knowledge was lacking13.

**Current research**

Given the ongoing changes to the NHS cervical screening programme and the landscape of HPV vaccination, it is important that HCPs are well-informed about HPV, the vaccine and changes to the screening programme. The aim of this study was to assess knowledge and attitudes towards HPV, the HPV vaccine, and changes to the screening programme among UK HCPs. In addition, since the schools-based HPV vaccination will soon be extended to boys, we explored levels of knowledge about the health sequelae for males.

**Methods**

An anonymous cross-sectional survey was conducted between March and April 2018. HCPs who had previously given permission to be contacted by Jo’s Cervical Cancer Trust were contacted by the charity and invited to complete the online survey. In addition, many in turn forwarded the link to their contacts to complete. The survey was advertised on the charity’s website and social media channels.

The survey was adapted from previous work13,14 with additional questions about primary screening, triage processes, and the implications of HPV for men. It explored four broad categories: demographics (age, gender, location) and level of experience (years smear taking, profession, years since HPV training, and those in England were asked whether they had completed the sample taker refresher eLearning module); HPV knowledge (general HPV knowledge, HPV triage and TOC knowledge and HPV vaccine knowledge), which were assessed using a true, false, don’t know format; and attitudes towards the HPV vaccine and self-perceived adequacy of HPV knowledge, which were assessed using 5-point Likert scales.

Statistical analyses

Data were summarised using frequencies, medians and interquartile ranges. Factors affecting HPV knowledge were explored using ordinal regression analysis. Knowledge scores were converted into poor, medium, or good for each participant for each domain of knowledge (ordinal outcome measure). For these analyses, profession was collapsed into five categories (nurse in GP practice; doctor in GP practice; nurse or doctor in colposcopy clinic; nurse in Family Planning Service/GUM clinic; doctor in Family Planning Service/GUM clinic), and years since HPV training was collapsed into 3 categories (never; ≤ 1 year; > 1 year). First, univariate regression analyses were conducted to identify variables associated with knowledge. Then, variables that predicted at least one knowledge domain in univariate analysis (with a p value <0.05) were entered into a multivariate model to estimate the association between these predictors and knowledge score, while controlling for potential confounders. Independent t-tests were used to explore whether knowledge scored differed for those who had high vs. low self-perceived adequacy and of knowledge and high vs. low confidence in that knowledge. Following Waller et al.,14 the item about HIV/AIDS was analysed separately from the remaining questions.

Analyses were conducted in Excel and in SPSS versions 24 and 25.

Ethical approval for the study was granted by Keele University Ethical Review Panel in February 2018, Reference ERP1367.

**Results**

726 individuals started the survey and 649 completed it (completion rate 89.4%). The data for 5 individuals were removed, as large sections were left unanswered. The data for a further individual was removed as they were not a HCP. Most (638, 99.2%) were female; 4 were male; 1 did not specify a gender. Of 643 participants, 5 had never taken a smear. For the 638 who had, levels of experience ranged from 1 month to 40 years (mean 12.24 years, median 11.5 years). Details about age categories, location, profession and date of most recent training are in Table 1.

General HPV knowledge

Using the questions from Waller et al14, from a maximum knowledge score of 15 (see individual questions in Table 2 and excluding the question about HIV/AIDS), the median score was 14 (range 5-15, interquartile range (IQR) 13-15), with 32.5% (N=209) achieving 100%.

When the additional knowledge questions were added in (but still excluding the question about HIV/AIDS), from a maximum score of 23, the median was 21 (range 8-23, IQR19-22), with 19.0% (N=122) achieving 100%.

In total, 93.3% (N=600) of respondents correctly identified that HPV does not cause HIV/AIDS.

HPV Triage and TOC knowledge

From a maximum knowledge score of 14 (see individual questions in Table 2), the median score was 12 (range 4-14, IQR 10-13), with 12.8% (N=82) achieving 100%.

HPV vaccine knowledge

From a maximum knowledge score of 7 (see individual questions in Table 2), the median score was 6 (range 0-7, IQR 5-7), with 32.2% (N=207) achieving 100%. One individual had no answers correct.

Factors influencing level of HPV knowledge

Table 3 shows the effect of predictors on the three types of knowledge, both unadjusted (‘crude’) and adjusted for the other covariates (‘full model’). In univariate analysis, years since HPV training was associated with Triage and TOC knowledge score and vaccine knowledge score, where those with more recent training were more likely to have a higher knowledge score. The association was strengthened when taking into account the other predictors for both Triage and TOC knowledge, and vaccine knowledge. No association between years since HPV training and general HPV knowledge score was observed in either univariate or multivariate analyses.

Nurses and doctors in colposcopy clinics had much greater odds of having higher knowledge scores than nurses from GP practices across all knowledge domains in univariate analysis, and this relationship was strengthened after adjustment for the other predictors. In addition, doctors in GP practices and doctors in Family Planning Services/GUM clinics had higher HPV knowledge scores than nurses in GP practices after adjusting for the other predictors.

Participants from Scotland had poorer Triage and TOC knowledge scores in univariate analysis, but similar scores for HPV knowledge and vaccine knowledge. When including other predictors in the model, those from Scotland still had statistically significantly poorer Triage and TOC knowledge scores, and also poorer HPV knowledge scores than the England group (though similar to that of those from Northern Ireland and Wales).

The effects of age and years smear taking on knowledge score were explored in univariate analysis as potential predictors but were not associated with any of the knowledge domain scores (data not shown).

The eLearning module

The effect of the eLearning module on knowledge score was explored (Table 4), though the analysis was restricted to the England group as the module was only compulsory in England. In univariate analyses, completing the eLearning module seemed to be associated with higher scores for HPV knowledge and Triage and TOC knowledge, but both associations were borderline significant. After adjustment for years since HPV training and current role, these associations attenuated and were not significant. While this analysis is based on 456 people, some of the categories for the current role variable contained very small numbers, for example nurse in Family Planning Service or GUM clinic (n=2), which may have affected results in the adjusted model.

Attitudes towards HPV vaccine

Of all respondents, 98.3% (N=632) agreed or strongly agreed that they would recommend the HPV vaccine, while 88.2% (N=567) respondents agreed or strongly agreed that men/boys should be offered the vaccine.

Reasons for not recommending vaccine

The explanations for answers were examined for those individuals who said they were unsure whether they would recommend the vaccine. Half the responses referred to a lack of knowledge, two individuals queried the fact it protects against HPV 16 and 18 but there are more types out there, two individuals queried why we do not vaccinate boys and one individual indicated it had not been used long enough yet.

Reasons for not extending vaccine to boys

The explanations for answers were examined for individuals who said they did not agree with extending the vaccine to boys, or who were unsure. Most responses indicated that they needed more information before they would be in favour of extending the programme (“Don't know enough to make an informed decision”). Other issues raised were: concerns about cost effectiveness, males get herd immunity from the female vaccination programme, MSM being the main beneficiaries of such a program, HPV vaccination is available for MSM through GUM clinics and whether benefits outweigh the risks for males.

Self-perceived adequacy of HPV knowledge

76.2% (N=490) respondents agreed or strongly agreed that they were adequately informed about HPV and 80.1% (N=515) respondents agreed or strongly agreed that they could confidently answer HPV related questions asked by patients. Independent t-tests confirmed that knowledge scores for general HPV knowledge, triage and TOC knowledge and HPV vaccine knowledge were all significantly higher for those participants who felt they were adequately informed than those who did not feel they were or who were unsure. The same was found for the question about feeling confident in answering patient questions (p<0.001).

Improving training

229 respondents (35.6%) provided suggestions for training improvements under the following categories: More information (eg about HPV) should be added to existing training; More frequent updates are needed to reflect changes that occur (suggested time frames included 6 monthly and annually); More face to face training; More online training; Provide more information and reference resources (eg leaflets, online website to consult for answers to patient questions, posters etc.); More information on specific topics such as how to manage distressed patients, HPV, future plans for smear tests, how HPV affects other sites and males; and Education targeted to specific groups (eg public, schools and practice nurses). 25 respondents indicated that they had no suggestions for improvements.

**Discussion**

General HPV knowledge was good, although a quarter of participants thought that HPV always requires treatment and it was concerning that 6.7% either believed that HPV causes HIV/AIDS or were unsure. Performance on triage and TOC and vaccine questions was poorer, with more gaps in knowledge, specifically around the fact that HPV primary screening is more effective than cytology and that one of the HPV vaccines protects against genital warts. In Scotland this is accounted for because HPV triage does not take place in Scotland. There were gaps in knowledge around the male health sequelae of HPV although this is not entirely unexpected since the HCPs in this survey were recruited through their engagement with Jo’s Cervical Cancer Trust, which focusses on female health, and furthermore, with the exception of GUM and HIV clinics, HPV vaccination is not currently available to males through the NHS. Although we would not have anticipated specialist knowledge around the health sequelae for males, it is of concern that health care professionals are not more aware of them as a matter of course, especially with the anticipated extension of the school-based HPV vaccination programme to boys in 2019. Clearly, training addressing this knowledge gap will be important. Reassuringly, most participants would recommend the HPV vaccine although fewer thought it should be extended to males. Nearly a quarter of respondents were unable to say that they felt adequately informed about HPV and over a third made recommendations for training improvements. Many of these centred around suggestions for additional frequency and content for training.

Strengths and weaknesses

This is the first study to our knowledge that has explored what HCPs across the UK know about HPV and the HPV vaccine. It is also the first to explore knowledge about NHSCSP processes such as triage and TOC and the first to include questions about males. A weakness is that most respondents are from England and Scotland with rather fewer from Wales or Northern Ireland. Furthermore, it is likely that knowledge across HCPs is overestimated in this survey since we recruited smear takers who had previously interacted with Jo’s Cervical Cancer Trust and therefore might be more engaged with the issues than other HCPs.

We had a larger sample than Patel et al and our survey was conducted 3 years later, so it was encouraging that generally, HPV knowledge and HPV vaccine knowledge were slightly better across the respondents in our survey. For example, 90.5% knew that HPV can be passed on by genital skin-to-skin contact compared with 77.7% in Patel et al’s survey13. However, answers to the TOC questions were generally poorer, for example, only 68.7% knew that if the post-lletz treatment high-risk HPV test is negative a woman will NOT require annual follow-up for ten years compared to 91.5% in Patel et al’s survey13. The increased knowledge about HPV and the vaccine was unsurprising, since our respondents had previously engaged with Jo’s Cervical Cancer Trust, however this also made it surprising that TOC knowledge was weaker.

It is possible that some questions might have been ambiguous to some respondents. For example, in the question “Primary HPV testing is more effective than cytology first", the word ‘effective’ could be referring to cost, sensitivity or specificity. This might have reduced the accuracy of the response rate.

**Conclusion**

While general HPV knowledge is acceptable in the HCPs surveyed, the nature of the recruitment means that knowledge is probably higher than in the wider HCP community. Given the gaps in knowledge and specifically around the details of triage and TOC processes, further education is needed to ensure that HCPs can keep abreast of changes to HPV-related initiatives and provide clear and accurate information and support. While high levels of knowledge about the health sequelae of males was not expected in this cohort, the existence of gaps in this knowledge, provides a baseline from which policy makers can think about providing training to prepare for when the HPV vaccination is extended to boys.

As HPV primary screening is rolled out across the UK and as the HPV vaccination programme evolves, it is imperative HCPs can respond to the rapid advances in the fight against HPV-related illnesses.

SS, CC, HP designed the study, CC collected the data, SS and HD analysed the data, SS, CC, HD, CB, HP wrote the manuscript.

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Conflict of interest

The authors declare there is no conflict of interest.

Funding

We received no funding to conduct this research.

Key points

* This is the first UK-wide survey of healthcare professionals’ knowledge about HPV
* General HPV knowledge was good
* There were gaps in HPV triage and TOC and HPV vaccine knowledge
* There were some gaps in knowledge around the male health sequelae of HPV
* It is essential that HCP knowledge keeps pace with changes to HPV vaccination and cervical screening programmes

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*Table 1. Participant characteristics.*

|  |  |  |
| --- | --- | --- |
| **Age** | **Age Bracket**  20-29  30-39  40-49  50-59  60-69 | **N (%)**  20 (3.1%)  99 (15.4%)  183 (28.5%)  278 (43.2%)  63 (9.8%) |
| **Location** | **Nation state**  England  Northern Ireland  Scotland  Wales | **N (%)**  456 (70.9%)  25 (3.9%)  138 (21.5%)  24 (3.7%) |
| **Profession** | **Profession**  Nurse in GP practice  Doctor in GP practice  Nurse in colposcopy clinic  Doctor in colposcopy clinic  Nurse in Family Planning Service  Doctor in Family Planning Service  Nurse in GUM clinic  Doctor in GUM clinic  Other | **N (%)**  519 (80.7%)  35 (5.4%)  36 (5.6%)  4 (0.6%)  10 (1.6%)  3 (0.5%)  14 (2.2%)  3 (0.5%)  19 (3.0%) |
| **Cervical sample taker update training** | **Date of last training**  Never  last 6 months  7-12 months  13-24 months  25-36 months  >3yrs | **N (%)**  49 (7.6%)  171 (26.6%)  143 (22.2%)  166 (25.8%)  87 (13.5%)  27 (4.2%) |
| **NHSCSP cervical sample taker eLearning module**  **(England only)** | **Training completed?**  Yes  No  Don’t know | **N (%)**  177 (38.8%)  266 (58.3%)  13 (2.9%) |

*Table 2. HPV and vaccine knowledge questions*

|  |  |  |  |
| --- | --- | --- | --- |
|  | Correct Response  N (%) | Incorrect Response  N (%) | Answer “don’t know” or blank  N (%) |
| **General HPV knowledge questions1** |  |  |  |
| HPV can cause cervical cancer | 622 (96.7%) | 20 (3.1%) | 1 (0.2%) |
| Having many sexual partners increases the risk of getting HPV | 613 (95.3%) | 23 (3.6%) | 7 (1.1%) |
| HPV can be passed on during sexual intercourse | 629 (97.8%) | 12 (1.9%) | 2 (0.3%) |
| A person could have HPV for many years without knowing it | 634 (98.6%) | 4 (0.6%) | 5 (0.8%) |
| HPV always has visible signs or symptoms | 639 (99.4%) | 2 (0.3%) | 2 (0.3%) |
| HPV is very rare | 613 (95.3%) | 18 (2.8%) | 12 (1.9%) |
| There are many types of HPV | 629 (97.8%) | 11 (1.7%) | 3 (0.5%) |
| Men cannot get HPV | 621 (96.6%) | 18 (2.8%) | 4 (0.6%) |
| Using condoms reduces the risk of getting HPV | 567 (88.2%) | 64 (10.0%) | 12 (1.9%) |
| HPV can be passed on by genital skin-to-skin contact | 582 (90.5%) | 47 (7.3%) | 14 (2.2%) |
| HPV can cause genital warts | 562 (87.4%) | 60 (9.3%) | 21 (3.3%) |
| HPV can be cured with antibiotics | 597 (92.8%) | 29 (4.5%) | 17 (2.6%) |
| HPV can cause HIV/AIDS | 600 (93.3%) | 12 (1.9%) | 31 (4.8%) |
| Most sexually active people will get HPV at some point in their lives | 496 (77.1%) | 114 (17.7%) | 33 (5.1%) |
| Having sex at an early age increases the risk of getting HPV | 544 (84.6%) | 73 (11.4%) | 26 (4.0%) |
| HPV usually doesn’t need any treatment | 468 (72.8%) | 148 (23.0%) | 27 (4.2%) |
| **Additional HPV knowledge questions3** |  |  |  |
| HPV can cause anal cancer | 421 (65.5%) | 94 (14.6%) | 128 (19.9%) |
| HPV is a bacterial infection | 597 (92.8%) | 24 (3.7%) | 22 (3.4%) |
| HPV can be transmitted through oral sex | 534 (83.0%) | 54 (8.4%) | 55 (8.6%) |
| HPV can cause cancer of the penis | 363 (56.5%) | 116 (18.0%) | 164 (25.5%) |
| HPV can be transmitted through anal sex | 554 (86.2%) | 35 (5.4%) | 54 (8.4%) |
| HPV infections always lead to health problems | 606 (94.2%) | 13 (2.0%) | 24 (3.7%) |
| HPV can cause oral cancer | 416 (64.7%) | 95 (14.8%) | 132 (20.5%) |
| A person with no symptoms cannot transmit the HPV infection | 606 (94.2%) | 33 (5.1%) | 4 (0.6%) |
| **HPV Triage and TOC knowledge questions** |  |  |  |
| If a woman tests positive for HPV she will definitely get cervical cancer1 | 638 (99.2%) | 4 (0.6%) | 1 (0.2%) |
| An HPV test can be done at the same time as a Smear test1 | 548 (85.2%) | 65 (10.1%) | 30 (4.7%) |
| HPV testing is used to indicate if the HPV vaccine is needed1 | 608 (94.6%) | 15 (2.3%) | 20 (3.1%) |
| An HPV test can tell how long you have had an HPV infection1 | 592 (92.1%) | 5 (0.8%) | 46 (7.2%) |
| When you have an HPV test, you get the results the same day1 | 489 (76.0%) | 11 (1.7%) | 143 (22.2%) |
| If an HPV test shows that a woman does not have HPV her risk of cervical cancer is low1 | 542 (84.3%) | 77 (12.0%) | 24 (3.7%) |
| If a woman has had the HPV vaccine, she doesn’t need to get tested for HPV3 | 613 (95.3%) | 9 (1.4%) | 21 (3.3%) |
| Primary HPV testing is more effective than cytology first3 | 334 (51.9%) | 115 (17.9%) | 194 (30.2%) |
| If a woman tests positive they should avoid sexual activity until the infection passes3 | 518 (80.6%) | 73 (11.4%) | 52 (8.1%) |
| An HPV test can tell a woman what HPV type they have3 | 471 (73.3%) | 116 (18.0%) | 56 (8.7%) |
| If post treatment, both cytology and high-risk HPV test are negative, they will require a repeat smear in 3 years2 | 502 (78.1%) | 85 (13.2%) | 56 (8.7%) |
| If the post-lletz treatment high-risk HPV test is negative a woman will require annual follow-up for ten years2 | 442 (68.7%) | 84 (13.1%) | 117 (18.2%) |
| All cervical samples showing normal, borderline nuclear changes or mild dyskaryosis 6 months post treatment are tested for high-risk HPV2 | 472 (73.4%) | 87 (13.5%) | 84 (13.1%) |
| All cervical samples showing borderline nuclear changes or mild dyskaryosis are tested for high-risk HPV2 | 541 (84.1%) | 61 (9.5%) | 41 (6.4%) |
| **HPV vaccine knowledge questions1** |  |  |  |
| The HPV vaccines offer protection against all sexually transmitted infections | 640 (99.5%) | 2 (0.3%) | 1 (0.2%) |
| Girls who have had the HPV vaccine do not need to have smear tests when they are older | 635 (98.8%) | 1 (0.2%) | 7 (1.1%) |
| Someone who has had HPV vaccine cannot develop cervical cancer | 628 (97.7%) | 3 (0.5%) | 12 (1.9%) |
| Girls under 15 years require two doses of HPV vaccines4 | 581 (90.4%) | 41 (6.4%) | 21 (3.3%) |
| The HPV vaccines are most effective if given to people who have never had sex | 536 (83.4%) | 79 (12.3%) | 28 (4.4%) |
| The HPV vaccines offer protection against most cervical cancers | 460 (71.5%) | 152 (23.6%) | 31 (4.8%) |
| The HPV vaccine offers protection against genital warts | 339 (52.7%) | 228 (35.5%) | 76 (11.8%) |

1Questions from Waller et al14

2Additional questions from Patel et al13

3Questions new to this survey

4Wording changed from original to reflect changes in the vaccine dose schedule

*Table 3. Ordinal regression of predictors of knowledge*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | HPV knowledge score (15 questions) | | | | | | | | | | |
|  | Crude | | | |  | | Full modela | | | | |
|  | OR | 95% CI | *p* |  | | OR | | 95% CI | | *p* | |
| Years since HPV training |  |  |  |  | |  | |  | |  | |
| Never | *Ref* |  |  |  | | *Ref* | |  | |  | |
| >1 year ago | 0.88 | 0.47-1.64 | 0.68 |  | | 1.19 | | 0.61-2.3 | | 0.61 | |
| ≤1 year ago | 1.10 | 0.59-2.07 | 0.76 |  | | 1.50 | | 0.77-2.91 | | 0.23 | |
|  |  |  |  |  | |  | |  | |  | |
| Current role |  |  |  |  | |  | |  | |  | |
| Nurse in GP practice | *Ref* |  |  |  | | *Ref* | |  | |  | |
| Doctor in GP practice | 2.20 | 0.97-4.97 | 0.06 |  | | 2.96 | | 1.22-7.19 | | 0.02 | |
| Nurse or Doctor in colposcopy clinic | 5.17 | 2.00-13.38 | <0.01 |  | | 6.24 | | 2.34-16.64 | | <0.01 | |
| Nurse in Family Planning Service/ GUM clinic | 1.23 | 0.54-2.79 | 0.63 |  | | 1.90 | | 0.76-4.76 | | 0.17 | |
| Doctor in Family Planning Service/GUM clinic | 6.90 | 0.87-54.43 | 0.07 |  | | 10.21 | | 1.25-83.21 | | 0.03 | |
| Country |  |  |  |  | |  | |  | |  | |
| England | *Ref* |  |  |  | | *Ref* | |  | |  | |
| Northern Ireland | 0.69 | 0.31-1.53 | 0.36 |  | | 0.58 | | 0.24-1.38 | | 0.22 | |
| Scotland | 0.77 | 0.53-1.14 | 0.19 |  | | 0.62 | | 0.41-0.95 | | 0.03 | |
| Wales | 0.81 | 0.35-1.86 | 0.62 |  | | 0.44 | | 0.17-1.14 | | 0.09 | |
|  |  |  |  |  | |  | |  | |  | |
|  | Triage and Test of Cure knowledge score (14 questions) | | | | | | | | | | |
|  | Crude | | | |  | | Full model | | | | |
|  | OR | 95% CI | *p* | |  | | OR | | 95% CI | | *p* |
| Years since HPV training |  |  |  | |  | |  | |  | |  |
| Never | *Ref* |  |  | |  | | *Ref* | |  | |  |
|  |  |  |  | |  | |  | |  | |  |
| >1 year ago | 2.23 | 1.25-3.96 | 0.01 | |  | | 3.09 | | 1.68-5.68 | | <0.01 |
| ≤1 year ago | 3.20 | 1.80-5.67 | <0.01 | |  | | 4.15 | | 2.25-7.63 | | <0.01 |
|  |  |  |  | |  | |  | |  | |  |
| Current role |  |  |  | |  | |  | |  | |  |
| Nurse in GP practice | *Ref* |  |  | |  | | *Ref* | |  | |  |
| Doctor in GP practice | 1.20 | 0.64-2.26 | 0.57 | |  | | 1.91 | | 0.94-3.87 | | 0.07 |
| Nurse or Doctor in colposcopy clinic | 4.19 | 2.26-7.79 | <0.01 | |  | | 6.20 | | 3.17-12.15 | | <0.01 |
| Nurse in Family Planning Service/ GUM clinic | 0.51 | 0.24-1.06 | 0.07 | |  | | 0.93 | | 0.4-2.2 | | 0.88 |
| Doctor in Family Planning Service/GUM clinic | 0.53 | 0.18-1.55 | 0.25 | |  | | 1.99 | | 0.63-6.28 | | 0.24 |
| Country |  |  |  | |  | |  | |  | |  |
| England | *Ref* |  |  | |  | | *Ref* | |  | |  |
| Northern Ireland | 0.97 | 0.46-2.04 | 0.93 | |  | | 1.03 | | 0.46-2.3 | | 0.94 |
| Scotland | 0.21 | 0.14-0.31 | <0.01 | |  | | 0.18 | | 0.12-0.28 | | <0.01 |
| Wales | 1.56 | 0.71-3.39 | 0.27 | |  | | 1.00 | | 0.41-2.46 | | 1.00 |
|  |  |  |  | |  | |  | |  | |  |
|  | Vaccine knowledge score (7 questions) | | | | | | | | | | |
|  | Crude | | | |  | | Full model | | | | |
|  | OR | 95% CI | *p* | |  | | OR | | 95% CI | | *p* |
| Years since HPV training |  |  |  | |  | |  | |  | |  |
| Never | *Ref* |  |  | |  | | *Ref* | |  | |  |
|  |  |  |  | |  | |  | |  | |  |
| >1 year ago | 1.85 | 0.98-3.48 | 0.06 | |  | | 1.96 | | 1.03-3.75 | | 0.04 |
|  |  |  |  | |  | |  | |  | |  |
|  |  |  |  | |  | |  | |  | |  |
|  |  |  |  | |  | |  | |  | |  |
| Current role |  |  |  | |  | |  | |  | |  |
| Nurse in GP practice | *Ref* |  |  | |  | | *Ref* | |  | |  |
| Doctor in GP practice | 0.72 | 0.35-1.46 | 0.36 | |  | | 0.89 | | 0.42-1.9 | | 0.77 |
| Nurse or Doctor in colposcopy clinic | 2.75 | 1.51-5.02 | <0.01 | |  | | 3.02 | | 1.62-5.62 | | <0.01 |
| Nurse in Family Planning Service/ GUM clinic | 1.29 | 0.59-2.82 | 0.53 | |  | | 1.52 | | 0.64-3.61 | | 0.35 |
| Doctor in Family Planning Service/GUM clinic | 1.81 | 0.59-5.57 | 0.30 | |  | | 2.35 | | 0.73-7.59 | | 0.15 |
| Country |  |  |  | |  | |  | |  | |  |
| England | *Ref* |  |  | |  | | *Ref* | |  | |  |
| Northern Ireland | 0.66 | 0.29-1.52 | 0.33 | |  | | 0.78 | | 0.32-1.87 | | 0.57 |
| Scotland | 0.92 | 0.63-1.35 | 0.68 | |  | | 0.82 | | 0.54-1.23 | | 0.33 |
| Wales | 1.09 | 0.48-2.47 | 0.84 | |  | | 0.69 | | 0.28-1.72 | | 0.43 |

a The full model included the variables “Years since HPV training”, “Current role”, and “Country”

*Table 4. Ordinal regression of the association between eLearning module completion and knowledge scores in England*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | HPV knowledge score (15 questions) | | | | | | |
|  | Crude | | |  | Full modela | | |
|  | OR | 95% CI | *p* |  | OR | 95% CI | *p* |
| elearning module |  |  |  |  |  |  |  |
| No | *Ref* |  |  |  | *Ref* |  |  |
| Yes | 1.49 | 0.98-2.24 | 0.06 |  | 1.38 | 0.90-2.12 | 0.14 |
|  |  |  |  |  |  |  |  |
|  | Triage and TOC knowledge score (14 questions) | | | | | | |
|  | Crude | | |  | Full modela | | |
|  | OR | 95% CI | *p* |  | OR | 95% CI | *p* |
| elearning module |  |  |  |  |  |  |  |
| No | *Ref* |  |  |  | *Ref* |  |  |
| Yes | 1.43 | 1.00-2.04 | 0.05 |  | 1.29 | 0.89-1.87 | 0.18 |
|  |  |  |  |  |  |  |  |
|  | Vaccine knowledge score (7 questions) | | | | | | |
|  | Crude | | |  | Full modela | | |
|  | OR | 95% CI | *p* |  | OR | 95% CI | *p* |
| elearning module |  |  |  |  |  |  |  |
| No | *Ref* |  |  |  | *Ref* |  |  |
| Yes | 1.29 | 0.88-1.88 | 0.19 |  | 1.28 | 0.87-1.90 | 0.21 |

a Full model adjusted for years since HPV training and current role