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To cite this article: E Karafillakis, P Peretti-Watel, P Verger, T Chantler & HJ Larson (2022): *"We don't have the same bodies; we don't react the same way": mothers and adolescent girls' perceptions of the risks and benefits of HPV vaccination in France*, Human Vaccines & Immunotherapeutics, DOI: [10.1080/21645515.2022.2036555](https://doi.org/10.1080/21645515.2022.2036555)

To link to this article: <https://doi.org/10.1080/21645515.2022.2036555>



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Published online: 03 Mar 2022.



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RESEARCH PAPER

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“We don’t have the same bodies; we don’t react the same way”: mothers and adolescent girls’ perceptions of the risks and benefits of HPV vaccination in France

E Karafillakis^a, P Peretti-Watel^{b,c}, P Verger^c, T Chantler^d, and HJ Larson^{a,e}

^aDepartment of Infectious Disease Epidemiology, London School of Hygiene & Tropical Medicine, London, UK; ^bUMR Vitrome, Aix-Marseille Université, IHU Méditerranée, IRD, Marseille, France; ^cSoutheastern Health Regional Observatory (ORS Paca), Aix-Marseille Université, Marseille, France; ^dDepartment of Global Health and Development, London School of Hygiene & Tropical Medicine, London, UK; ^eCentre for the Evaluation of Vaccination, Vaccine and Infectious Disease Institute, University of Antwerp, Antwerp, Belgium

ABSTRACT

Human Papillomavirus (HPV) vaccination is one of the most publicly mistrusted vaccines in Europe, with countries such as France struggling with low vaccine uptake due to parental questioning of vaccine risks and benefits. However, limited evidence exists on adolescent girls’ perceptions of the risks and benefits of HPV vaccination. The aim of this qualitative study was to provide an in-depth exploration and comparison of French mothers (n = 21) and adolescent girls’ (n = 36) perceptions of the risks and benefits of HPV vaccination. A thematic analysis showed that adolescent girls and mothers perceived the risks and benefits of HPV vaccination differently, with girls reporting positive and beneficial views and emotions toward vaccination and mothers expressing concerns about possible risks. Adolescent girls also reported that both perceptions and actual risks and benefits may vary from one individual to another. Vaccine safety was also understood differently, with mothers reporting a widespread view that vaccines are unsafe and focusing on controversial side effects and girls discussing short-term consequences of vaccination (e.g. pain, fever) and administration and storage issues. Strategies to improve uptake of HPV vaccination should consider and address both the mothers’ and daughters’ perceptions and understandings of HPV vaccination.

ARTICLE HISTORY

Received 1 November 2021
Revised 18 January 2022
Accepted 28 January 2022

KEYWORDS

Human papillomavirus; vaccination; adolescents; risk; benefits; perceptions; safety; confidence; vaccine hesitancy

Introduction

Despite Human Papillomavirus (HPV) infection being the most common sexually transmitted infection in the world, vaccination against HPV remains highly mistrusted by the public in many countries, including in Europe.^{1,2} While most HPV infections will be cleared out naturally by the immune system, they can sometimes lead to the development of genital warts as well as cervical, anal, oropharyngeal, penile, vaginal, and vulvar cancers.³ Following breast cancer, cervical cancer is the second most common cancer among women aged 15–44 years in Europe in terms of incidence and mortality.^{1,4} Evidence has shown that 85% of new cases of cervical cancer in Europe are caused by eight “high-risk” types of HPV, with HPV 16 and 18 alone contributing to an estimated 73% of these new cases.^{5,6}

Cervical cancer prevention in Europe consists of routine cytological screening programs and vaccination of boys and girls before the onset of sexual activity with either a bivalent, quadrivalent, or nine-valent vaccine.^{1,7,8} Countries in Europe have had varying degrees of success with HPV prevention, with vaccination coverage rates ranging from 4% in Bulgaria to 94% in Portugal (2018).⁹ Despite around 3,000 women being diagnosed with cervical cancer and 1,000 dying from the disease every year in France,¹⁰ the country has one of the lowest HPV vaccination coverage in Europe, with only 24% of the targeted population having completed their course of HPV vaccination

in 2019.⁹ The routine HPV vaccination program started in France in 2007, targeting 11 to 14-year-old girls with a catch-up campaign for 15 to 19 year-old girls. Boys were only included in the HPV vaccination programme in 2020.¹¹ Vaccines are available at pharmacies and can be administered by general practitioners (GPs), pediatricians and gynecologists. Studies have found low HPV vaccine uptake in France can partly be explained by mothers, young women and adolescent girls having concerns about the risks associated with the vaccines, and questioning their effectiveness and importance.^{12–15}

Vaccine intentions have been described as a consequence of one’s cognitive and affective perceptions of risks associated with vaccines as well as vaccine-preventable diseases: if the risks of vaccination are perceived to be greater than the risks of the disease it prevents, then individuals will be less likely to vaccinate.¹⁶ While information received from doctors, peers, or other sources, such as the internet allow individuals to assess the risks and benefits of vaccination, the decision-making process is also influenced by individual beliefs and experiences as well as heuristics, trust, emotions, or health literacy.^{16–18} The cultural, political, social or economic context in which decisions are made can also shape beliefs and perceptions.¹⁹

Most theories and frameworks related to HPV vaccination have been developed in relation to parental decision-making. However, adolescent perceptions of risks are fundamentally different from those of adults primarily because adolescents

tend to overestimate risks, which could be explained by peer influences and emotional reactions to risks.^{20,21} While adolescents can have a heightened perception of risks, they also tend to be higher risk-takers than adults, sometimes referred to as the paradox of adolescent risk perception. In fact, adolescents place more weight on perceived benefits than perceived risks when making decisions, even when they overestimate these risks.²⁰ This explains why adolescents might still engage in risky behaviors if they perceive certain benefits associated with the behavior. Additionally, adolescents sometimes engage in risky behaviors because of the perception that they are less vulnerable to certain risks as individuals than their peers.^{20,22}

While parents often remain key decision-makers for their children's vaccination, adolescents are becoming more engaged in these decisions, with countries such as the United Kingdom (UK) allowing 12- to 13-year-old boys and girls to get vaccinated against HPV without parental consent. Understanding the way both mothers and adolescent girls perceive the benefits and risks of HPV vaccination and how they may influence each other is therefore important to inform the development of strategies to improve confidence in and uptake of HPV vaccination. The aim of this study is to provide an in-depth exploration and comparison of mothers and adolescent girls' perceptions of the risks and benefits of HPV vaccination in France.

Methods

Qualitative research, including semi-structured interviews and focus groups, was conducted to explore adolescent girls and their mothers' perceptions around the risks and benefits of HPV vaccination in Paris, France.

Setting, participant recruitment, and data collection

Adolescent girls between 15 and 16 years old and their mothers were recruited for this study from different *arrondissements* (local districts) of Paris between October 2018 and March 2019. The study focused on girls as they were targeted by the vaccination program at the time of data collection, with the age range selected to ensure participants had passed the age at which HPV vaccination is typically offered in France. The study focused on mothers instead of parents or fathers as they are the most common decision-makers for childhood vaccination.²³

In total, 24 adolescent girls (aged 15–16) participated in in-depth interviews and 12 additional girls participated in two focus groups (with 5 and 7 participants in each group). Additionally, 21 in-depth interviews were conducted with mothers (aged 36–55) of the adolescent girls taking part in in-depth interviews (3 mothers of included adolescent girls declined to participate). Participants were purposively selected to target vaccinated and unvaccinated girls. However, due to the low vaccine coverage rates in France, only eight vaccinated girls were identified to take part in this study (four in in-depth interviews and three in focus groups).

Participants were recruited for this study during two distinct phases. In the first phase, adolescents were approached through their schools, or *Lycées*. A list of all *Lycées* in Paris was

drawn from public registrars, including public, private, and professional and school directors were approached to ask for their consent to recruit girls from their schools. As only four in-depth interviews and two focus groups were conducted using this recruitment method by January 2019, a second recruitment phase was organized to obtain additional participants between February and March 2019. For the second phase, a local behavioral research agency was recruited to identify and recruit the remaining participants from their existing panel of research participants. The objective was to recruit 20 adolescents and their mothers for in-depth interviews and to conduct 3 focus groups with 8–10 adolescent girls in each group.

All participants were provided with detailed information about the study, including confidentiality and anonymity, in an information letter that was handed out physically or sent by e-mail to them a few days before the interview. This information was summarized verbally before each interview, and participants were reminded that they had the right to withdraw from the study at any time, even during the interview or focus group. After being given an opportunity to ask questions, adolescent girls and their mothers were then asked to provide written informed consent to take part in the study and for the interviews or focus groups to be audio-recorded. Adolescent girls were also required to provide the written consent from their parent or guardian. In order to thank them for their time, adolescents recruited during the first phase were able to enter a lottery to receive an Amazon voucher while all participants recruited in the second phase were compensated for their time as per the local recruitment agency's practices.

Interviews lasted between 30 and 60 minutes and were conducted in participants' homes or at a private place of their choosing. Focus groups were conducted with girls from the same school class and were therefore conducted in schools, lasting around 60 minutes. All data was collected in French by an experienced researcher fluent in both English and French who also analyzed the data in French to prevent losing some of the meaning. Interviews with adolescent girls and mothers were conducted separately and privately, and no parent or guardian asked to be present during the interviews with adolescent girls.

Interviews and focus groups were conducted using semi-structured topic guides that covered predefined topics (see supplementary materials) while allowing discussions to be shaped by participants' responses. Topic guides focused on knowledge, attitudes, and behaviors around HPV vaccination, with a focus on the perceptions and beliefs around the risks and benefits of vaccination. Topic guides were piloted with three adolescent girls who were excluded from the analysis and final number of interviews.

Data analysis

Audio-recordings from the interviews and focus groups were transcribed by a local transcription company, respecting participants' confidentiality and using secured transfers and password-protected files. Before being imported into Nvivo for analysis, all data files including transcripts from interviews and focus groups, field notes and analytical memos were

anonymized by removing personal identifiers such as names and locations or replacing them with codes ('A' for adolescents, 'M' for mothers, and 'V' for vaccinated participants).

Data on Nvivo was analyzed using a coding framework, first developed by deductively drawing codes from the topic guides, analytical memos and relevant literature and contextual information on HPV vaccination. The coding framework was revised and updated by drawing codes inductively from close readings of the data from four interviews. The final framework, revised by a second researcher, was used to code all transcripts while allowing codes to be modified, merged or removed as required during the analysis. A thematic analysis of codes consisting of an analysis and comparison of coded extracts was performed to draw a list of issues and themes. While transcripts of interviews with mothers and adolescent girls were coded separately, emerging codes and themes were then compared to understand differences and similarities between both groups. This included a comparison of mothers and girls in general and of mothers and girls from the same dyad. Quotes for this article were directly translated into English by the researcher fluent in English and French. Findings were then discussed in relation to existing literature and contextual background information on HPV vaccination in France.

Ethical approval

Ethical approval for this study was obtained from the London School of Hygiene & Tropical Medicine [Ref. 15320-3] and from Aix-Marseille Université [Ref. 2018-12-07-005].

Results

The thematic analysis identified five key themes: 1) the individuality of perceptions around HPV vaccination risks and benefits; 2) differences in the understanding of what vaccine safety represents; 3) varied perceptions of vaccine benefits; 4) the influence of emotions on HPV vaccination perceptions; and 5) the influence of perceptions around natural medicine. Table 1 provides an overview of the sub-themes and perceptions identified for these 5 themes among adolescent girls and/or mothers.

Everybody is different: the individuality of perceptions around HPV vaccination risks and benefits

During the qualitative interviews and focus groups, adolescent girls talked about the risks and benefits of HPV vaccination as factors that vary from one individual to the next due to both

Table 1. Summary of key themes and perceptions among adolescent girls and mothers.

	Adolescent girls	Mothers
Individuality of perceptions around HPV vaccination risks and benefits	<ul style="list-style-type: none"> • Individual physical and ideological differences lead to different vaccine risks and benefits • Vaccination need is dependent on personal HPV risk (e.g. sexual activity) • Side effects are given different meaning and value by people • Human bodies respond differently to diseases (i.e. susceptibility) and vaccines (i.e. effectiveness) • Need to develop individualized vaccines, adapted for everyone • Personal responsibility for contracting HPV (i.e. sexual behavior, religious beliefs) • Individuals tolerate vaccines differently, affecting individual risks of side effects 	<ul style="list-style-type: none"> • Even a small risk could translate to a risk for their own daughters
Differences in the understanding of what vaccine safety represents	<ul style="list-style-type: none"> • Strong trust toward vaccine safety • Vaccine risks relate to vaccines not working or not being injected properly • Vaccines carry minor side effects (e.g. fever, nausea, pain) • More important concerns mirror own mothers' concerns (sometimes word for word) • n/a 	<ul style="list-style-type: none"> • Nothing in life comes without risk, including vaccination • Important concerns about vaccine safety (i.e. controversies, ingredients long-term risks) • Vaccines are controversial: lack of scientific consensus around vaccine safety • Conspiracy theories
Varied perceptions of vaccine benefits	<ul style="list-style-type: none"> • Vaccine benefits relates to reducing risks of disease • Decision-making is based on comparing risks • For some, the risk of vaccination is worth taking to prevent cancer but for others the risk of vaccination is scarier than the risk of cancer • Permanence of risks associated with vaccination compared to cancer (it cannot be undone) 	<ul style="list-style-type: none"> • HPV vaccination could dilute messages on prevention of other STIs or pregnancy
Influence of emotions on HPV vaccination perceptions	<ul style="list-style-type: none"> • Strong positive emotions toward the benefits of vaccination (e.g. security, reassurance, protection) • Minor worries about side effects or fear of needles 	<ul style="list-style-type: none"> • Strong negative emotions toward possible side effects of HPV vaccination • Cancer fears are used to convince parents to accept vaccination • Guilt and shame for not vaccinating daughters • Own or friends' experience with cervical cancer brings out fear but does not always translate to willingness to vaccinate daughters
Influence of perceptions around natural medicine	<ul style="list-style-type: none"> • Distress about the risk of cancer, perceived as a dangerous and life-threatening disease that can happen to anyone • Sexually transmitted infections bring out more emotional reactions than other diseases (e.g. taboos, embarrassment) • n/a 	<ul style="list-style-type: none"> • Desire to let the body defend itself naturally • France described as a highly medicalized country, with too many vaccines
	<ul style="list-style-type: none"> • The less drugs are used, the better • Preference for natural remedies (sometimes supported by doctors) compared to chemicals in drugs and vaccines 	

physical and ideological differences. For some participants, this was explained in terms of the influence of individual values and behaviors. Adolescent girls described the need for vaccination in relation to their personal risk of contracting HPV and whether or not they were already sexually active: “*Personally, I do not see the use of doing it now, knowing that I do not have sex*” (A2). The role of individual sexual behavior and personal responsibility for contracting HPV was also discussed by adolescent girls and some mothers, with one girl reporting that young people might benefit from vaccination because they take more risks than adults. One’s religious beliefs was also seen as a factor influencing the risk of contracting HPV by two Muslim mothers and one adolescent girl: “*I am Muslim and in my religion, as I know it’s transmitted sexually, in my religion well, it’s after the wedding . . . so, I don’t really need it*” (A4). One mother believed that her doctor did not recommend the vaccine because of cultural taboos around sex: “*Maybe they didn’t dare [recommend it] because I’m Arab (. . .) maybe it’s all this, it’s a taboo for us*” (M24). Finally, girls who took part in focus groups also discussed the individual meaning and value placed on side effects, explaining that some side effects, such as infertility, might be perceived as more or less important by different people.

Additionally, a few girls discussed the risk of getting a disease in relation to natural susceptibility, explaining that people’s bodies are different and that vaccines might therefore only be useful for some people: “*We don’t necessarily have the same physiology (. . .), there is a possibility that I could get the disease . . . we are all different, so it could vary with every person, [we could] even have different symptoms . . .*” (A3). Similarly, adolescent girls stated that vaccines do not offer complete protection and that it would still be possible to contract the disease even after getting vaccinated, with some girls explaining that vaccines might only be effective in certain people: “*I don’t think it can work for everyone (. . .) we don’t have the same bodies, we don’t react the same way*” (A11).

The belief that individual bodies might react differently to vaccines was also expressed in relation to the risk of possible side effects. However, while some adolescents and mothers explained that the fact that some girls might have bad reactions to vaccination does not mean that they will, some mothers also perceived that every risk that exists could be a risk for their own daughters: “*When they tell you ‘It’s 1 every 10,000’, you think ‘yes, but this 1 in 10,000 exists,’ you see? And I’m already someone who is very anxious*” (M19). Some girls and mothers explained that people might tolerate vaccines differently for example, due to preexisting conditions: “*It happens to, I don’t know, a tiny portion of the population who did [the vaccine] (. . .). Maybe these people had, I don’t know, medical history that emerged with the vaccine or they were more susceptible to this kind of disease*” (A10). One girl suggested that in order to restore trust in vaccination, vaccines should be ‘individualised’ and adapted for everyone.

What does vaccine safety mean?

Vaccine safety was understood differently by adolescent girls and their mothers in this study. Almost all mothers, including those who vaccinated their daughters, raised concerns about

vaccine safety and acknowledged that nothing in life comes without risk. This was not always described in a negative way, as some mothers discussed vaccine risks in a calm, objective manner: “*Whatever medication we take, (. . .) there are always risks and indeed, we know, it’s part of life. (. . .) Risk zero does not exist*” (M1V). Mothers expressed concerns about vaccine ingredients and adjuvants such as aluminum and mercury and referred to specific side effects such as auto-immune and neurological complications, arthritis, paralysis, cancer, infertility and multiple sclerosis. Some mothers also expressed concerns about uncertainties around future and long-term risks of vaccination: “*You have to skip at least two generations to see the effects on children . . . (. . .) The child is fine, and all at once, poof!*” (M7). Many mothers also perceived the HPV vaccine as ‘controversial,’ particularly in comparison to other childhood vaccines and described a lack of scientific consensus around the safety of HPV vaccination, even among doctors and health professionals. Three mothers justified their concerns about HPV vaccination by describing past cases in which drugs were found to cause issues years after they were introduced: “*When I hear: ‘we gave this medicine for X amount of time to women and now, they have this [problem].’ Well, we vaccinated our children and now, they have this . . . No, I don’t want to do it . . . Seriously, I’m afraid!*” (M15). Two mothers also described HPV vaccine safety in the context of larger conspiracy theories, for example stating that all manmade products, including shampoos, toothpaste or tampons, are poisonous or believing that the government is trying to ‘weaken’ people with vaccines in order to more easily ‘dominate’ and ‘manipulate’ them.

Contrastingly, most adolescent girls expressed strong trust in the safety of vaccines and rarely described them as controversial. Some believed vaccines are safer in France than in other parts of the world and others placed their trust in the thought that vaccines would not be injected to people if they were not safe. Although some girls acknowledged vaccines can have side effects, they could rarely explain what they were precisely concerned about: “*the problem . . . I don’t know what the risks of a vaccine are, actually*” (A7). When probed further, many girls were found to understand vaccine risks as ‘the risk of them not working’ or the risk of doctors failing to inject the vaccine properly: “*[the vaccine] can be done incorrectly, and then, well it can become infected (. . .) Yes, he could do [the injection] in the wrong place or if the needle is not cleaned properly, or things like that*” (A14). Girls that described specific safety concerns often referred to minor and plausible side effects such as fever, nausea, pain at the site of injection or allergies. Those who reported more important concerns often mirrored or even repeated their own mothers’ concerns, with one girl particularly affected by online articles about the risks of the HPV vaccine that her mother had shown her: “*I know it’s highly controversial (laughs) and even among doctors, there are some who are for it and others who are against. On the internet, you can find anything and everything, so what I remembered first is we don’t know whether or not to do it*” (A10). Two adolescent girls also discussed the risk of dying after having received the HPV vaccine: “*Every time there is something new, a new vaccine, some people die until they find the real solution. It’s the same with vaccines.*” (FG02).

HPV vaccine benefits: reducing the risk of disease

Many adolescent girls looked at the benefits of vaccination in terms of ‘reducing risks’ of diseases and therefore compared the risks associated with the disease to the risks of vaccinating when deciding whether or not to accept HPV vaccination. Most of these girls as well as a few mothers believed that it is worth to ‘take the risk’ to protect yourself as the risks of cancer and HPV were seen as higher than the risks of vaccination: *“I think I would take [the vaccine] because well it’s a serious disease (. . .). But then, it can harm our body . . . but since, as they say, it’s a risk well, it’s better to take the risk”* (A21 V). Only two girls and two mothers described the risks of vaccination as being higher, or at least scarier, than the risks of cancer or HPV: *“I would say no because I’m too afraid of what can happen afterwards (. . .). I wouldn’t take the risk, frankly no. Well, obviously, by not taking [the vaccine], I’m also taking a risk, once again, it’s paradoxical.”* (A10). One girl and one mother also compared the permanence of risks, explaining that risks associated with vaccination are more permanent than the risk of infection and cannot be undone. A couple of mothers also focused on the risk of their daughters becoming pregnant or contracting other sexually transmitted infections such as HIV, and feared that HPV vaccination could dilute messages focusing on these important issues.

From security and reassurance to fear: emotional reactions to HPV vaccination

Discussions around HPV vaccination triggered strong albeit varied emotional reactions among both mothers and adolescent girls. Adolescent girls often used positive emotional language to refer to the benefits of vaccination, reporting feelings of security, reassurance and protection offered by the vaccine: *“I would feel reassured, I wouldn’t be scared to contract the disease, so that’s the most important I think”* (A6). Almost all adolescent girls described HPV vaccination as beneficial and perceived vaccination as an important tool to protect themselves, their partners or the population in general from the risks of diseases. Most girls therefore expressed willingness to get vaccinated, and some questioned why parents would refuse to vaccinate and protect their daughters: *“It’s something that should be done. It’s useless to ask yourself ‘yes or no’ because it’s obviously better to do it”* (A6).

Despite some mothers and girls questioning the need for HPV vaccination, including because of the existence of alternative protection methods such as condoms or screening, both girls and mothers also expressed distress about the risk of contracting HPV and developing cancer. Most of these discussions focused on cancer rather than HPV, with adolescent girls and mothers describing cancer as a serious, dangerous and life-threatening disease: *“It’s important; it’s not something . . . well it’s not futile. We shouldn’t take it lightly . . . it could be serious”* (A20). One mother also believed that people’s fears around cancer are being used to convince them to accept vaccination, expressing her own feelings of guilt and shame for not vaccinating her daughter. A few girls and one mother also perceived the risk of developing cancer to be high, expressing concerns that it can happen to anyone, even themselves. Three mothers

described their own or their friends’ experience with the detection of pre-cancerous lesions or cervical cancer as tough and scary. However, while one mother explained this experience convinced her to vaccinate her daughter, another one stated: *“no, at no point did I say to myself that I was going to vaccinate her because this happened to me. No, I was really disgusted to have it, but . . .”* (M11). Only one mother discussed the benefits of preventing a sexually transmitted infection, comparing HPV to AIDS: *“Even though it’s not the same, a sexually transmitted disease to me, I’m referring a bit to AIDS or other [diseases]. Now, if there’s a vaccine that [provides] a cure, yes, I would do it, with my eyes closed, without thinking.”* (M20). Some participants also believed that discussions around sexually transmitted infections bring more emotional reactions than other infections, including embarrassment and taboos.

Only two girls reported worries about potential vaccine side effects and one girl expressed a fear of needles. In fact, mothers reported more negative emotions toward the risk of side effects following HPV vaccination than their daughters. These emotions were reinforced when discussing the uncertainties surrounding what was still described as a ‘new vaccine,’ for which too much remained unknown, including about its effectiveness, safety or long-term risks: *“For me, it’s more about whether it will bring other problems, other diseases later. Will we discover [something], in I don’t know, 5, 10, 15 years?”* (M9). Some mothers explained that ‘new vaccines’ refer to those that were not available when they were children or that have not been tested long enough, perceiving vaccinated girls as Guinea pigs: *“I think not enough time has passed, the vaccine is all new, come on our children are not Guinea pigs.”* (M15).

Perceptions around natural medicine

Almost all mothers as well as a few adolescent girls explained that the less drugs they use, the better it is for their health: *“I had a teacher (. . .) who told me that it’s better to let the disease run its course, and it will go away alone. And it’s not by taking medicines all the time that it will go away”* (A17). One girl repeated almost word for word what her mother said during her own interview: *“The less medication I take and the less I give my daughters, the better I feel”* (M10), *“The less I take them, the better it is, so I prefer to treat myself naturally than with medicines”* (A10). The use of natural remedies, essential oils and homeopathy instead of ‘chemicals’ found in drugs and vaccines was commonly discussed by mothers, who sometimes reported receiving recommendations to use natural remedies from their doctors. Girls also reported a preference for natural remedies or alternatives to vaccines, with a couple stating it would also be better for the environment. In addition to worries about injecting foreign chemicals with vaccination, some mothers were also concerned about allowing the body to defend itself naturally: *“When we are used to receiving too many vaccines, the problem is that the body is not used to protecting itself against infections anymore”* (M9).

Contrastingly to the reported preference for natural medicine and the need to limit the use of drugs, France was also described as a highly medicalized country by two mothers: *“In France, I have to say that we are one of the countries that consume the highest number of drugs. So, I don’t know, maybe*

people receive too many vaccines, too many drugs” (M9). This led to some mothers believing there are too many vaccines, with HPV vaccine described as ‘one too many.’ Two mothers also questioned the need to prevent all diseases: “We will never be able to stop an accident or something like that, so yes I think that it’s ridiculous to do too many vaccines. And even the thought of saying ‘we will protect ourselves against everything,’ no, that will never happen” (M8).

Discussion

Vaccine hesitancy has sometimes been described as being driven by risk perceptions^{24–27} and low uptake of HPV vaccination in France could in part be explained by such perceptions among parents, adolescents, and healthcare professionals.^{12,13,28} As adults and adolescents understand and perceive risks differently, this study provided an in-depth exploration and comparison of mothers and adolescent girls’ understanding of HPV vaccine risks and benefits and their influence on vaccine decisions in France.

Individual differences in vaccine benefits and risks

Among adolescents, the perception of that HPV vaccine benefits and risks vary from one individual to another was a strong theme. Adolescents explained that bodies respond differently to both vaccines and diseases, including in terms of vaccine safety (i.e. side effects might not happen to everyone and people might tolerate vaccines differently), vaccine effectiveness (the vaccine might work in some but not others), and risk of disease (i.e. some people are less at risk of HPV). The impact of these views on risk perceptions have previously been described in the context of HIV transmission and protection among adolescents,²⁹ with a lack of previous experience with serious health issues provided as a possible reason for low perceived vulnerability to certain risks.³⁰ Interestingly, findings from our study did not solely reflect a lack of perceived vulnerability by adolescents but a more general perception that medicine should be more personalized to respond to specific individual needs. In such cases, communication strategies focusing on low-level construal messages, such as those using narrative information and stories adolescents can relate to could be more effective to improve vaccine acceptance.³¹

Both adolescent girls and mothers also reflected on individual risk behaviors, with religious beliefs discussed as an important factor influencing whether individuals engage in sexual activity and are therefore at risk of catching HPV, confirming findings from previous studies.^{32–35} The influence of parental beliefs, values and upbringing on adolescents’ perceptions of sexual behavior and HPV vaccination could constitute an important barrier to vaccine uptake, with possible taboos related to religious convictions hindering communication and engagement of both parents and adolescents.³⁶

The social construction of vaccine safety perceptions

Vaccine safety is one of the most commonly reported determinants of vaccine hesitancy, with evidence showing individuals may delay or refuse vaccines due to concerns about their

safety.^{16,24,37} Most studies have defined and explored perceptions of vaccine safety in relation to the perceived risk of adverse events following vaccination. However, this study has found that vaccine safety can be interpreted and understood differently by individuals. In fact, mothers in this study perceived vaccine safety in relation to the vaccine product itself, discussing concerns and relaying rumors about what they see as a controversial vaccine with important side effects and thinking about long-term effects. Contrastingly, instead of questioning the product, adolescent girls discussed vaccine safety in relation to whether it may be administered or stored incorrectly, for example because of the use of unclean needles and only discussed short-term effects. This supports the theory that adolescents tend to think about risks in the short-term rather than in the longer-term.²⁰

This distinction could also point to perceptions of vaccine safety being socially constructed, understood and interpreted differently by populations and communities with different cultural and social environments. For instance, adolescent girls in this study also highlighted the impact of social constructionism by explaining individuals place different weight on certain illnesses or conditions, which could influence whether or not they believe they have been affected by a vaccine adverse event. These distinctions in risk and benefit perceptions are important for future research on the determinants of vaccine hesitancy, including in terms of the development of research questions that reflect differences in the understanding of vaccine safety. While health and illness have previously been described as subjective experiences that can be socially constructed,^{38,39} more research should be conducted to determine how the occurrence and understanding of perceived and real adverse events following immunization may be socially constructed and influenced by social norms, including within different population groups such as fathers, adolescent boys or healthcare professionals.

Controversies and widespread concerns about vaccine safety

Another important difference comes from the nature of side effects believed to be associated with HPV vaccination. While adolescent girls in this study discussed side effects such as fever or allergies, mothers mostly focused on unproven side effects around which rumors and misinformation has been shown to spread on digital and social media. Some mothers, for example, believed HPV vaccination could lead to multiple sclerosis, reflecting similar discredited rumors around Hepatitis B vaccination in France back in the 1990s.¹²

Additionally, most mothers in this study, whether they vaccinated their daughters or not, raised concerns about vaccine safety and admitted that nothing comes without risk. This contrasts to a previous 2012 study¹³ and could point to a now widespread belief that vaccines are unsafe in France,^{40,41} with mothers no longer questioning whether vaccines can have side effects, but whether their own daughters will suffer from these side effects. Mothers’ exposure to a strongly conflicting information environment around vaccination in France could explain their concerns about these unproven side effects and their mistrust of medications in relation to past events that had

been mismanaged.¹² On the other hand, as adolescent girls expressed low awareness and understanding of HPV vaccination, it could indicate their lack of involvement in decision-making has largely shielded them from exposure to misinformation, even if they use social media more often than their mothers. Yet, some girls reported similar concerns as their mothers, showing the risk of rumors and hesitancy passing from mothers to daughters as they start becoming more involved in decision-making.

Vaccination as a mean of preventing risks

While many girls talked about the importance of vaccination for protection, most of them did so by expressing the importance of preventing the *risks* of disease in comparison to the risks of vaccines, confirming previous evidence showing that individuals are more likely to accept vaccination when they feel at risk or threatened.¹⁶ Adolescents have also been shown to overestimate risks and to place more weight on perceived benefits than risks when making decisions.^{20,21} Our study shows that the risk of cervical cancer is considered sufficiently important by adolescents to get vaccinated against HPV. However, adolescent girls did not share significant concerns about risks of negative consequences from vaccination as much as their mothers did, and we could not determine whether this would have had an impact on adolescents' decision to get vaccinated. Contrastingly, mothers who also acknowledged the risk of cervical cancer were also negatively influenced by the risk of possible side effects.

Risks were also mostly discussed in relation to cervical cancer rather than sexually transmitted infections, genital warts or HPV infection. The only mother who discussed HPV infection as risky compared it to HIV, showing low perceived severity associated with HPV itself. This highlights the need for communication strategy to focus on cervical cancer as well as the need for strong awareness campaigns on HPV infection, especially if campaigns become more gender-neutral.

Emotional assessments of risks and benefits

While individuals may make decisions by analyzing the scientific risks and benefits of vaccination, they will also process risks as feelings, using an instinctive and emotional system to develop a subjective perception of the risks and benefits of vaccination.^{17,18,42,43} This study found that mothers and adolescent girls both had strong but different emotional reactions to HPV vaccination. Most girls expressed very positive emotions such as security or reassurance in relation to the protection offered by the vaccine, which was less present among mothers. Vaccination seemed like a natural and obvious behavior and some girls expressed incredulity at the thought that some parents may refuse them. In addition to the positive feeling of protection offered by the vaccine, both girls and mothers described distress and fear associated with the risk of cancer. Cancer is one of the diseases that provokes anxiety in the general population,⁴⁴ and despite expressing concerns about cervical cancer, some mothers, including those who

experienced precancerous cervical lesion, showed stronger emotions around the perceived risks of HPV vaccination. While this was less commonly reported by girls, this could indicate that vaccination campaigns aiming to elicit fears around the consequences of not vaccinating would resonate less with mothers. More research should be conducted with women who experienced lesions to understand their perceptions of HPV infection, cervical cancer, and vaccination.

In addition to vaccine side effects, fears were also raised in relation to vaccines being unnatural. Despite the fact that the HPV vaccine had been introduced over a decade ago in France, there were also concerns that it was a new vaccine with inherent uncertainty about potential long-term effects. Another qualitative study conducted in France found similar results, highlighting the importance of how familiar a vaccine is with how people perceive its risks.¹² Stronger support is needed to help navigate the uncertain and conflicting environment around HPV vaccination, particularly for mothers as they decide whether to vaccinate their daughters against HPV.

Strengths and limitations

This study has several limitations that should be taken into account as they could have influenced some of the findings. Participants included in this study came from only one city in France and were mostly unvaccinated against HPV, which could have influenced the themes and issues around risk and benefit perceptions that were identified. Furthermore, insufficient data on socio-economic demographics was collected to identify possible differences in responses by socio-economic background. Findings could also have been affected by the two methods of recruitment used to identify adolescent girls, including the different compensation mechanisms. While the interviewer was fluent in both French and English, it is possible that some concepts might have been lost in translation. Finally, despite interviews taking place in private, participants may have felt uncomfortable answering some questions, especially with their mothers or daughters in the room next door.

Conclusion

While many studies have been conducted with the aim of exploring factors influencing HPV vaccine perceptions, most of these have focused on parents or mothers, especially in terms of risk and benefits perceptions. This study found that perceptions of HPV vaccination risks and benefits differ between adolescent girls and their mothers. Beyond expected differences in whether vaccines are perceived as safe, beneficial and effective, deeper nuances in how these concepts are understood and applied were identified. Adolescent girls described HPV vaccination in a more beneficial manner, using positive emotions and language to explain their willingness to be vaccinated. Mothers, were more impacted by a conflicting information environment surrounding HPV vaccination in France, focusing on concerns about what appeared to be a widespread belief that these vaccines are unsafe. This difference should be further explored, including its impact on strategies to rebuild confidence in HPV vaccination.

Acknowledgments

HJL and TC are affiliated to the National Institute for Health Research (NIHR) Health Protection Research Unit in Immunisation at the London School of Hygiene & Tropical Medicine in partnership with Public Health England. The views expressed are those of the author(s) and not necessarily those of the National Health Service, the NIHR, the Department of Health, or Public Health England.

Disclosure Statement

HJL/EK are part of research projects funded by GSK, Merck, and Janssen; and received support for participating in Merck and GSK meetings. HJL is a member of the Merck Vaccine Confidence Advisory Board.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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