Reducing young people’s cancer risk by vaccinating against HPV

The UK introduced human papillomavirus (HPV) vaccination for girls in 2008 to protect against HPV infection and reduce the risk of cervical cancer in later life. Since then, more than 10 million young women have received the vaccine, with 80% of women aged 15-24 years now vaccinated (Public Health England, 2018). In 2018, an HPV vaccination programme was introduced for men who have sex with men (MSM), up to the age of 45, through sexual health clinics. In July 2018, the Joint Committee on Vaccination and Immunisation recommended that UK governments extend the HPV vaccination programme to adolescent boys. This was implemented in September 2019 – HPV vaccination is now offered to all young people aged 11-14 years in Year 8 in England and Wales, S1 in Scotland, and Year 9 in Northern Ireland. PHE (2019a) states that: “As well as providing individual protection to males from anogenital warts and non-cervical HPV-associated cancers, this should add resilience to the UK programme, accelerate the control of cervical cancer in women and offers the potential for the elimination of HPV vaccine types in the UK.” The timeline of the HPV vaccination programme for England is shown in Fig 1.

HPV infection is the cause of almost all cervical cancers
A UK vaccination programme for girls has significantly reduced infections, genital warts and pre-cancerous cervical disease
Adolescent boys are now also being offered vaccination to help prevent HPV-related cancers

HPV and cancer risk
HPV is a double-stranded DNA virus that infects the surface of the skin and mucosae of the upper respiratory and anogenital tracts. There are over 100 different types, of which around 40 infect the genital tract. They are classified as high risk or low risk, depending on their association with the development of cancer (PHE, 2019a).

In this article...
- Types of human papillomavirus (HPV) and their cancer risk
- Review of the HPV vaccination programme in the UK
- Why the vaccination programme has been extended to boys as well as girls

Key points
- Human papillomavirus (HPV) is a common sexually transmitted infection that is usually asymptomatic and self-limiting
- Persistent infection from high-risk virus types is linked to anogenital and oropharyngeal cancers
- HPV infection is the cause of almost all cervical cancers
- A UK vaccination programme for girls has significantly reduced infections, genital warts and pre-cancerous cervical disease
- Adolescent boys are now also being offered vaccination to help prevent HPV-related cancers

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Abstract
The human papillomavirus (HPV) is one of the most common sexually transmitted infections in the UK. Although most infections are asymptomatic and self-limiting, persistent infection with high-risk virus types is associated with anogenital and oropharyngeal cancers in men and women, and is detectable in >99% of cervical cancers. HPV vaccination was successfully introduced in the UK for girls in 2008 and has already significantly reduced pre-cancerous cervical disease, HPV infections and genital warts. In September 2019, the programme was extended to include adolescent boys, which should further reduce the incidence of HPV-related cancers.

Citation

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Human papillomavirus/Cervical cancer/HPV vaccination

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**HPV transmission**

HPV is one of the most common sexually transmitted infections in the UK and in unvaccinated populations, most people will be infected at some point in their lifetime. HPV infections are spread primarily by sexual contact with an infected partner, mostly through sexual intercourse but also by non-penetrative genital contact, including oral sex. Condoms do not protect fully against HPV infection. A person's risk of infection increases with the number of sexual partners, but infection also depends on partners' sexual history and can occur after any sexual encounter. HPV infection commonly occurs soon after a person's first sexual contact, with almost 40% of women being infected within two years (PHE, 2019a).

**HPV vaccine**

More than 80 million people have received the HPV vaccine worldwide (PHE, 2019b). In the UK almost all the vaccine is delivered in schools, although eligible young people who have missed it can receive it through their GP up to their 25th birthday. The HPV vaccine currently used in the UK is Gardasil, which protects against HPV types 6, 11, 16 and 18 and does not contain thiomersal or porcine gelatin (Bit.ly/EMCGardasil). It is most effective when given before a young person becomes sexually active, which is why the vaccine is usually offered to young people in the UK during the first couple of years at senior school. When administering Gardasil:

- Two doses are required for maximum protection, with the second dose given 6-24 months after the first;
- If the first dose is given after a young person's 15th birthday, three doses are required as the vaccine is less effective in an older age group. The second should be at least one month after the first, and the third at least three months later. Ideally all three doses should be given within one year;
- Even if a person has already had an HPV infection, they will still benefit from protection against the other HPV types included in the vaccine;
- Studies show protection is maintained for at least 10 years, although it is expected to last much longer (Bit.ly/EMCGardasil).

**Vaccination effectiveness**

The HPV vaccination programme has been running in the UK for just over 10 years and is already showing significant reductions in pre-cancerous cervical disease, HPV infections and genital warts.

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**Box 1. Anogenital and oropharyngeal cancers**

**Figures for the UK show that:**

- More than 3,000 women are diagnosed with cervical cancer and around 850 die from it each year
- The highest incidence of cervical cancer is in women aged 25-29 years
- Around a third of women diagnosed with invasive cervical cancer die within five years
- In 2016, there were around 900 new cases of anal cancer in women and 500 in men
- Each year, there are around 1,500 new diagnoses of vulval and vaginal cancers, and 600 new diagnoses of penile cancers (Bit.ly/CRUKstats)

**Figures for England show that:**

- 4,689 women and 1,749 men were diagnosed with oropharyngeal cancers in 2016, and around half of these were related to human papillomavirus (Public Health England, 2019a)
An evaluation of the programme in Scotland showed vaccinated women were almost 90% less likely to develop pre-cancerous cervical disease (cervical intraepithelial neoplasia [CIN] grades 2 and 3 or higher) than older women who had not been offered the vaccine. The evaluation also re-confirmed that the vaccine is more effective at a younger age, with an 86% reduction for CIN grade 3 or higher for girls vaccinated aged 12–13 years, compared with a 51% reduction for women vaccinated at the age of 17 (Palmer et al, 2019).

Surveillance of the programme in England showed HPV 16/18 decreased from 8.2% to 1.6% in 16-18 year-olds, and from 14% to 1.6% in 19-21 year-olds. Vaccine effectiveness against HPV16/18 was estimated at 82% for women vaccinated <15 years (Mesher et al, 2018). England has also seen a large decline in diagnoses of anogenital warts since introducing the Gardasil vaccine, with an 82% reduction in females aged 15–17 years and a 68% reduction in same age heterosexual males, showing the protective impact on males from having vaccinated females (Checchi, 2019).

Australia was one of the first countries to introduce HPV vaccination, beginning its programme in 2007, and has also seen the substantial impact of the programme in lowering the prevalence of vaccine-included HPV types, anogenital warts and pre-cancerous lesions in vaccinated cohorts. If high levels of vaccination and cervical screening are maintained, cervical cancer could potentially be eliminated as a public health issue in Australia within the next 20 years (Hall et al, 2019).

Vaccine safety
The safety of the Gardasil vaccine has been established through rigorous testing in clinical trials, and over 10 years of extensive use. Since the vaccine was introduced, reports to the Medicines and Healthcare products Regulatory Agency of suspected side-effects have been within usual levels, taking into account the many millions of doses given worldwide. As with any medicinal product, some people may experience adverse reactions such as a redness or pain at the injection site, headache, myalgia, fatigue and low-grade fever (Bit.ly EMC Gardasil). These are generally mild, of short duration and are far outweighed by the expected benefits of the vaccine.

Extensive reviews of vaccine safety do not support a link between the HPV vaccine and a range of long-term conditions, including chronic fatigue syndrome (Arbyn et al, 2018; Cameron et al, 2016; Vichhnin et al, 2015; Arnhem-Dahlström et al, 2013). Chronic fatigue syndrome does occur naturally in adolescence and evidence from these studies, and the wide use of the vaccine, suggests reports of chronic fatigue syndrome following HPV vaccine are coincidental. As with all vaccines, the safety of HPV vaccine will remain under close and continual review.

Conclusion
In the UK, the HPV vaccine has been offered to girls since 2008, offering protection against a range of cancers causally related to HPV infection and genital warts. The vaccine has already significantly reduced the numbers of pre-cancerous cervical lesions and high-risk HPV infections (Box 2 gives a list of useful resources). From September 2019, the vaccine has also been offered to year 8 boys. It is anticipated that the vaccine will significantly reduce morbidity and mortality from HPV-related anogenital and oropharyngeal cancers in the UK. NT

References
Checchi M et al (2019) Declines in anogenital warts diagnoses since the change in 2012 to use the quadrivalent HPV vaccine in England data to end 2017. Sexually Transmitted Infections; 95, 368-373.

Box 2. Resources
- HPV Vaccination: Protecting Against HPV Infection to Help Reduce Your Risk of Cancer (leaflet for young people). Bit.ly/PHEHPVleaflet
- HPV Vaccination (video on vaccination). Bit.ly/NHSHPVvideo
- Human Papillomavirus (HPV) Vaccination Universal HPV Adolescent Immunisation Programme (HPV vaccine training slideset). Bit.ly/PHEHPVslides