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Systematic Review

Acceptability of human papillomavirus vaccination in the United Kingdom: a systematic review of the literature on uptake of, and barriers and facilitators to HPV vaccination

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Abstract

Background: Human papillomavirus (HPV) is the most common sexually transmitted infection worldwide, with HPV and HPV-related diseases representing a substantial disease burden. HPV vaccination has reduced HPV infections and HPV-related diseases; however, there is growing evidence of delayed or refused vaccination due to a lack of trust in vaccines. Understanding the factors that impact vaccine uptake will allow the development and implementation of successful vaccination programmes.

Objectives: This study aimed to evaluate the acceptability of HPV vaccination among adolescents and parents in the United Kingdom (UK).

Design: Systematic review.

Methods: Online databases (Embase, Medline and Cochrane) and grey literature sources were searched to identify publications pertaining to 'adolescents', 'parents', 'vaccine uptake', 'vaccine hesitancy' and 'barriers or facilitators to vaccination'. Searches were limited to English language and articles published specific to the United Kingdom between 2017 and 2023.

Results: Following a review of 152 abstracts, 24 publications met the inclusion criteria. While HPV vaccination is widely accepted in the UK, with coverage reported ⩾80% in peer-reviewed literature, the UK Health Security Agency report that vaccine coverage estimates in England between 2020–2023 remain below 80% and are lower than pre-COVID levels. Several important barriers were identified that may impact vaccine uptake, including system-level (challenges with obtaining consent), psychological/behavioural (perception of HPV risk vs vaccine risks), and sociodemographic factors, with similar factors reported among adolescents and parents.

Conclusion: HPV vaccination coverage remains below pre-COVID levels in the UK and common barriers among adolescents and parents have been identified that must be addressed to improve coverage rates. There is currently limited evidence among adolescent boys to fully evaluate any differences in vaccination coverage, or barriers, compared to girls. More research is required into facilitators to vaccination (especially to address sociodemographic barriers), to identify approaches to tackle the barriers that currently impede HPV vaccination uptake.

Plain language summary

Acceptability of human papillomavirus vaccination in the United Kingdom: a systematic review

Why was the study conducted? Human papillomavirus (HPV) is the most common sexually transmitted infection worldwide, with HPV and HPV-related diseases

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representing a substantial disease burden. HPV vaccination has reduced HPV infections and HPV-related diseases, however, there is growing evidence of delayed or refused vaccination due to a lack of trust in vaccines. Understanding the factors that impact vaccine uptake will allow the development and implementation of successful vaccination programmes.

What did the researchers do? A literature review was conducted using online databases to identify publications reporting on 'adolescents', 'parents', 'vaccine uptake', 'vaccine hesitancy', and 'barriers or facilitators to vaccination' in English and published in the United Kingdom, between 2017 and 2023.

What did the researchers find? After reviewing 152 publications, 24 met the inclusion criteria. While HPV vaccination is widely accepted in the UK, reported vaccine coverage estimates are mixed, with UK Health Security Agency estimates remaining below pre-COVID levels. Several important barriers were identified that may impact vaccine uptake, including challenges with obtaining consent for vaccination, perception of risks of vaccination, and sociodemographic factors. Similar barriers were reported among adolescents and parents.

What do the findings mean? HPV vaccination coverage remains below pre-COVID levels in the UK and common barriers among adolescents and parents have been identified that must be addressed to increase vaccine uptake. The limited evidence identified for adolescent boys prevented a full comparison of differences in vaccination coverage between boys and girls. More research is required on the factors that increase vaccine uptake, to identify approaches that could address the barriers currently limiting high vaccine coverage in the UK.

Keywords: adolescents, HPV vaccine, human papillomavirus, vaccination coverage, vaccine hesitancy

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Introduction

HPV is the most common sexually transmitted infection (STI) worldwide, such that almost all sexually active individuals will be exposed during their lifetime.[1] There are over 150 types of HPV that can be characterised into high-oncogenic risk (e.g. HPV 16/18/31/33/35/39/45/51/52/57/58/59/68) and low-oncogenic risk (e.g. HPV 6/11) types, based on their association with cancer and precursor lesions.[2] Infection with high-risk HPV types can lead to both low- and high-grade lesions of the cervix, vagina, vulva, anus, penis and oropharynx.[3,4]

HPV presents a substantial disease burden for sexually active individuals.[5] In women, high-risk HPV types are responsible for virtually all cervical cancer cases, with cervical cancer being the fourth most common cancer and the fourth leading cause of cancer death globally.[4,5] Furthermore, the burden of certain HPV-related diseases is much larger in men than among females, with a four-fold higher incidence of oropharyngeal cancer observed in men compared to women.[5,6]

Due to this burden, three HPV vaccines have been developed and marketed globally: a

bivalent, quadrivalent and nonavalent vaccine.[7] Since the introduction of these vaccines, there has been an increasing body of global evidence supporting the effectiveness of HPV vaccination and its population-level impact on reducing HPV infection and related diseases.[8–10] Research in Scotland has now demonstrated that no cervical cancer cases have been detected in fully vaccinated women following bivalent HPV vaccination at 12–13 years, since programme initiation in 2008.[11]

The acceptability of HPV vaccination by all key stakeholders, including adolescents and their parents/guardians, is key to the success of HPV vaccination.[12,13] Despite the breadth of evidence supporting both the use of HPV vaccination among adolescents and the impact of vaccination, there is growing evidence of delayed vaccination or vaccine refusals resulting from a lack of trust in the safety and effectiveness of vaccines and a mistrust of health authorities.[14–17] This further exacerbates the underlying challenges to high-vaccination coverage from persisting barriers and acceptability issues.[18]

Understanding the acceptability of HPV vaccination in both adolescents and their parents/guardians is of particular importance given that the age of primary vaccination for HPV vaccination in the UK is 12–13 years.[19] While adolescents are legally able to self-consent as long as they understand the issues in giving consent, the age of consent for medical treatment in the UK is 16 years, which means that adolescents may be overruled by their parents/guardians.[20,21] Therefore, it is of the utmost importance that both the barriers and facilitators to vaccination are identified for each population.

Although there has been research into the attitudes of adolescents and, separately, of parents towards vaccination in Europe,[22] there has been little research comparing the attitudes of both adolescents and their parents towards HPV vaccination in the UK.[22,23] Therefore, the objective of this systematic literature review (SLR) was to evaluate the current vaccination uptake levels in adolescents and possible factors (facilitators or barriers to vaccination) influencing this uptake among adolescents and their parents/guardians.

Methods

Search strategy

Embase, Medline, the Cochrane Library (Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews and Database of Abstracts of Reviews of Effects) and EconLit were searched for academic publications (2017–2022). The search strategy was created in accordance with standard PRISMA and Cochrane guidelines,[24,25] and comprised of key terms and Medical Subject Headings (MeSH) relating to HPV, vaccination uptake/coverage/perception, adolescents (not limited by gender), and parents/guardians. Boolean operators (AND/OR) were used to combine these search terms (Supplemental Table 1), and searches were limited to the English language and studies conducted in the UK, using language and geographical limits. A grey literature review was also conducted through JCVI minutes and reports, UK Health Security Agency (HSA) reports, and conference proceedings from ISPOR Europe, EUROGIN, International Papillomavirus Conference, and European Public Health Conference, with all being searched 2021–2023 using terms pertinent to the study objectives (see Supplemental Table 3).

Study selection and data extraction

All identified academic records were reviewed for inclusion by two independent reviewers using the population, comparators, outcomes, time and study design (PICOTS) framework (Table 1). Included articles were primary studies reporting on (1) adolescents (any gender) eligible for HPV vaccination in the UK or parents/guardians of eligible adolescents, or (2) vaccine uptake or hesitancy outcomes; (3) real-world evidence. Publications included in the initial title and abstract screening phase underwent full-text screening (with both reviewers using the same PICOTS criteria at both screening phases). All discrepancies identified in the screening process were resolved by consensus discussion among the two reviewers.

Data from included articles were extracted on population characteristics, HPV vaccination coverage, and barriers and facilitators to vaccination and qualitatively synthesised. A quality

Table 1. Eligibility criteria.

Topic	Inclusion criteria	Exclusion criteria
Population	Studies reporting on adolescents aged 12–17 years or parents/guardians of adolescents eligible for HPV vaccination	• Studies reporting on adolescents who are ineligible for HPV vaccination or adults who are not primary caregivers/guardians • Studies reporting on women/men with no mention of age
Intervention	Studies reporting on HPV vaccination (all types)	Studies reporting on other adolescent vaccines
Comparators	No comparator data expected	N/A
Outcomes	Studies reporting on vaccine uptake, hesitancy, barriers to vaccination, and facilitators of vaccination	Studies that do not contain any of the outcomes of interest specified in the inclusion criteria, including vaccine efficacy or safety data
Study design	• Studies that report real-world evidence • RCTs • Modelling studies	Any other study types, for example, systematic reviews* and case reports (sample size $n \leqslant 2$)
Other	• Limit to studies published between 2017 and 2022 • Limit to English language • Limit to studies in the United Kingdom • Limit to Humans	Conference abstracts that report the same data as a subsequent full-text publication will be marked as duplicates and excluded

*Systematic reviews were excluded; however, the reference lists of systematic reviews were hand-searched and reviewed against the eligibility criteria, to ensure that all relevant primary publications are captured within this review.
N/A, not applicable; RCT, randomised controlled trial.

assessment was conducted on all included publications based on the CASP assessment tool for cohort studies, and the National Institute for Health and Care Excellence (NICE) guidance for quantitative and qualitative studies to ensure robustness and relevance to the study objectives.[26–28]

Results

The search, run on 30th January 2024, identified a total of 152 articles (once duplicates had been removed), of which 56 were taken through to full-text review (Figure 1). Records were primarily excluded for not reporting on either adolescents or parents, or for not focusing on outcomes related to barriers or facilitators to vaccination. After screening the full texts against the eligibility criteria, 21 publications were included. Furthermore, 25 publications were identified through grey literature searches, with three publications included following the review against the eligibility criteria. A total of 24 publications were included in the quality appraisal and qualitative synthesis.

Study characteristics

Studies were identified from all countries within the UK, with most studies conducted in England ($n = 19$). Two studies were identified from Scotland and the UK overall, with one study identified from Wales. No studies were identified from Northern Ireland. Most studies reported on barriers to vaccination ($n = 17$), with 14 reporting on facilitators of vaccination, and 14 reporting on vaccine coverage. Most studies ($n = 10$) specifically reported on outcomes in adolescent girls, while six studies reported on both adolescents and parents, and five reported on parents only. Three studies were included reporting on both boys and girls, with one study each reporting on boys only and the population not specified.

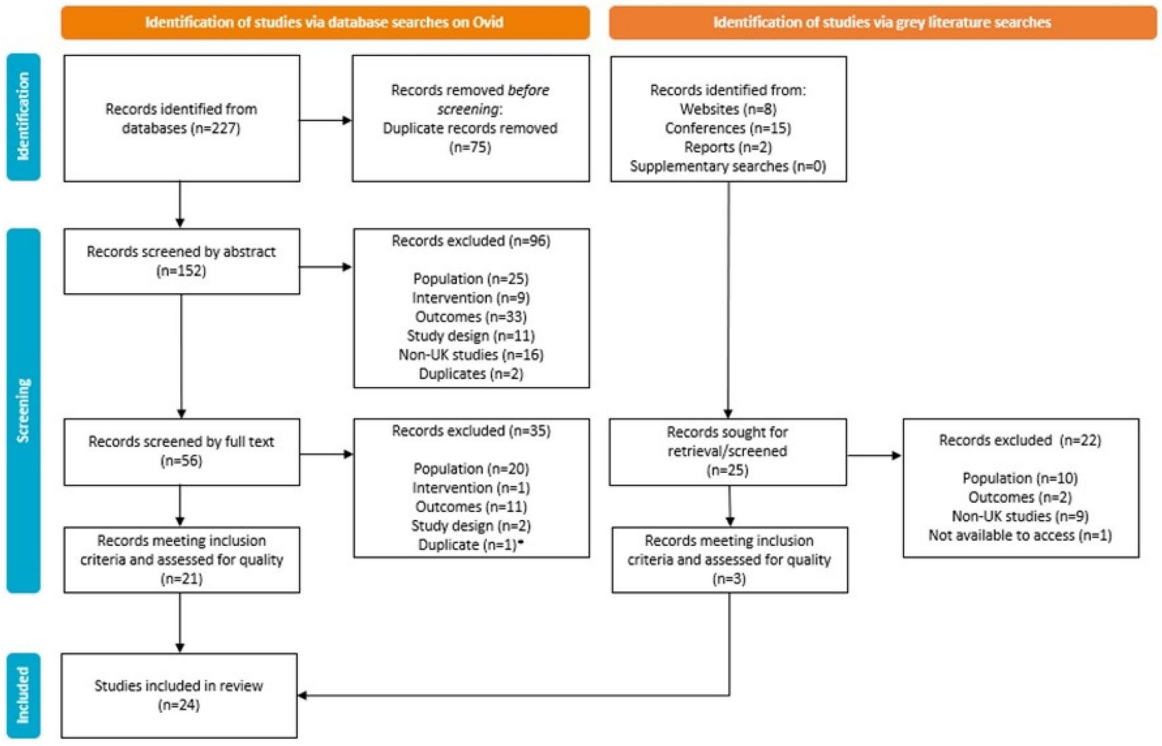

Figure 1. PRISMA diagram.
*Record removed due to being a duplicate (secondary publication on the same dataset as an included publication), as opposed to duplicates of the same publication identified during abstract screening.

Most peer-reviewed studies ($n = 14$) were deemed to be of high,[23,29–41] or moderate quality,[42–45] (Supplemental Figure 1) with only one evaluated to be of poor quality.[46] However, the study by Williamson et al. was an abstract only, limiting the ability to complete a full evaluation of the methods.[46]

Vaccine coverage

Among the included publications, 13 reported HPV vaccine coverage among adolescents in the United Kingdom (Table 2).[29,33,34,36,37,39,41,42,47–51] The majority of these studies reported vaccination coverage in girls only.[29,33,34,36,37,39,41,42,47,48] Two studies reported vaccine coverage data in both girls and boys.[50,51] Four studies that reported vaccine coverage using either national immunisation records, or at a country level, reported generally high HPV vaccination coverage (⩾80%) among adolescent girls.[29,39,48,52] Furthermore, two studies evaluated vaccine coverage by year, with both studies indicating high vaccine coverage for at least one dose (>84.0% from 2009 to 2017: 84.3% in 2009/2010 to 90.9% in 2012/2013 from Tiley et al., and 89.6% in 2014/2015 to 89.8% in 2016/2017 from Pollock et al. 2019).[48,52] However, the UK Health Security Agency reported that vaccine coverage estimates in England in the 2021–2021 and 2021–2022 academic years were below 80% in both girls and boys for most age groups receiving their first and second doses.[50,51] The highest coverage (82.8%) was reported for girls in year 9 (aged 14–15 years) receiving their first dose in the 2021/2022 academic year.[51] For each dose and year group in the two academic years, vaccination coverage was lower among boys than girls (e.g. dose 1 coverage in year 8 females in 2021/2022 was 69.6% in females vs 62.4% in males).[50,51]

Two studies evaluated vaccine coverage in the context of ethnic minorities and/or socioeconomic status (SES).[37,52] In a cross-sectional study

Table 2. HPV vaccine coverage.

Study details	Study design	Timeframe	Study setting and population	HPV vaccination coverage: *n* (%)
Audrey et al. 2020[42]	Qualitative	2017/2018 and 2019/2020	Schools in two local authorities in South-West England adolescent girls and parents) *N* = NR	Vaccination with parent written consent: 5538 (87.3) Vaccination with parent verbal consent: 299 (4.7) Vaccination with adolescent self-consent: 17 (0.3) Vaccination with community catch-up clinics: 217 (3.4) Vaccination with GP: 219 (3.5)
Bedford et al. 2021[39]	Prospective cohort	2012–2015	Cross-sectional data from the Millennium Cohort Study (England) (Girls) *N* = 5695	Vaccinated: 5265 (92.3) Not vaccinated: 399 (7.2) Don't know: 26 (0.5)
Emerson et al. 2019[41]	Cross-sectional	NR	Families randomly selected from Child Benefit Records in England (parents) *N* = 5087 (HPV only)	Children with intellectual disabilities: 149 (87.4) Other children: 4938 (93.1)
Fisher et al. 2021[37]	Cross-sectional	2017/2018 and 2018/2019	Two local authorities in South-West England (girls and parents) *N* = 7129	Overall: 6341 (89.0) White British: 4552 (93.1) Non-white British: 492 (86.0) Unknown: 1297 (77.7) Least deprived: 1235 (91.6) Most deprived (84.0)
Jean et al. 2018[36]	Cross-sectional	2013–2014	School vaccination data from PHE (adolescent girls) *N* = NR	Dose 1: (90.6) Dose 2 (89.5) Dose 3 (86.5)
Nickel et al. 2017[34]	Cross-sectional	NR	Parents of 9- to 17-year-old adolescent girls in the US, UK and Australia *N* = 179	Vaccinated: 37 (62.7) Not vaccinated 22 (37.3)
Pollock et al. 2019[52]	Prospective	2014–2017	Adolescent girls registered in S3 (aged 13–14) in Scotland *N* = NR	2014/2015: UK: 21,840 (89.6) Eastern Europe: 284 (75.5) Polish: 233 (77.2) Total Scotland: 23,588 (88.8) 2015/2016: UK: 20,775 (87.2) Eastern Europe: 260 (68.1) Polish: 209 (69.7) Total Scotland: 22,570 (86.5) 2016/2017: UK: 20,998 (89.8) Eastern Europe: 304 (72.7) Polish: 231 (72.0) Total Scotland: 23,040 (88.8)
Rockcliffe et al. 2017[33]	Cross-sectional	2008–2011	Adolescent girls attending 195 London schools *N* = NR	Dose 1: (73.3) Dose 2: (70.8) Dose 3: (66.2)

(Continued)

Table 2. (Continued)

Study details	Study design	Timeframe	Study setting and population	HPV vaccination coverage: *n* (%)
Tiley et al. 2019[29]	Ecological	2016–2017	Girls aged 13–14 in schools in England *N* = NR	National: (82.1)
Tiley et al. 2020[48]	Retrospective registry analysis	2008–2017	School-based immunisation programme data in England (girls) *N* = NR	⩾1 dose 2008/2009: (88.1) 2009/2010: (84.3) 2010/2011: (88.9) 2011/2012: (90.6) 2012/2013: (90.9) 2013/2014: (91.1) 2014/2015: (89.4) 2015/2016: (90.2) 2016/2017: (88.8)
JCVI 2023[49]	Grey literature report	2022–2023	HPV coverage in Wales (population not specified)	Dose 1: (83.0)
UK Health Security Agency 2021[50]	Retrospective registry analysis	2020–2021	Total number of eligible females or males in the target population aged 13 or 14 years, who had received dose 1 and/or dose 2 for the academic year in England	Dose 1 (females, year 8): (76.1) Dose 1 (males, year 8): (71.0) Dose 2 (females): (60.2) Dose 2 (males): (54.4)
UK Health Security Agency 2022[51]	Retrospective registry analysis	2021–2022	Total number of eligible females or males in the target population aged 13–15 years, who had received dose 1 and/or dose 2 for the academic year in England	Dose 1 (females, year 8): (69.6) Dose 1 (males, year 8): (62.4) Dose 1 (females, year 9): (82.8) Dose 1 (males, year 9): (77.6) Dose 2 (females, by year 9): (67.3) Dose 2 (males, by year 9): (62.4) Dose 2 (females, by year 10): (76.8) Dose 2 (males, by year 10): (70.9)

*HPV vaccination was not available for boys in the NIP at the time of the study.
N/A, not applicable; NR, not reported; PHE, Public Health England; RCT, randomised controlled trial; SES, socioeconomic status; STI, sexually transmitted infection; UK, United Kingdom.

of girls in South-West England ($N = 7129$), Fisher et al. 2021 reported that vaccine coverage was 89.0% among the overall cohort ($n = 6341$).[37] However, vaccination was highest among girls from the least deprived areas (91.6%; $n = 1235$) compared to girls from the most deprived areas (84.0%; $n = 1194$).[37] Furthermore, Fisher et al. reported that vaccine coverage was highest among White British girls (93.1%) when compared to girls of non-white British (86.0%) and unknown ethnicity (77.7%).[37] In a national prospective study of girls aged 13–14 in Scotland ($N = NR$), Pollock et al. (2019) reported that HPV vaccination coverage was consistently lower from 2014/2015 to 2016/2017 among girls from Eastern European migrant families than those from the UK.[52]

Two studies reported vaccination coverage by vaccine dose, with vaccine coverage highest at dose one in both studies.[33,36] Jean et al. (2018) reported that across local authorities in the UK ($N = NR$), vaccine coverage varied across all three doses, with a mean coverage of 90.6% at dose

one, falling to 86.5% for dose three.[36] The authors reported that the vaccination rate was lower across all three doses in local authorities with more high-income families than in those areas with more low-income families ($p < 0.001$).[36] Vaccination coverage was lower among areas with less education deprivation across all doses ($p < 0.001$).[36] Furthermore, local authorities with a higher percentage of white residents had higher vaccination rates compared to those with non-whites across all doses ($p < 0.001$).[36] Unlike Jean et al. (2018), Rockcliffe et al. (2017) did not report any significant differences in vaccine coverage by ethnicity.[33]

Emerson et al. (2019) evaluated HPV vaccine coverage among children with and without intellectual disabilities ($N = 5087$) and reported that HPV vaccine coverage was lower among children with intellectual disabilities (87.4% ($n = 149$) versus 93.1% ($n = 4938$), respectively).[41] However, the difference between groups was not statistically significant ($p = 0.054$).[41]

When evaluating vaccination coverage by route of vaccination, Audrey et al. (2020) reported that, in two local authorities in South-West England ($N = $ NR), most girls were vaccinated in a school setting following parental written consent (87.3%; $n = 5538$).[42] Only 3.5% ($n = 219$) were vaccinated at GP surgeries and 3.4% ($n = 217$) were vaccinated through community catch-up.[42]

Barriers and facilitators to vaccination

Nineteen publications reported on barriers to HPV vaccination among parents and adolescents, and 14 reported on facilitators of vaccination. Several themes emerged for barriers and facilitators to HPV vaccination in the United Kingdom (Supplemental Table 2). Health/school system factors were the most cited barrier and, correspondingly, had the most cited facilitators to improve vaccination. Concerns about the vaccine itself and sociodemographic/religious factors were also identified as barriers to vaccination; however, no facilitators to address either of these factors were identified.

Barriers

Several barriers were reported among both adolescents and parents/guardians, with these primarily focused on three themes: health/school system factors, psychological/behavioural factors and sociodemographic factors (Figure 2 and Supplemental Table 2).

When comparing barriers reported by adolescents and parents, this review identified that parents reported a greater number of barriers to HPV vaccination than adolescents (Figure 2). Barriers reported by parents alone can be grouped into the first overarching themes above: health/school system factors (challenges of obtaining consent, lack of knowledge about HPV and HPV vaccination, school absence during vaccination sessions), and psychological/behavioural factors (poor experience of other adolescents vaccinated previously, lack of perception of risk, parental challenges discussing HPV with adolescents, and fears over vaccine safety and effectiveness). Interestingly, while only parents reported concerns about vaccination on the behaviour of adolescents (i.e. risky sexual behaviour),[30,35,44] a study conducted by Knight et al. (2021) evaluating adolescent awareness of HPV and HPV vaccination ($n = 357$) identified that adolescent boys reported that '*they may take more sexual risks following vaccination*'.[45]

Only one barrier was reported by adolescents alone, namely rumours and misinformation about vaccination resulting in fear of vaccination (Figure 2). In the study conducted by Fisher et al. (2020; $n = 53$), one adolescent girl reported, '*When no one tells you. . .well the girls at my school just started making stuff up. Oh, the needles are really long and you're going to die and stupid stuff like that and that got some of the girls really scared*'.[43] While parents also reported misinformation about vaccination as a barrier to vaccine receipt, this misinformation was obtained when parents sought further information about HPV vaccination via the Internet on their own accord.[43] Fisher et al. reported that parents did cite recognition of the potential illegitimacy of this information; however, one parent in the focus group noted '*Then you google and then you see the scare story, and then you don't want to have it [the HPV vaccine] done*'.[43]

Health and school system factors

Understanding and application of consent was raised as a barrier to vaccination by both adolescents and parents, with parents primarily noting

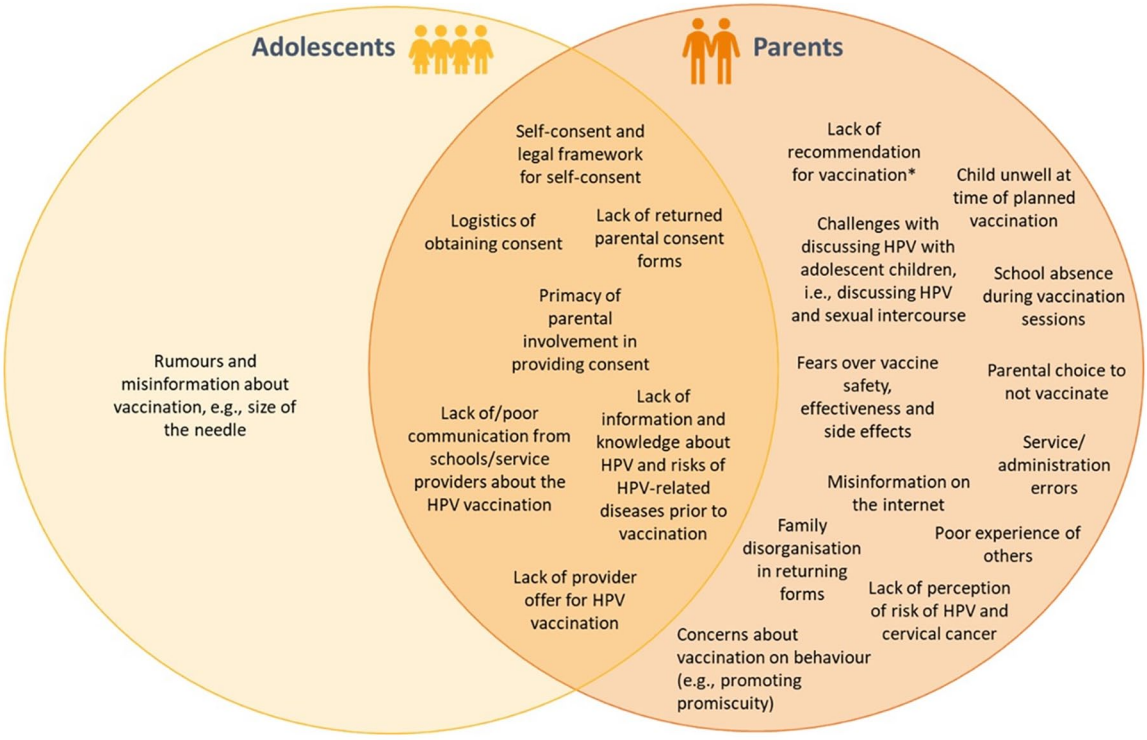

Figure 2. Venn diagram illustrating barriers to vaccination reported by adolescents and parents.[23,29–31,34,35,37,39–46]
*Vaccination was not recommended for adolescent boys in the NIP at the time of the study.[23]

that the logistics of receiving or returning the consent form were a barrier to vaccination, and adolescents identifying withholding consent forms, or self-consent as a barrier to vaccination.[31,40–43] Interestingly, Audrey et al. identified that most parents and adolescents were not aware of the legal framework for self-consent for HPV vaccination (i.e. that adolescents can provide self-consent provided they demonstrate an understanding of the issues), with parents stating a preference for deciding the age of vaccine receipt (aged 12–13), or involvement in the decision-making as a minimum.[42] Adolescent girls were not always aware of the possibility of self-consent and generally agreed that parents should be involved in the decision-making process, with girls noting that self-consent may result in lower vaccination uptake.[42] Fisher et al. (2020; $n=53$) reported that the typical procedure of returning consent forms relied on both parents completing the forms and girls returning the forms to school, noting that, '*They think if they hide the form, they don't need to have it [the vaccine] and it's amazing how many forms miraculously appear out of the bags when you say that you're going to phone the parents*'.[43] Rockcliffe et al. (2018; $n=242$) evaluated the use of incentives to counteract these barriers, specifically the opportunity to win £50 shopping vouchers for returning a consent form, and reported that a positive opinion of vaccination from girls and their parents did not necessarily relate to a positive view of the use of incentives to address the challenges with the return of consent forms.[31]

Poor communication from schools and service providers about HPV and vaccination were also identified as barriers to HPV vaccine coverage, with information provided via leaflets seen as insufficient for communicating the risks and benefits of both HPV and vaccination, respectively.[30,40,44,45] Adolescent girls and boys reported that they would prefer a lesson with a healthcare professional (HCP) or teacher over simply receiving a leaflet to provide them with information about HPV, to allow an informed decision about

receiving the vaccine.[45] Parents also identified that there were limitations with the current forms of communication about HPV and HPV vaccination, impacting their knowledge.[30,40,44]

Accepted and clear communication from schools and service providers about HPV vaccination is particularly important as parental HPV knowledge was identified as a barrier to vaccination.[23,34,44,46] Waller et al. ($N=1049$) reported that lack of HPV awareness among parents was often a barrier to vaccination, with poor communication from schools and service providers about HPV and the vaccine programme impacting coverage.[30] For example, 55% of parents of adolescents in England and Wales were aware of HPV and 55% were aware of HPV vaccination in girls but only 23% were aware that vaccination would be available for boys.[30]

Three publications reported that adolescents not being at school at the time of vaccination or not receiving an offer for vaccination were barriers to vaccine receipt.[35,39,41] For example, Bedford et al. (2021) reported that 22.6% ($n=90$) of parents stated that their daughter did not receive the HPV vaccine because their daughter had not been at school during the vaccination session.[39] Similarly, Emerson et al. (2019; $N=5087$) reported that adolescents being unwell at the time of vaccination resulted in non-receipt.[41] Jackson et al. reported on vaccination among the Traveller community ($N=174$) and highlighted that some London Irish Traveller mothers reported non-receipt for their adolescent as they were either travelling or not in school on the day, with another noting that it was difficult to access HPV vaccination for a home-schooled daughter.[35]

Psychological and behavioural factors

Perception of low risk of HPV, HPV-related cancer and therefore lack of need for vaccination were identified as barriers to vaccination in four studies (Supplemental Table 2).[23,34,44,46] Sherman et al. (2018) reported on the parents of adolescent boys specifically, with 71.4% of parents ($n=21$) stating that they did not know enough about HPV vaccination in general, and 57.1% reporting that they did not know enough about HPV-related diseases in boys.[23]

Furthermore, two studies reported that parents were concerned about the impact on the behaviour of adolescents following receipt of HPV vaccination, for example, promoting promiscuity.[35,45] Knight et al. investigated HPV awareness among adolescent girls and boys and reported that both genders felt vaccination would impact their risks of STIs.[45] Specifically, a significantly greater proportion of boys agreed that HPV vaccination may result in taking more sexual risks than girls (55.1% vs 24.5%, respectively ($p<0.001$)).[45] Similarly, Jackson et al. (2017; $n=174$) reported that mothers in the Traveller community had strong opinions on the moral overtones of HPV vaccination, given the strong belief in no sex before marriage; however, this was not a consistent opinion in the sample.[35]

Four studies reported concerns about HPV vaccine effectiveness and adverse events associated with receipt of the vaccine (Supplemental Table 2).[23,30,35,44] Forster et al. evaluated aspects associated with HPV vaccine refusal among parents from ethnic minorities and reported that parents from various backgrounds were concerned about the research behind the vaccine, particularly the potential for side effects.[44]

Sociodemographic factors

In one study, Tiley et al. identified that religion may act as a barrier to HPV vaccine receipt in some instances, with school denomination significantly associated with vaccine coverage ($p<0.001$; Supplemental Table 2).[29] Specifically, Muslim and Jewish schools had significantly lower vaccine coverage than schools of no religious faith (56.7% and 59.6% vs 82.4%, respectively).[29]

Facilitators

Several facilitators were reported among both adolescents and parents/guardians, with these primarily focused on two themes: health/school system factors and psychological/behavioural factors with no reported sociodemographic factors (Figure 3 and Supplemental Table 2).

Health and school system factors

Proactive communication from schools and service providers and clear information about vaccination were identified as facilitators of vaccination

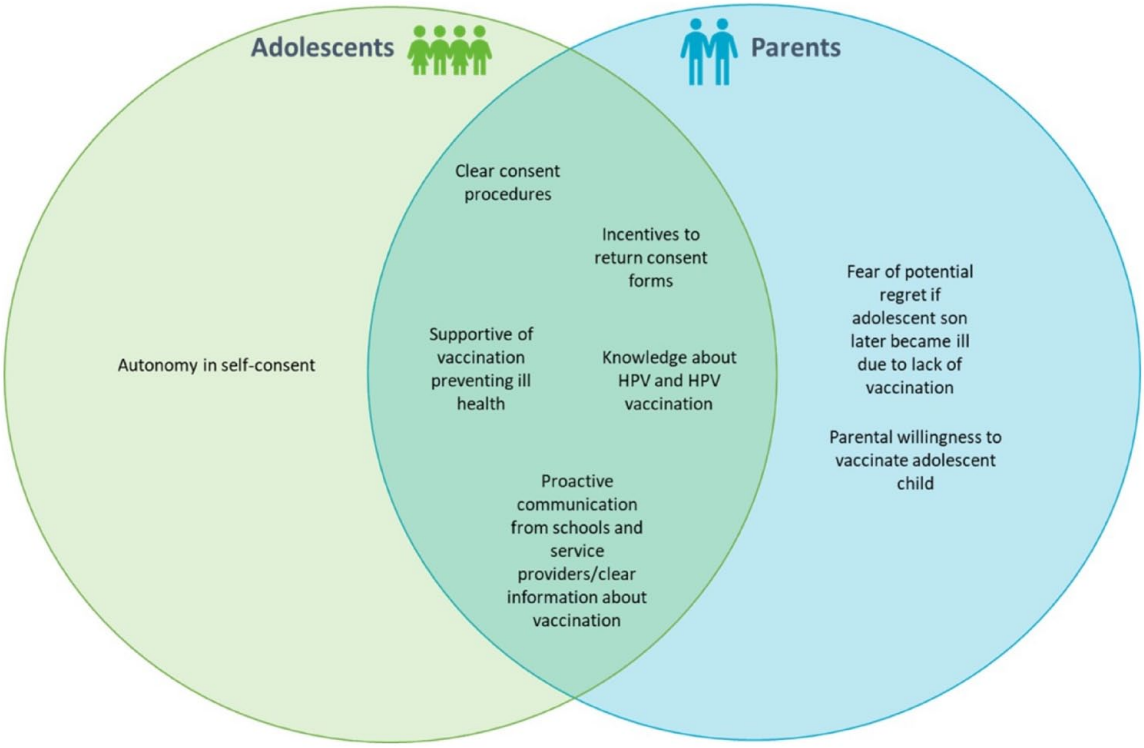

Figure 3. Venn diagram illustrating facilitators to vaccination reported by adolescents and parents.[23,30–32,34,37,38,40,42,43,46]

coverage by three studies.[23,40,46] Williamson et al. (2020) reported that the acceptability of HPV vaccination among adolescent girls and boys was high; however, there was a unanimous desire for accessible information to be offered before vaccination to enable an informed decision.[46] Related to this, both adolescents and parents reported that knowledge of HPV and vaccination, and being supportive of vaccination preventing ill health, were facilitators to vaccination.[23,30,34,42]

Furthermore, adolescents and parents both reported the importance of clear consent procedures and also the use of incentives to return consent forms, as facilitators to improving vaccination coverage.[31,37,38,43] Specifically, Forster et al. (2018) reported that 71% of parents both agreed and strongly agreed that incentives to maximise consent form return are a good idea.[38] Rockcliffe et al. reported mixed views about the use of incentives among both girls and their parents, with both reporting that while it encouraged a faster return of the consent form, the use of incentives was not wholly acceptable.[31]

Psychological and behavioural factors

Parental knowledge of HPV and vaccination was associated with HPV vaccine receipt (Supplemental Table 2).[23,30,34] Nickel et al. 2017 reported that, compared to parents of unvaccinated daughters with low knowledge scores, those with higher knowledge scores were more likely to vaccinate their daughters (low knowledge: 27.3%, medium: 44.1%, high: 4.1%; $p \leqslant 0.001$).[34] Among 81 parents of teenage boys who were willing to vaccinate their sons against HPV, 92.6% stated that this was because 'my son is also at risk of HPV infection'.[23] Furthermore, positive vaccine beliefs among adolescents and parents play an important role in vaccine receipt.[23,42] Sherman et al. reported that 82.7% of parents of boys believed that both sexes should have equal rights to HPV vaccination and that 64.2% welcomed all vaccinations for children.[23]

Sociodemographic factors

No facilitators to vaccination uptake were identified related to sociodemographic factors.

Discussion

This systematic review identified 24 publications reporting on HPV vaccine coverage, and barriers and facilitators to HPV vaccination, among adolescents and parents in the United Kingdom, to explore HPV vaccination uptake and factors impacting this.

While HPV vaccination is widely accepted in the UK, with coverage reported ⩾80% in peer-reviewed literature,[29,39,48,52] the UK Health Security Agency (HSA) reported that vaccine coverage estimates in England for academic years 2020/2021, 2021/2022 and 2022/2023 were below 80% in both girls and boys for most age groups.[50,51] Furthermore, the HSA data for 2019/2020 indicated that HPV vaccination levels fell during the SARS-COV-2 pandemic due to the disruption in school attendance, with coverage remaining below pre-pandemic levels in 2020/2021, demonstrating the need for policymakers to do more to encourage HPV vaccine uptake.[50] Despite a slight increase from 2021 to 2022, vaccine coverage is still substantially lower than pre-COVID levels, with one-dose coverage of 71.3% in adolescent girls aged 12–13 in England in the 2022/2023 school year (16.7% lower in absolute terms than 2018/2019).[56]

The reported HPV vaccination coverage across the UK does not consistently achieve the 90% target set by the World Health Organization for cervical cancer elimination,[53] highlighting a need to improve vaccine uptake to achieve this goal and to ensure that the herd immunity protective effects observed following the initiation of HPV vaccination in the UK continue.[57] In September 2023, the UK vaccination programme moved to a single dose for those under the age of 25, which may make this target more achievable.[54,55] Evidence from vaccine trials, systematic reviews and meta-analyses demonstrate that a one-dose regimen is as effective in preventing HPV infection as a multi-dose regimen while maintaining durability of protection against HPV and cervical precancerous lesions.[58–61] Modelling studies have indicated that switching to a one-dose programme is not predicted to increase the prevalence of cervical cancers if the duration of protection is ⩾20 years and vaccine uptake is high.[58,62] The convenience of the one-dose programme may support increased uptake among adolescents, continuing to contribute to the observed public health impact of HPV vaccination in reducing both HPV infections and HPV-related cancers.[8,11] High routine vaccination coverage, coupled with multi-cohort vaccination, has led to fast and substantial herd immunity effects in reducing HPV-related infections,[8] and the continued monitoring of the incidence and prevalence of anogenital warts and high-risk HPV infections in the population will support the evaluation of one-dose vaccination in this regard.

Despite the introduction of a gender-neutral vaccination programme in the UK in 2019,[63,64] this literature review identified minimal data specifically reporting vaccination coverage among adolescent boys (and no data on non-binary or transgender adolescents). The lack of identified published literature reporting vaccine coverage among adolescent boys in this review is likely a result of the relatively recent expansion of the HPV vaccination programme to include this population, limiting the period for research to be conducted and published in peer-reviewed publications. The reported coverage among boys in the UK ranged from 35.0% to 65.0% in the first year of the GNV programme,[50] with coverage in the 2022/2023 school year of 65.2% in England.[56] Vaccine coverage in boys is consistently lower than among girls, thus highlighting a need to demonstrate the importance of HPV vaccination among adolescent boys and their parents. This also highlights a need to conduct real-world studies among adolescent boys (and adolescents of other genders beyond girls) to allow policymakers to review the factors impacting uptake in the initial years of the GNV programme and develop targeted, or programmatic, changes to improve vaccination rates.

The majority of included publications ($n = 19$) reported on barriers to vaccination, with the barriers reported among both adolescents and parents predominantly relating to challenges with consent and lack of information about HPV and vaccination. Analysis of the barriers reported overall identified that health and school system factors (i.e. logistic factors) were the most cited barriers to HPV vaccination in the UK.[23,30,31,35,39–45]

School attendance was highlighted as a barrier to HPV vaccination among adolescents by parents of children at secondary schools, special education schools and parents within the Traveller

community.[35,39,41] Difficulty in accessing HPV vaccination among home-schooled girls also represents an important programmatic challenge.[35] The exact number of adolescents that are home educated in the UK is unknown due to voluntary registration of these data, therefore home-schooled adolescents, those regularly missing school and those in alternative education represent an important population to reach for vaccination.[65]

Notably, concerns about vaccine safety and effectiveness, and reports of misinformation from social media as a barrier to vaccination, were infrequently reported in studies identified in this review. This contrasts with the wider literature, where social media and fear of vaccines have been frequently reported in association with vaccine hesitancy as a barrier to vaccine uptake.[66–70]

This review also identified that health and school system, and psychological factors, were frequently identified as facilitators of vaccination in both adolescents and parents. Specifically, proactive communication from schools and service providers, the provision of clear information about HPV and HPV vaccination, and parental knowledge of HPV vaccination were identified as important facilitators of vaccination.[23,30,34,37,40,43,46] This is widely reported in the broader literature too, with the important role of parental knowledge acknowledged as a clear facilitator of vaccination uptake.[18,71]

Policy and programmatic considerations and implications for future research

While this review has identified that HPV vaccination is broadly accepted by adolescents and parents/guardians of adolescents, there is evidence that vaccination coverage has dropped following the SARS-CoV-2 pandemic which necessitates urgent action from policymakers.[56] Data on populations with lower-than-average vaccination coverage (i.e. those, from minoritised ethnic or religious groups, or those with anti-vaccination attitudes), indicate that policymakers may need to work with these communities to discuss how best to improve uptake and address any inequalities in access, to increase vaccination coverage in the UK.[54]

Strong cooperation between the health and education sectors to ensure clear and accessible information about HPV vaccination for adolescents and their parents/guardians in alternative formats such as interactive lessons, apps or films, alongside clear consent processes, should enable successful vaccination programme implementation. Schools are well-positioned to deliver positive messages about HPV vaccination, and vaccination in general, alongside the standard curriculum. For example, the benefits of HPV vaccination could be discussed alongside safer sexual practices within Relationships and Sex Education (RSE) in secondary schools.[72] Research in Australia has indicated that adolescents receiving more education about HPV and HPV vaccination had positive attitudes towards vaccination because they had a good understanding of HPV and vaccination, encouraging vaccine uptake.[73]

While evidence shows that school-based immunisation reduces health disparities by improving access to vaccines, this review has highlighted that there needs to be more consideration for those outside the standard school setting to ensure that adolescents in Traveller communities, home education or schools for special educational needs are still receiving information about HPV and access to vaccination. Research conducted by NHS Scotland has highlighted that there is a need to consider non-standard approaches for vaccination programmes to reach underserved populations, including Traveller communities, and people with learning disabilities.[74] A diverse range of strategies may be required, including dedicated services, clear information and reminders about eligibility for vaccination via health practitioners, in addition to alternative vaccination centres, for example, pharmacies or general practices.[74]

The shift to a one-dose HPV vaccination schedule emphasises the need to strengthen school-based immunisation efforts. While a one-dose schedule simplifies the vaccination process and may boost compliance, the reduction in school visits could also decrease both initial and catch-up vaccination opportunities for students, particularly those who miss school due to illness or who move during the school year. This reduced access risks exacerbating existing inequalities in vaccine uptake, as highlighted in this review. The JCVI's recommendation for the one-dose program, therefore, advised that resources saved from fewer vaccination sessions should be reallocated to enhance programme delivery, supporting broader vaccine coverage and minimising barriers to

vaccination.[58] As described previously, this may require alternative vaccination centres for adolescent HPV vaccination, or dedicated services to support the effort to increase HPV vaccine uptake.[74]

Of note, very few of the included studies specifically set out to evaluate facilitators to HPV vaccination among adolescents or parents in the UK, rather, studies reported facilitators alongside identified barriers or in relation to vaccine coverage rates, indicating the need for further specific research in this area to understand public health/programmatic approaches that may increase vaccination coverage in the UK.

Strengths and limitations

There are several limitations to consider. This review aimed to use gender-neutral terminology, that is, adolescents, for the targeted vaccination population; however, the wider literature frequently refers to the vaccination of girls/women or boys/men.[8,64] In the UK, the vaccination programme for adolescents is now termed GNV, due to the inclusion of all genders; however, this terminology is not always reflected in the wider literature.[64,75] Similarly, we were restricted in this review by the limited ethnoracial categorisations in the wider literature.[76]

Although this review aimed to evaluate possible factors (facilitators or barriers to vaccination) influencing vaccine uptake among adolescents and their parents/guardians, only one identified study reported on adolescents and their parents, with most identified studies reporting on either adolescents, parents, or adolescents and other parents. Therefore, it has not been possible to conclude the influence of parental/guardian opinions on HPV vaccination uptake among adolescent children.

The quality assessment used in this literature review was developed based on existing guidelines.[27,28,77] The approach to develop a series of key quality criteria was selected to allow comparison between studies of different designs. A strength of this approach is that the quality assessment of all included studies was conducted using a consistent approach allowing for comparison in the quality appraisal. However, it is acknowledged that this approach may reduce the overall reliability and validity of the quality assessment, as the criteria have not been piloted in another setting.

Conclusion

The studies identified in this literature review present a broadly positive opinion of HPV vaccination among both adolescents and parents/guardians of adolescents in the UK, with generally high vaccine coverage, albeit not yet back to pre-COVID levels. However, there remains a need to improve vaccination uptake in underserved groups across the UK to comprehensively increase vaccine coverage. Barriers to vaccination in both adolescents and parents, such as consent processes, a lack of communication from providers and knowledge gaps, must be addressed to improve vaccine coverage. Notwithstanding the identification of barriers, there was limited evidence in the literature landscape reporting facilitators to address these barriers and improve vaccination uptake. This highlights the need for further research on facilitators of vaccination among adolescents and parents in the UK and focusing on the co-production of vaccination programmes that involve both service users and key stakeholders to improve vaccine coverage (especially to address sociodemographic barriers).

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Author contributions

Anna Karakusevic: Conceptualisation; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Validation; Visualisation; Writing – original draft; Writing – review & editing.

Anna M. Foss: Conceptualisation; Formal analysis; Investigation; Methodology; Project administration; Resources; Supervision; Validation; Visualisation; Writing – review & editing.

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Availability of data and materials
The authors confirm that the data supporting the findings of this study are available within the article (and/or) its supplementary materials.

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Supplemental material

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