**UK healthcare professionals’ attitudes towards the introduction of varicella vaccine into the routine childhood vaccination schedule and their preferences for administration.**

Susan M. Sherman1, Charlotte Allerton-Price1, Nicola Lingley-Heath1, Jasmine Lai2, Helen Bedford3

1 School of Psychology, Keele University, Keele, ST5 5BG, UK

2 Division of Biosciences, University College London, London, WC1E 6BT, UK

3 Great Ormond Street Institute of Child Health, University College London, London, WC1N 1EH, UK

**Word count:** 4893 excl references, abstract, supplementary materials

Corresponding author: Susan M. Sherman, [s.m.sherman@keele.ac.uk](mailto:s.m.sherman@keele.ac.uk)

**ABSTRACT**

**Background.** Varicella (chickenpox) is a highly contagious disease caused by the varicella-zoster virus. Although typically mild, varicella can cause complications leading to severe illness and even death. Safe and effective varicella vaccines are available. The Joint Committee on Vaccination and Immunisation has reviewed the evidence and recommended the introduction of varicella vaccine into the UK’s routine childhood immunisation schedule.

**Objectives.** To explore UK healthcare professionals’ (HCPs) knowledge and attitudes towards varicella vaccination, its introduction to the UK routine childhood immunisation schedule, and their preferences for how it should be delivered.

**Design.** We conducted an online cross-sectional survey exploring HCPs’ attitudes towards varicella, varicella vaccine, and their preferences for delivery of the vaccine between August and September 2022 prior to the recommendation that varicella vaccine should be introduced.

**Participants.** 91 HCPs working in the UK (81% nurses/health visitors, 9% doctors, 10% researcher/other mean age 48.7 years).

**Results.** All respondents agreed or strongly agreed that vaccines are important for a child’s health.. However, only 58% agreed or strongly agreed that chicken pox was a disease serious enough to warrant vaccination. Gaps in knowledge about varicella were revealed: 21.0% of respondents disagreed or were unsure that chickenpox can cause serious complications, while 41.8% were unsure or did not believe chickenpox was serious enough to vaccinate against. After receiving some basic information about chickenpox and the vaccine, almost half of the HCPs (47.3%) in our survey would prefer to administer the varicella vaccine combined with MMR.

**Conclusions**. Given the positive influence of HCPs on parents’ decisions to vaccinate their children, it is important to understand HCPs’ views regarding the introduction of varicella vaccine into the routine schedule. Our findings highlighted areas for training and HCPs’ preferences which will have implications for policy and practice when the vaccine is introduced.

**Keywords:** Varicella, vaccination, healthcare professionals, immunisation schedule, barriers, routine immunisation, acceptance, preference, vaccine hesitancy, chickenpox

**INTRODUCTION**

Varicella (chickenpox) is a highly contagious disease caused by the varicella-zoster virus (VZV) (Gonzalez-Martin, 2019). Common symptoms include an itchy rash with small fluid filled blisters (vesicles), fever, fatigue, loss of appetite and malaise which can last up to two weeks. Viral transmission occurs through direct contact with an infected person, such as respiratory droplets or the fluid from the vesicles. After initial infection, the varicella virus remains latent in the individual’s sensory nerve ganglia where, in 10-20% of cases, it reactivates usually in later life, causing herpes zoster (shingles) (WHO, 2016). Whilst varicella can be contracted at any age, in temperate areas 90% of cases are seen in children before the age of 10 years (Helmuth, et al 2015). In most cases the disease is mild, although serious complications can occur, more commonly in adults particularly pregnant women and in immunocompromised individuals. Other complications occurring at an estimated rate of 2-6% (Rodrigues et al., 2023) include secondary bacterial infections of the skin or soft tissues. Recent chickenpox infection is an important risk factor for invasive Group A streptococcus (iGAS) in children (Zangarini et al., 2023).

Safe and effective varicella vaccines have been available since the 1970s and in routine use in USA since 1995 and Australia since 2005, proving highly successful in reducing disease (Seward et al., 2002; Liese et al., 2008). The vaccine can be administered as a monovalent or a quadrivalent vaccine in combination with the measles, mumps and rubella vaccines (MMRV). In a recent survey of UK parents’ acceptance of varicella vaccine, parents reported a preference for a combination MMRV vaccine, or an additional vaccination visit for a single varicella vaccine over an additional injection at the same vaccination visit as existing vaccines (Sherman et al., 2023). This preference has been borne out in practice in Canada, where the introduction of a combination MMRV vaccine led to higher uptake of varicella vaccine compared with when it was offered separately (MacDonald et al., 2020).

A single-dose of varicella vaccine has been estimated to provide about 80% protection against all infection and almost 100% protection against moderate or severe disease (Marin et al., 2016). In cases where vaccinated individuals do contract varicella, their symptoms are typically milder with fewer complications (Annunziato & Gershon, 2000). Despite this, many countries including the UK currently only recommend varicella vaccination for high-risk groups and individuals in close contact with an immunocompromised individual. Implementation of a routine childhood varicella vaccination programme in UK was considered but not recommended by the Joint Committee on Vaccination and Immunisation (JCVI) in 2009 (JCVI, 2009) and this position has been reviewed again with a recommendation that it should now be implemented (JCVI. 2023).

Through epidemiological modelling, the JCVI (2010) predicted that with a high uptake, incorporating varicella vaccine into the routine schedule would see a large reduction in cases of varicella. However, it was also predicted that in the years following its introduction there would be an increase in cases of herpes zoster in adults. This is because it has been hypothesised that vaccinating children would remove or reduce circulating VZV which boosts immunity against herpes zoster; this lack of boosting could lead to an increase in herpes zoster. A shingles vaccine programme for older people been in place in UK since 2013. Furthermore, there has been concern that the reduction in circulating virus would result in an upward shift in the age of acquiring chickenpox infection putting susceptible individuals at risk of disease in adulthood when it is more severe. To avoid these potential consequences of vaccine introduction, it is estimated that a vaccine uptake of above 80% is necessary (WHO, 2014).

A recent study (Sherman et al., 2023) highlighted the trust parents place in advice from the NHS and healthcare professionals (HCPs) when considering vaccination for their children. More than 80% of the 596 parents surveyed, strongly or somewhat agreed that they trusted the advice given on vaccination by practice nurses, health visitors, and their GP. These findings were echoed by the most recent tracking survey of over 1000 parents of children under five years conducted by UK Health Security Agency (UKHSA, 2023). Verger et al., (2022) describes HCPs’ interactions with their patients as “the keystone enabling confidence in vaccination and successful reduction of vaccine hesitancy” (page 2). Through effective communication, HCPs can reassure parents of the safety and benefits of vaccination, addressing any of their concerns so they are able to make informed decisions in their child’s best interests (Verger et al., 2022). Conversely, vaccine-hesitant HCPs may exacerbate or create doubts for parents.

Given the influence HCPs can have on parents’ vaccination decisions, it is important to understand their own views not just as professionals working within the healthcare sector, but also as members of the public and in some cases parents themselves. Building on the work of Sherman et al., (2023), and in anticipation of the JCVI review, this study aimed to explore HCPs’ views about the potential introduction of a varicella vaccine into the routine childhood schedule, and what they anticipate parents’ responses to be. This study will also seek HCPs’ insight into any potential barriers or facilitators they consider may have an impact on uptake, as well as which option for administering varicella vaccine they would prefer.

**METHOD**

**Design**

We conducted a cross-sectional survey between 10th August 2022 – 29th September 2022. Participants completed the survey online on the web-based survey tool Qualtrics.

**Participants**

Participants (n=91) were recruited through convenience and snowball sampling via contacts within the research team, the Royal College of Nursing, and social media pages for example nurses’ Facebook groups. Participants were eligible to take part if they were a healthcare professional, living and working in the UK, who provided advice about or administered childhood vaccines. Of 109 individuals who began the survey, 91 completed it (83.5% completion rate). Although we included 2 attention check questions, no participants failed both and so none were excluded.

**Measures**

The questionnaire was developed based on our recent survey of parental attitudes towards the introduction of varicella vaccination (Sherman et al, 2023) and a literature review of vaccine hesitancy in healthcare professionals and varicella vaccination. The final questionnaire is available online (<https://osf.io/vejmz/?view_only=2ace6027f9b4499c88059d24a9c3fc63> [peer review link to be updated on acceptance with public link]).

Participants were asked for their demographic details. Questions were asked about: their attitudes towards vaccination generally; knowledge about the chickenpox virus and their perceptions of its risk and seriousness; their own experience of chickenpox; likely parental responses to the introduction of chickenpox vaccine and preferences for how it should be administered; their own preference for how it should be administered and likely barriers and facilitators to parental uptake of the vaccine.

Specifically, we asked participants to report their age, gender, ethnicity, religion, primary healthcare role, the region in which they practice, whether they had children under the age of 18, and if so, whether their children were up to date with their childhood vaccines as per the UK vaccination schedule.

To explore attitudes to vaccination in general, we modified eight items from the WHO SAGE Vaccine Hesitancy Scale (VHS) (Larson et al, 2015; Shapiro et al, 2018) for use in a UK setting and aimed at all participants, not just those with children, to assess attitudes towards childhood vaccines (e.g., reworded from “childhood vaccines are important for my child’s health” to “childhood vaccines are important for a child’s health”). A further item from the VHS was included for parents only (“Generally I do what my doctor or health care provider recommends about vaccines for my child/children”). We also included 9 additional items such as “vaccines are generally safe”, “I believe that healthcare professionals should be up to date with their vaccines to work in the healthcare sector”, “children are vaccinated too early” and “talking with people who are uncertain about vaccination, increases my own uncertainty about vaccination” adapted from Di Martino et al., (2020) and Tomljenovic et al., (2021). Items regarding perceptions of vaccine safety and effectiveness were clarified by including definitions of ‘safe’ (‘means serious side effects are rare’) and ‘effective’ (‘means that most vaccines give good protection’) to ensure consistent interpretation by respondents. Participants were asked to indicate the extent to which they agreed or disagreed with the items on a five-point Likert scale.

We then asked participants to indicate on a five-point Likert scale (from strongly agree to strongly disagree) their agreement with statements: “Chickenpox is usually a mild disease in healthy children”; “Chickenpox can cause serious complications”; “I think chickenpox is a disease serious enough to vaccinate against”; “I am worried about the side effects of chickenpox vaccination”; “Immunity from contracting chickenpox naturally is better than receiving the vaccine”; “It is better to have chickenpox when you are a child than when you are an adult”.

We then asked participants if they had personally seen complications of chickenpox and if this was in their own patients, their own child or other. If they indicated they had seen it in their own patients, we then asked them to estimate for every ten cases of chickenpox how many had complications. We also asked, “For every 10 parents you see for children's vaccinations, how many would you say ask for chickenpox vaccination for their children?”.

Following this, we asked participants to indicate on a five-point Likert scale (from strongly agree to strongly disagree) their agreement with seven statements concerning the likely response from parents if/when the chickenpox vaccination is introduced in the UK and how they would feel about responding to parents, such as “Most parents will vaccinate their child against chickenpox” and “I would find it difficult to discuss the chickenpox vaccination with parents”.

All participants were then provided with some basic information about the infection and the vaccine (as we did for parents in Sherman et al., 2023). We also outlined the options for delivering the vaccination as follows: 1. Combining the chickenpox vaccine with MMR (MMRV); 2. Giving the chickenpox vaccine at the same time as MMR but as a separate injection (MMR+V); 3. Giving the chickenpox vaccine at an additional visit (V). Participants were asked which option they would prefer to deliver (they were given an ‘other’ option with free text as well). We asked a follow-up open-ended question asking them to explain the reasons for their choice. We then asked them to rank order the 3 options above in the order they thought parents would prefer them.

We then asked participants to indicate on a five-point Likert scale (from extremely likely to extremely unlikely) to what extent they thought each of 11 items (e.g., children already receiving too many injections; social media influence) might stop parents from having the chickenpox vaccine for their child/ren. Lastly, we asked to what extent they thought each of 9 items (e.g., reduction of chickenpox infection discomfort, advice from a well-informed healthcare professional) might encourage parents to accept the chickenpox vaccine. Both sets of items (adapted from Karafillakis et al., 2016) were supplemented with an ‘other’ option and an accompanying open-ended text box.

Two unrelated attention check questions were included as a quality control measure. Participants were excluded if they answered both of these questions incorrectly.

The study was reviewed and approved by Keele University’s Psychology Research Ethics Committee (reference: REC 0116).

**RESULTS**

The survey was completed by a total of 91 participants aged between 26 and 65 years (mean=48.7, standard deviation=9.4) who were included in the data analysis. Participant characteristics are detailed in Table 1. Thirty-nine (42.9%) respondents reported having a child under the age of 18 and all reported that their child was up to date with their vaccines.

**Table 1.** Participant characteristics

|  |  |  |
| --- | --- | --- |
| **Demographic questions** | **Level** | ***n* (%)** |
| Gender | Female | 88 (96.7) |
|  | Male | 3 (3.3) |
| Ethnicity | White | 83 (91.2) |
|  | Other ethnic groups  Prefer not to say | 7 (7.7)  1 (1.1) |
| Religion | No religion | 43 (47.2) |
|  | Christian | 45 (49.5) |
|  | Other religion | 1 (1.1) |
|  | Prefer not to say | 2 (2.2) |
| Primary role | Lead nurse/nurse/nurse practitioner/trainee | 64 (70.3) |
|  | Health visitor | 10 (11.0) |
|  | Consultant/paediatric doctor | 6 (6.6) |
|  | Researcher | 3 (3.3) |
|  | GP/doctor | 2 (2.2) |
|  | Other | 6 (6.6) |
| Region | East Midlands | 18 (19.8) |
|  | East of England | 9 (9.9) |
|  | London | 8 (8.8) |
|  | North East & Cumbria | 1 (1.1) |
|  | North West | 6 (6.6) |
|  | Northern Ireland | 1 (1.1) |
|  | Scotland | 3 (3.3) |
|  | South East | 20 (22.0) |
|  | South West | 9 (9.9) |
|  | Wales | 2 (2.2) |
|  | West Midlands | 7 (7.7) |
|  | Yorkshire & the Humber | 5 (5.5) |
|  | Prefer not to say | 2 (2.2) |
| Have children under 18 | Yes | 39 (42.9) |
|  | No | 52 (57.1) |

**General vaccine attitudes**

Participants attitudes towards vaccination in general are presented in Table 2.

**Table 2.** Healthcare professionals’ attitudes towards vaccination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Vaccine attitudes** | **Level** | ***n*** | **%** | **95% Confidence Interval** |
| Childhood vaccines are important for a child's health | Strongly agree | 89  2  0  0  0 | 97.8 | 92.3-99.7 |
| Somewhat agree | 2.2 | 0.3-7.7 |
| Neither agree nor disagree | 0.0 | - |
| Somewhat disagree | 0.0 | - |
| Strongly disagree | 0.0 | - |
| Childhood vaccines are effective ('effective' means that most vaccines give good protection) | Strongly agree | 88 | 96.7 | 90.7-99.3 |
| Somewhat agree | 3 | 3.3 | 0.7-9.3 |
| Neither agree nor disagree | 0 | 0.0 | - |
| Somewhat disagree | 0 | 0.0 | - |
| Strongly disagree | 0 | 0.0 | - |
| Vaccines are generally safe ('safe' means serious side effects are rare) | Strongly agree | 87 | 95.6 | 89.1-98.8 |
| Somewhat agree | 4 | 4.4 | 1.2-10.9 |
| Neither agree nor disagree | 0 | 0.0 | - |
| Somewhat disagree | 0 | 0.0 | - |
| Strongly disagree | 0 | 0.0 | - |
| Vaccinating children is important for the health of others in the community | Strongly agree | 88 | 96.7 | 90.7-99.3 |
| Somewhat agree | 3 | 3.3 | 0.7-9.3 |
| Neither agree nor disagree | 0 | 0.0 | - |
| Somewhat disagree | 0 | 0.0 | - |
| Strongly disagree | 0 | 0.0 | - |
| All childhood vaccines offered by the NHS are beneficial | Strongly agree | 81 | 89.0 | 80.7-94.6 |
| Somewhat agree | 10 | 11.0 | 5.4-19.3 |
| Neither agree nor disagree | 0 | 0.0 | - |
| Somewhat disagree | 0 | 0.0 | - |
| Strongly disagree | 0 | 0.0 | - |
| New vaccines carry more risk than older vaccines | Strongly agree | 1 | 1.1 | 0.0-6.0 |
| Somewhat agree | 16 | 17.6 | 10.4-27.0 |
| Neither agree nor disagree | 21 | 23.1 | 14.9-33.1 |
| Somewhat disagree | 25 | 27.5 | 18.6-37.8 |
| Strongly disagree | 28 | 30.8 | 21.5-41.3 |
| The information I receive about vaccines from the NHS is reliable | Strongly agree | 75 | 82.4 | 73.0-89.6 |
| Somewhat agree | 14 | 15.4 | 8.7-24.5 |
| Neither agree nor disagree | 2 | 2.2 | 0.3-7.7 |
| Somewhat disagree | 0 | 0.0 | - |
| Strongly disagree | 0 | 0.0 | - |
| Getting vaccines is a good way to protect children from disease | Strongly agree | 86 | 94.5 | 87.6-98.2 |
| Somewhat agree | 5 | 5.5 | 1.8-12.4 |
| Neither agree nor disagree | 0 | 0.0 | - |
| Somewhat disagree | 0 | 0.0 | - |
| Strongly disagree | 0 | 0.0 | - |
| Generally, I do what my doctor or health care provider recommends about vaccines for my child/children\* | Strongly agree | 25 | 64.1 | 47.2-78.8 |
| Somewhat agree | 13 | 33.3 | 19.1-50.2 |
| Neither agree nor disagree | 0 | 0.0 | - |
| Somewhat disagree | 0 | 0.0 | - |
| Strongly disagree | 1 | 2.6 | 0.0-13.5 |
| I am concerned about serious adverse effects of vaccines | Strongly agree | 5 | 5.5 | 1.8-12.4 |
| Somewhat agree | 29 | 31.9 | 22.5-42.5 |
| Neither agree nor disagree | 15 | 16.5 | 9.5-25.7 |
| Somewhat disagree | 22 | 24.2 | 15.8-34.3 |
| Strongly disagree | 20 | 22.0 | 14.0-31.9 |
| I believe more in natural immunity acquired through disease than in vaccines | Strongly agree | 0 | 0.0 | - |
| Somewhat agree | 4 | 4.4 | 1.2-10.9 |
| Neither agree nor disagree | 8 | 8.8 | 3.9-16.6 |
| Somewhat disagree | 28 | 30.8 | 21.5-41.3 |
| Strongly disagree | 51 | 56.0 | 45.2-66.4 |
| I am against vaccinations because of my religious beliefs | Strongly agree | 0 | 0.0 | - |
| Somewhat agree | 0 | 0.0 | - |
| Neither agree nor disagree | 0 | 0.0 | - |
| Somewhat disagree | 1 | 1.1 | 0.0-6.0 |
| Strongly disagree | 90 | 98.9 | 94.0-100.0 |
| Healthcare professionals should be vaccinated in order to be a role model for patients | Strongly agree | 47 | 51.6 | 40.9-62.3 |
| Somewhat agree | 24 | 26.4 | 17.7-36.7 |
| Neither agree nor disagree | 12 | 13.2 | 7.0-21.9 |
| Somewhat disagree | 5 | 5.5 | 1.8-12.4 |
| Strongly disagree | 3 | 3.3 | 0.7-9.3 |
| I believe that healthcare professionals should be up to date with their vaccines to work in the healthcare sector | Strongly agree | 66 | 72.5 | 62.2-81.4 |
| Somewhat agree | 14 | 15.4 | 8.7-24.5 |
| Neither agree nor disagree | 8 | 8.8 | 3.9-16.6 |
| Somewhat disagree | 1 | 1.1 | 0.0-6.0 |
| Strongly disagree | 2 | 2.2 | 0.3-7.7 |
| Having too many vaccines all at once can have a negative effect on the immune system | Strongly agree | 1 | 1.1 | 0.0-6.0 |
| Somewhat agree | 3 | 3.3 | 0.7-9.3 |
| Neither agree nor disagree | 5 | 5.5 | 1.8-12.4 |
| Somewhat disagree | 13 | 14.3 | 7.8-23.2 |
| Strongly disagree | 69 | 75.8 | 65.7-84.2 |
| Children receive too many vaccines | Strongly agree | 0 | 0.0 | - |
| Somewhat agree | 2 | 2.2 | 0.3-7.7 |
| Neither agree nor disagree | 8 | 8.8 | 3.9-16.6 |
| Somewhat disagree | 15 | 16.5 | 9.5-25.7 |
| Strongly disagree | 66 | 72.5 | 62.2-81.4 |
| Children are vaccinated too early | Strongly agree | 0 | 0.0 | - |
| Somewhat agree | 4 | 4.4 | 1.2-10.9 |
| Neither agree nor disagree | 5 | 5.5 | 1.8-12.4 |
| Somewhat disagree | 11 | 12.1 | 6.2-20.6 |
| Strongly disagree | 71 | 78.0 | 68.1-86.0 |
| Talking with people who are uncertain about vaccination, increases my own uncertainty about vaccination | Strongly agree | 2 | 2.2 | 0.3-7.7 |
| Somewhat agree | 2 | 2.2 | 0.3-7.7 |
| Neither agree nor disagree | 2 | 2.2 | 0.3-7.7 |
| Somewhat disagree | 14 | 15.4 | 8.7-24.5 |
| Strongly disagree | 71 | 78.0 | 68.1-86.0 |

\*question only given to those who had children under 18 (N=39)

**Knowledge of Varicella disease**

Participants’ knowledge about varicella are shown in Table 3.

**Table 3.** Healthcare professionals’ knowledge of varicella

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Varicella knowledge** | **Level** | ***n*** | **%** | **95% Confidence Interval** |
| Chickenpox generally has a mild disease course in healthy children | Strongly agree  Somewhat agree  Neither agree nor disagree  Somewhat disagree  Strongly disagree | 27 | 29.7  54.9  6.6  7.7  1.1 | 20.5-40.2  44.2-65.4  2.5-13.8  3.1-15.2  0.0-6.0 |
| 50 |
| 6 |
| 7 |
| 1 |
| Chickenpox can cause serious complications | Strongly agree | 42 | 46.2 | 35.6-56.9 |
| Somewhat agree | 30 | 33.0 | 23.5-43.6 |
| Neither agree nor disagree | 6 | 6.6 | 2.5-13.8 |
| Somewhat disagree | 8 | 8.8 | 3.9-16.6 |
| Strongly disagree | 5 | 5.5 | 1.8-12.4 |
| I think chickenpox is a disease serious enough to vaccinate against | Strongly agree | 26 | 28.6 | 19.6-39.0 |
| Somewhat agree | 27 | 29.7 | 20.5-40.2 |
| Neither agree nor disagree | 15 | 16.5 | 9.5-25.7 |
| Somewhat disagree | 18 | 19.8 | 12.2-29.4 |
| Strongly disagree | 5 | 5.5 | 1.8-12.4 |
| I am worried about the side effects of chickenpox vaccination | Strongly agree | 1 | 1.1 | 0.0-6.0 |
| Somewhat agree | 10 | 11.0 | 5.4-19.3 |
| Neither agree nor disagree | 27 | 29.7 | 20.5-40.2 |
| Somewhat disagree | 26 | 28.6 | 19.6-39.0 |
| Strongly disagree | 27 | 29.7 | 20.5-40.2 |
| Immunity from contracting chickenpox naturally is better than receiving the vaccine | Strongly agree | 8 | 8.8 | 3.9-16.6 |
| Somewhat agree | 12 | 13.2 | 7.0-21.9 |
| Neither agree nor disagree | 40 | 44.0 | 33.6-54.8 |
| Somewhat disagree | 17 | 18.7 | 11.3-28.2 |
| Strongly disagree | 14 | 15.4 | 8.7-24.5 |
| It is better to have chickenpox when you are a child than when you are an adult | Strongly agree | 60 | 65.9 | 55.3-75.5 |
| Somewhat agree | 24 | 26.4 | 17.7-36.7 |
| Neither agree nor disagree | 6 | 6.6 | 2.5-13.8 |
| Somewhat disagree | 0 | 0.0 | - |
| Strongly disagree | 1 | 1.1 | 0.00-6.0 |

**Personal experience of varicella**

Forty respondents (44.0%, CI 33.6-54.8) reported that they had personally seen complications from varicella. For those who indicated situations other than in their patients or their own child, these included among relatives or friends (n=5), personal experience (n=1) and seeing complications as a student working in adult intensive care (n=1). Respondents’ experiences of varicella are presented in Table 4.

**Table 4**. Responses to questions about experience of varicella

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Question** | **Level** | ***n*** | **%** | **95% Confidence Interval** |
| \*Have you personally seen | Yes, in my patients | 29 | 31.9 | 22.5-42.5 |
| complications of chickenpox? | Yes, in my own child\*\*  Other  No  Prefer not to say | 6  7  51  0 | 15.4  7.7  56.0  0.0 | 5.9-30.5  3.2-15.2  45.3-66.4  - |
| For every 10 cases of | 1-2 out of 10 cases | 27 | 67.5 | 50.9-81.4 |
| chickenpox that you see, how many would you say have complications?\*\*\* | More than 2 out of 10 cases | 2 | 5.0 | 0.6-16.9 |
| For every 10 parents you see | 1-2 | 40 | 44.9 | 34.4-55.9 |
| for children's vaccinations, how | 3-5 | 9 | 10.1 | 4.7-18.3 |
| many would you say ask for | More than 5 | 2 | 2.2 | 0.3-7.9 |
| chickenpox vaccination for their children?\*\*\*\* | None | 38 | 42.7 | 32.3-53.6 |

\*Please select all that apply

\*\*denominator for this response is 39 (number of respondents with children under 18)

\*\*\*denominator for this response is 40 (number of respondents who have seen complications of chickenpox)

\*\*\*\*denominator for this response is 89 (number who replied)

**Preferences for administration of varicella vaccine**

Forty-three respondents (47.3%, CI 36.7-58.0) indicated they would prefer to deliver the vaccine combined with MMR – the MMRV option, 25 (27.5%, CI 18.6-37.8) preferred the MMR+V option and 20 (22.0%, CI 14.0-31.9) preferred to give the vaccine at an additional visit (V). Three participants (3.3%, CI 0.7-9.3) responded ‘other’, with one commenting that 4 vaccines are already a lot for a 12-month-old and the parent; another queried the relative risk of febrile convulsion for giving the vaccine at an additional visit, and the third indicated they did not want to give the varicella vaccine. Respondents were asked to provide an open-ended response explaining the rationale for their choice (see Table S4). The number of injections was the most frequently identified reason among those who selected MMRV and those who selected V. For those who selected MMR+V, the risk of febrile convulsions was the most frequently cited reason. Regarding likely parental preferences, 29 of the 74 respondents who answered (39.2%, CI 28.0-51.2) indicated they thought parents would prefer the V option, 25 (33.8%, CI 23.2-45.7) MMR+V and 20 (27.0%, CI 17.4-38.6) MMRV. Predicted parental preferences for how the vaccine should be delivered are presented in Table 5.

**Table 5.** Predicted parental preference for administering vaccine (N=74)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item** | **Level** | ***n*** | **%** | **95% Confidence Interval** |
| Combining the chickenpox vaccination with MMR (MMRV) | 1st choice | 20 | 27.0 | 17.4-38.6 |
| 2nd choice | 22 | 29.7 | 19.7-41.5 |
| 3rd choice | 32 | 43.2 | 31.8-55.3 |
| Giving the chickenpox vaccination at the same time as MMR but as a separate injection (MMR+V) | 1st choice | 25 | 33.8 | 23.2-45.7 |
| 2nd choice | 36 | 48.6 | 36.9-60.6 |
| 3rd choice | 13 | 17.6 | 9.7-28.2 |
| Giving the chickenpox vaccination at an additional visit (V) | 1st choice | 29 | 39.2 | 28.0-51.2 |
| 2nd choice | 16 | 21.6 | 12.9-32.7 |
| 3rd choice | 29 | 39.2 | 28.0-51.2 |

**Likely response from parents**

Respondents provided their level of agreement with statements about the likely response from parents if/when the chickenpox vaccination is introduced in the UK and their own perceived capability to address questions. The majority of respondents strongly or somewhat agreed that most parents will vaccinate their child against chickenpox (72.5%, CI 62.2-81.4) and that they would feel confident to explain to parents the importance of vaccination against chickenpox (78.0%, CI 68.1-86.0). The responses are presented in the Supplementary Materials.

**Potential barriers and facilitators to parents accepting varicella vaccine**

Respondents were asked to identify the extent to which a range of issues might stop parents from having the chickenpox vaccine for their child/ren. The three potential barriers most frequently endorsed (strongly/somewhat agree responses) were perception that chickenpox is not serious, fear of vaccine side effects and social media influence. The responses are presented in the Supplementary Materials. Additionally, respondents were offered the opportunity to identify other barriers. Of 14 responses, five mentioned the influence of others such as friends, family, other parents, and playground gossip. Each of the following was also mentioned by one respondent: the anti-vaccination campaign, inconvenience of getting chickenpox, lack of clear government leadership and communication, lack of knowledge, older age for vaccination if the child has already had chickenpox infection, the idea of chickenpox parties so all children catch it when young and positive personal experience of this, concern about how long vaccine immunity will last and whether one is more likely to catch as an adult when immunity wanes, unable to get an appointment at their surgery due to staff shortages, and the influence of midwife/health visitor.

Respondents were asked to identify the extent to which a range of issues might encourage parents to accept the chickenpox vaccine. All of the potential facilitators were highly endorsed. The four most frequently endorsed were prior positive vaccination experience, being aware that the vaccination will reduce the risk of rare but serious chickenpox complications, advice from a well-informed healthcare professional and positive attitude towards vaccination from healthcare professional. The responses are presented in the Supplementary Materials. Additionally, respondents were offered the opportunity to identify other facilitators. Of the 13 responses, five mentioned the influence of friends, families and other mothers, five the role of social and other media, with two highlighting positive messaging, two that it would mean parents would not have to take time off work with a sick child, one mentioned dispelling chickenpox parties and one knowing it has been introduced in other countries to good effect.

**DISCUSSION**

To our knowledge this is the only contemporary published survey of UK healthcare professionals’ views about introducing varicella vaccine to the routine childhood vaccination schedule. Although most participants recognised chickenpox to be a generally mild infection, they were also aware that it could result in serious complications. Only 58% of respondents strongly agreed or agreed that chickenpox is serious enough to vaccinate against. This finding contrasts with our previous study conducted among parents of whom almost three-quarters were extremely/somewhat likely to accept the vaccine. (Sherman et al 2023)

We found that almost half of the HCPs in our survey would prefer to administer the varicella vaccine combined with MMR – the MMRV option, while the rest were almost evenly split between preferring the MMR+V option and giving the vaccine at an additional visit (V). A small number of HCPs responded that they did not favour an additional injection as the current schedule already includes four injections at 12 months. However, changes to the UK vaccination schedule due to be introduced (probably in 2025) when the current Hib/Men C vaccine given at 12 months of age will be removed (JCVI, 2022), will mean that even if a separate varicella vaccine was introduced, the total number of injections would still not exceed four. In contrast, more HCPs thought parents would prefer the V option, followed by MMR+V, with fewest respondents indicating they thought parents would prefer the MMRV option. This contrasts with our study of parents’ attitudes and preferences (Sherman et al, 2023) which suggested that parents would also prefer the MMRV option, with 65.6% of participants saying they would be extremely or somewhat likely to accept this option compared with 62.6% for V and 46.5% for MMR+V.

In our survey, more than a fifth of our sample reported feeling either uncertain or disagreeing that they would feel confident explaining to parents the importance of vaccination against chickenpox. However, since the introduction of any vaccine in the UK is accompanied by information materials for parents and training for HCPs, this uncertainty will be addressed. Some of the responses in our survey highlighted areas that need to be addressed in these materials. For example, there was a spread of responses to the statement that new vaccines carry more risk than older vaccines, with nearly a fifth of respondents agreeing with this statement and more than a third of respondents indicated they were concerned about serious adverse effects of vaccines. Varicella vaccine has been used widely in many countries for decades, which should prove reassuring for those HCPs with concerns about the safety of apparently ‘new’ vaccines. Additionally, as there was some uncertainty about the severity of chickenpox and its association with serious complications, this will require clarification. Interestingly, most of our sample believed that HCPs should be vaccinated as a role model for patients, and up-to-date with vaccines to work in the healthcare sector.

There is additional evidence from this survey of an appetite among parents for varicella vaccine, with more than a half of respondents reporting that parents have asked them for the vaccine for their children. The majority of respondents also endorsed the view that most parents will vaccinate their child against chickenpox if/when the vaccine is introduced to the UK routine immunisation schedule. Two of the main potential barriers chimed with those identified by parents in Sherman et al. (2023), specifically the perception that chickenpox is not serious and fear of vaccine side effects, underlining the information that parents will require to inform their vaccine decisions.

Our findings regarding support for the introduction of routine varicella vaccine contrast with those of other studies conducted among health care professionals in other countries. For example, 58% of health care professionals in our study believed that chickenpox is serious enough to vaccinate against, while in Hungary where many vaccines are mandatory and uptake is very high, 76.3% of HCPs surveyed, mainly health visitors, supported universal varicella vaccination(Huber et al 2020). In contrast, in a survey of Dutch HCPs only 21% believed varicella vaccine should be offered to all children mainly due to the perceived mild nature of the infection (Van Lier et al, 2016). However, these health professionals worked in public in the vaccination programme, rather than in acute settings and may have less personal experience of the complications of varicella infection. Such direct exposure to the complications of varicella either as a parent or as a health professional appears to influence views about the necessity for vaccination, with Huber et al reporting that in their sample, support for vaccination increased with greater exposure to complications of varicella.

This survey is timely in light of the JCVI recommendation to add varicella to the routine vaccination schedule (JCVI, 2023). However, there are limitations to the survey, most notably the limited sample size which means it may not be fully representative of UK healthcare professionals’ attitudes towards the introduction of varicella vaccine into the routine childhood vaccination schedule and their preferences for administration.

This survey of HCPs’ attitudes and preferences for varicella vaccination complements the recent survey by Sherman et al. (2023) exploring the parent perspective. While the sample in this study is relatively small, it provides important insights into how HCPs would prefer to administer the vaccine as well as likely training needs to support the introduction of the vaccine into the routine schedule.

**Transparency declaration**

The authors affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally planned have been explained.

**Data sharing statement**

Data are available here: <https://osf.io/vejmz/?view_only=2ace6027f9b4499c88059d24a9c3fc63> (public link to follow acceptance)

**Conflict of interest statement**

The authors have no conflicts of interest to declare.

**Licence Statement**

 I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the [author licence](https://authors.bmj.com/wp-content/uploads/2020/09/BMJ-Journals-Combined-Author-Licence-November-2018.pdf)), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd (“BMJ”) its licensees.

**References**

Annunziato, P. A., & Gershon, A. A. (2000). Primary immunization against varicella. Varicella-zoster virus: virology and clinical management. Cambridge University Press, Cambridge, United Kingdom, 460-476..

Di Martino, G., Di Giovanni, P., Di Girolamo, A., Scampoli, P., Cedrone, F., D’Addezio, M., & Staniscia, T. (2020). Knowledge and attitude towards vaccination among healthcare workers: a multicentre cross-sectional study in a Southern Italian Region. *Vaccines*, *8*(2), 248-260.

Gonzalez-Martin, C. (2019). Airborne infectious microorganisms. *Encyclopaedia of Microbiology*, 2(4), 52-60.

Helmuth, IG., Poulsen, A., Suppli, CA., Mølbak, K. (2015) Varicella in Europe—A review of the epidemiology and experience with vaccination. Vaccine, 33(21), 2406-2413,

Huber, A., Gazder, J., Dobay, O., Mészner, Z., & Horváth, A. (2020). Attitudes towards varicella vaccination in parents and paediatric healthcare providers in Hungary. Vaccine, 38(33), 5249-5255.

Joint Committee on Vaccination and Immunization Varicella Sub-Committee. (2009, March 9). *Minutes of the Varicella JCVI subgroup meeting on Monday 9th March 2009*.  [https://webarchive.nationalarchives.gov.uk/ukgwa/20130107105354/http:/www.dh.gov.uk/prod\_consum\_dh/groups/dh\_digitalassets/@dh/@ab/documents/digitalasset/dh\_103573.pdf Retrieved February 2nd 2024](https://webarchive.nationalarchives.gov.uk/ukgwa/20130107105354/%20http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@ab/documents/digitalasset/dh_103573.pdf%20Retrieved%20February%202nd%202024).

Joint Committee on Vaccination and Immunization Varicella Sub-Committee. (2015, July 31). *Chickenpox: public health management and guidance - GOV.UK*. Retrieved May 11, 2022, from <https://www.gov.uk/government/collections/chickenpox-public-health-management-and-guidance>

Joint Committee on Vaccination and Immunization. (2022, November 30). *Joint Committee on Vaccination and Immunisation (JCVI) statement on changes to the childhood immunisation schedule*. Retrieved August 25th 2023, from <https://www.gov.uk/government/publications/changes-to-the-childhood-immunisation-schedule-jcvi-statement/joint-committee-on-vaccination-and-immunisation-jcvi-statement-on-changes-to-the-childhood-immunisation-schedule>

Joint Committee on Vaccination and Immunization. (2023, November 14). *JCVI statement on a childhood varicella (chickenpox) vaccination programme*. <https://www.gov.uk/government/publications/childhood-varicella-vaccination-programme-jcvi-advice-14-november-2023/jcvi-statement-on-a-childhood-varicella-chickenpox-vaccination-programme>

Karafillakis, E., Dinca, I., Apfel, F., Cecconi, S., Wűrz, A., Takacs, J., Suk, J., Celentano, P. L., Kramarz, P.,   & Larson, H. J. (2016). Vaccine hesitancy among healthcare workers in Europe: A qualitative study. *Vaccine*, *34*(41), 5013-5020.

Larson, H. J., Jarrett, C., Schulz, W. S., Chaudhuri, M., Zhou, Y., Dube, E., & Wilson, R. (2015). Measuring vaccine hesitancy: the development of a survey tool. *Vaccine*, *33*(34), 4165-4175.

Liese, J. G., Grote, V., Rosenfeld, E., Fischer, R., Belohradsky, B. H., Kries, R. V., & ESPED Varicella Study Group. (2008). The burden of varicella complications before the introduction of routine varicella vaccination in Germany. *The Pediatric infectious disease journal*, *27*(2), 119-124.

MacDonald, S. E., Tough, S., Guo, X., & Kellner, J. D. (2020). Impact of combination MMRV vaccine on first-dose coverage for measles and varicella: a population-based study. *Journal of Public Health*, 30(2), 1-6.

Marin, M., Marti, M., Kambhampati, A., Jeram SM, Seward JF. (2016) Global varicella vaccine effectiveness: a meta-analysis. Pediatrics,137(3): e2015374.

Rodrigues, F., Marlow, R., Gouveia, C., Correia, P., Brett, A., Silva, C., Gameiro, I., Rua, I., Dias, J., Martins, M. and Diogo, R., (2023). Prospective study of loss of health-related quality adjusted life years in children and their families due to uncomplicated and hospitalised varicella. *Vaccine*, *41*(6), pp.1182-1189.

Seward, J. F., Watson, B. M., Peterson, C. L., Mascola, L., Pelosi, J. W., Zhang, J. X., & Wharton, M. (2002). Varicella disease after introduction of varicella vaccine in the United States, 1995-2000. *Jama*, *287*(5), 606-611.

Shapiro, G. K., Tatar, O., Dube, E., Amsel, R., Knauper, B., Naz, A., & Rosberger, Z. (2018). The vaccine hesitancy scale: Psychometric properties and validation. *Vaccine*, *36*(5), 660-667.

Sherman, S. M., Lingley-Heath, N., Lai, J., Sim, J., & Bedford, H. (2023). Parental acceptance of and preferences for administration of routine varicella vaccination in the UK: a study to inform policy. *Vaccine*, *41*(8), 1438-1446.

Tomljenovic, M., Petrovic, G., Antoljak, N., & Hansen, L. (2021). Vaccination attitudes, beliefs and behaviours among primary health care workers in northern Croatia. *Vaccine*, *39*(4), 738-745.

United Kingdom Health Security Agency.(2023) Attitudes to the childhood vaccination programme in parents of babies and children under 5 years of age. https://www.gov.uk/government/publications/childhood-vaccines-parental-attitudes-survey-2022 (accessed 12th June 2023)

van Lier, A., Tostmann, A., Harmsen, I. A., de Melker, H. E., Hautvast, J. L., & Ruijs, W. L. (2016). Negative attitude and low intention to vaccinate universally against varicella among public health professionals and parents in the Netherlands: two internet surveys. *BMC infectious diseases*, *16*(1), 1-12.

Verger, P., Botelho-Nevers, E., Garrison, A., Gagnon, D., Gagneur, A., Gagneux-Brunon, A., & Dubé, E. (2022). Vaccine hesitancy in health-care providers in Western countries: a narrative review. *Expert Review of Vaccines*, 1-19.

World Health Organization. (2014, July 9). *Varicella and herpes zoster vaccines: WHO position paper*. Retrieved May 11, 2022, from <https://www.who.int/publications/i/item/who-wer-8925-265-288>

World Health Organization. (2016, March 1). *Varicella*. Retrieved May 8, 2022, from <https://www.who.int/teams/health-product-and-policy-standards/standards-and-specifications/vaccine-standardization/varicella>

Zangarini, L., Martiny, D., Miendje Deyi, V.Y., Hites, M., Maillart, E., Hainaut, M., Delforge, M., Botteaux, A., Matheeussen, V., Goossens, H. and Hallin, M., (2023). Incidence and clinical and microbiological features of invasive and probable invasive streptococcal group A infections in children and adults in the Brussels-Capital Region, 2005–2020. *European Journal of Clinical Microbiology & Infectious Diseases*, *42*(5), pp.555-567.