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Factors influencing healthcare professionals' confidence in vaccination in Europe: a literature review

D. Pavlovic^a, P. Sahoo^b, H. J. Larson^{b,c}, and E. Karafillakis^c

^aSchool of Medicine, University of Zagreb, Zagreb, Croatia; ^bDepartment of Infectious Disease Epidemiology, London School of Hygiene & Tropical Medicine, London, UK; ^cCentre for the Evaluation of Vaccination, Vaccine and Infectious Disease Institute, University of Antwerp, Zagreb, Croatia

ABSTRACT

Health-care professionals (HCPs) have a fundamental role in vaccination, their own beliefs and attitudes affecting both their uptake and recommendation of vaccines. This literature review (n = 89) summarises evidence on HCPs' perceptions of the risks and benefits of vaccination, trust, and perceptions of mandatory vaccination in Europe. HCPs across studies believed that vaccination is important to protect themselves and their patients. However, beliefs that some diseases such as influenza are less risky were reported by some HCPs as a reason for not getting vaccinated. Concerns about both short- and long-term side effects were identified among HCPs in most studies, such as those affecting the immune or neurological system. Mistrust toward health authorities and pharmaceutical industry was reported in some studies. The question of mandatory vaccination revealed mixed opinions, with some favoring self-determination and others viewing vaccination as a duty. This review highlights key factors influencing HCPs' confidence in vaccination in Europe.

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KEYWORDS

Health-care professionals; confidence; beliefs; vaccine hesitancy; benefits; risks; effectiveness; safety; trust; mandatory

Introduction

Despite evidence demonstrating the benefits of vaccination for individuals, populations, health systems and society in general,¹ vaccine hesitancy still remains a key factor influencing vaccine uptake, sometimes leading to outbreaks of vaccine-preventable diseases.²⁻⁴ Factors influencing public confidence in vaccination have been extensively studied and summarised in literature reviews,⁵⁻¹⁰ revealing the global scale of vaccine hesitancy and its impact on vaccination acceptance. Health-care professionals (HCPs) are some of the most trusted source of information around vaccination and therefore play an important role in motivating, reassuring and convincing individuals to get vaccinated.¹¹⁻¹³ Yet, while the majority of HCPs in Europe have confidence in vaccination some HCPs across different specialty fields and countries are becoming more hesitant, refusing some vaccines for themselves or avoiding recommending certain vaccines to their patients.¹⁴⁻²⁰

Due to the essential role HCPs have in influencing their patients' attitudes toward vaccination, as well as the risk of unvaccinated HCPs transmitting infections to their patients, there is a need to develop a better understanding of the factors influencing HCPs' attitudes toward vaccination. This literature review therefore aims to summarise evidence published between 2015 and 2020 on factors influencing HCPs' confidence in vaccination in Europe, exploring HCPs' 1- perceptions of the risks and benefits (including importance and effectiveness) of vaccination; 2- trust in vaccination and sources of information on vaccination (e.g. government, pharmaceutical companies); and 3- perceptions of mandatory vaccination for HCPs.

While the role of perceived risks and benefits of vaccination in influencing vaccine acceptance and confidence among the general public has previously been explored in a systematic review,⁵ similar synthesised evidence is lacking for HCPs and will therefore be investigated in this review. Trust has also been identified as an important factor influencing public and HCPs' confidence in vaccination, with HCPs' mistrust of health authorities, professional recommendations or the pharmaceutical industry influencing both their own vaccination status and their recommendation behavior.^{21,22} Finally, some countries have made certain vaccines such as those against influenza, hepatitis B and now COVID-19 mandatory for HCPs in an effort to increase low uptake rates.²³⁻²⁵ However, such measures have also been met with discontent by HCPs citing ethical concerns and their right to self-determination.²⁶ Summarising literature around these three themes will therefore provide important insights that could contribute to the development of future strategies to improve vaccine confidence and acceptance among HCPs and the public.

Methods

This review is part of a larger project exploring HCPs' confidence in vaccination in 15 countries: Austria, Belgium, France, Germany, Greece, Hungary, Italy, Morocco, the Netherlands, Poland, Romania, Spain, Switzerland, Turkey and the UK.

In order to identify studies published across Europe, a search strategy was developed in OVID Medline and adapted for use across Embase and PsycINFO in November 2020, using a list of keywords designed to

Table 1. Keywords used in the search strategy.

Concept	List of keywords
Vaccination	Immunis* OR immuniz* OR vaccin*
AND Healthcare professionals	"healthcare worker*" OR "health worker*" OR "health professional*" OR "healthcare professional" OR midwi* OR nurse* OR doctor* OR GP* OR pediatrician* OR paediatrician* OR "general practitioner*" OR physician* OR gynecologist* OR gynecologist*
AND Vaccine hesitancy	Anxiety OR attitude* OR awareness OR behavi*r OR belief* OR criticis* OR accept* OR confiden* OR doubt* OR distrust OR choice* OR mandatory OR fear* OR hesitan* OR concern* OR "decision making" OR trust OR mistrust OR perception* OR refus* OR reject* OR rumo*r OR compulsory OR anti-vaccin* OR anti-vax* OR resist* OR intent* OR controvers* OR misconception* OR misinformation* OR opposition* OR knowledge* OR objection* OR uptake OR barrier* OR skeptic* OR Uncertain* OR risk* OR opinion*
AND Countries of interest	Europe* OR Austria OR Belgium OR Flanders OR Wallonia OR France OR Germany OR Greece OR Hungary OR Ireland OR Italy OR Luxembourg OR Netherlands OR Poland OR Romania OR Spain OR UK OR Britain OR England OR Scotland OR Wales OR Turkey OR Morocco OR Switzerland OR Estonia OR Latvia OR Lithuania OR Bulgaria OR Croatia OR Portugal OR Slovakia OR Slovenia OR Cyprus OR Malta OR Czech OR Denmark OR Sweden OR Finland

provide precise and comprehensive results (Table 1). Keywords were identified by reviewing existing literature reviews produced by the VCP on this topic.^{5,17,27}

De-duplicated articles retrieved from the databases were stored in Endnote and screened by title and abstract and full text by three reviewers according to a set of inclusion and exclusion criteria. Articles were included if they were:

- peer-reviewed
- focusing on HCPs' perceptions of the risks and benefits of vaccination, their trust in vaccines and sources of information, and their perceptions of mandatory vaccination for HCPs
- from any European country, Morocco or Turkey
- written in a language spoken by the researchers (English, French, Spanish, German or Italian)

Articles were excluded if they were:

- not conducted with HCPs or not on their own perceptions
- focusing on other factors influencing HCPs' confidence in vaccination (e.g. knowledge, socio-economic determinants associated with uptake or access)
- published before the last global review of HCPs' confidence in vaccination (October 2015).¹⁷

Data from the included studies was extracted into an Excel spreadsheet by three researchers. Extracted data included study characteristics (study country, setting and year, aim and objectives, design and key methods, vaccine(s) of focus, and participant type and numbers) and key findings from the studies, which were categorised by theme (vaccine benefits (importance and effectiveness), vaccine safety, trust, mandatory vaccination). For each of these five themes, this review provides a descriptive, narrative analysis and summary of key study findings, for instance by reporting proportions of HCPs with specific perceptions across European countries (quantitative studies) and summarising key themes identified by qualitative studies.

Results

This review identified 2,013 unique articles, of which 1,845 were excluded after title and abstract screening (Figure 1). A total of 89 articles were included for analysis, following the exclusion of 79 articles during the full-text review for the following reasons: not about vaccine hesitancy or one of the themes of focus (n = 31), not involving HCPs (n = 16), no full text/language available (n = 14), unsuitable study design (n = 8), published before October 2015 (n = 8), article withdrawn (n = 1), and not from targeted countries (n = 1).

Study characteristics

Articles in this review were published between October 2015 and November 2020 and included studies with quantitative or cross-sectional (n = 77), qualitative (n = 9) and mixed study designs (n = 3). Most studies focused on nurses and/or midwives (n = 47), HCPs working in hospitals (n = 34), general/family practitioners (n = 33) or pediatricians (n = 21). Figure 2 provides an overview of the number of studies identified per country and vaccine and all study characteristics are available in supplementary material 1.

The benefits of vaccination

Overall, 79 studies explored HCPs' perceptions of the benefits of vaccination, including perceived transmission and severity of vaccine-preventable diseases as well as perceived vaccine effectiveness. Key findings focusing on the benefits of vaccination are described further below, with more details available in supplementary material 2.

Hcps' perceived risk of contracting vaccine-preventable diseases

Influenza vaccines. Most studies looking at HCPs' perceived risk of contracting vaccine-preventable diseases focused on influenza. While 25–33% of unvaccinated HCPs in studies in **Italy**²⁸ and **France**²⁹ stated not being vaccinated against influenza because they did not consider themselves at risk of influenza, 38.9–61.2% of HCPs in **Turkey**³⁰ and the **Netherlands**³¹ stated accepting the vaccine to reduce their risk of catching flu. One study from **Spain** also found that on a scale from 1 (total disagreement) to 5 (total agreement), HCPs scored the statement

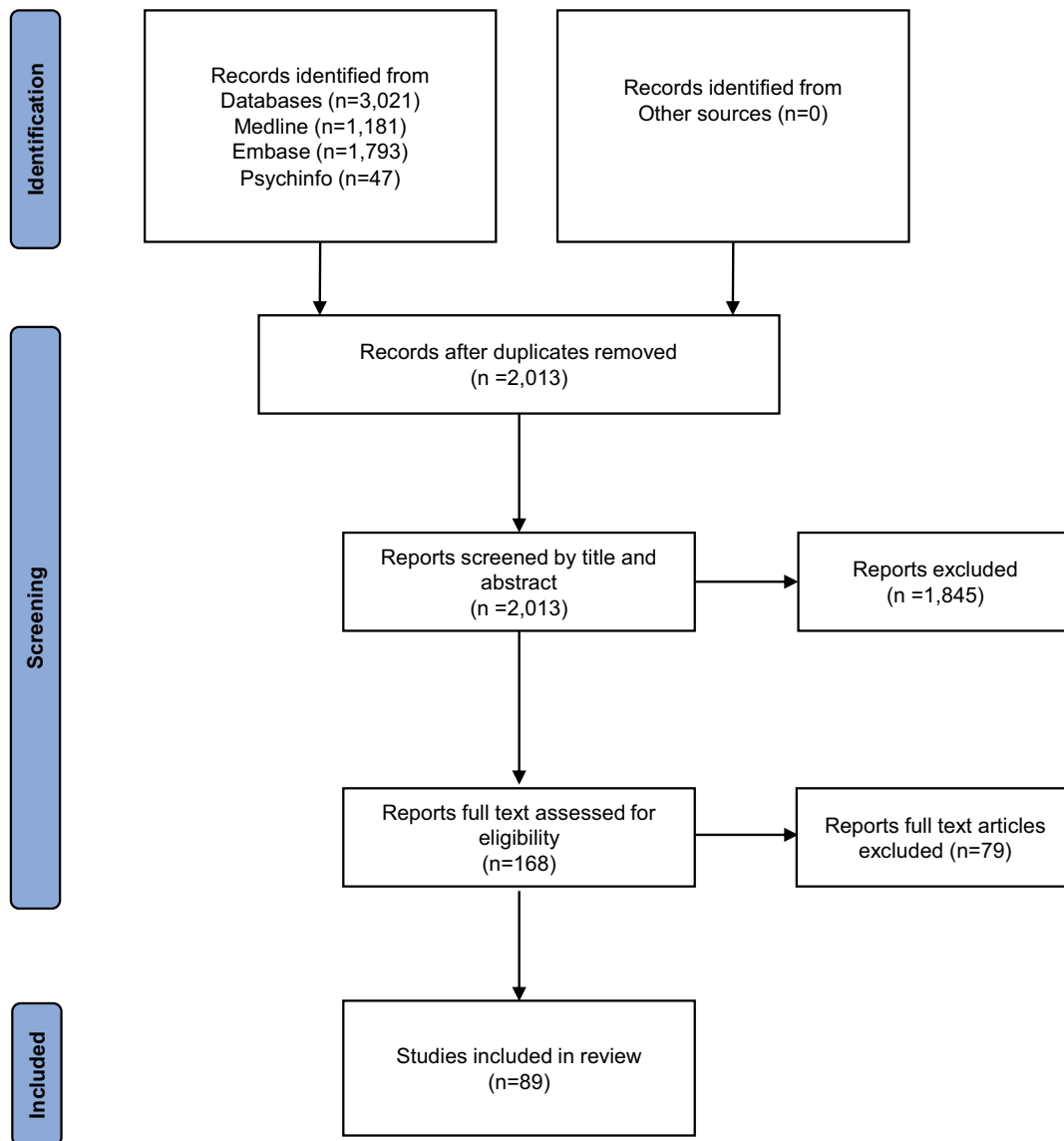


Figure 1. PRISMA Flowchart.

that they are at a higher risk of catching influenza with a median of 2.57 when asked about reasons for refusing vaccination.³² Nurses who perceived themselves at greater risk of acquiring influenza were also more likely to accept the vaccine in **Ireland** (OR 1.84, 95% CI [1.14–2.99]),³³ with similar results found among pharmacists in **Italy**.³⁴ Additionally, studies from **Italy and Spain** found that between 38.2–90.6% of HCPs believed that the vaccine is given to HCPs to protect them and HCPs' risk of contracting influenza is greater than for the general public.^{28,35–39} Two qualitative studies among nurses in **Slovenia** and **Switzerland** reported beliefs that young or healthy HCPs are not at high risk of influenza.^{40,41}

Other vaccines. With regards to other vaccines, a study from **Italy** found that while 87.1% of HCPs believed that vaccination in general is important to protect their health, only 50.9% considered themselves at high risk of contracting an infectious disease.⁴² Another study from **Italy** found that 5.7–17.3% of HCPs did not consider themselves at risk of any infectious diseases.⁴³ Additionally, a study from the **Netherlands** found that only 5.9–

15.8% of HCPs felt personally susceptible to pertussis, despite 25.1–32% of them believing that HCPs in their profession are more susceptible.⁴⁴ Finally, while 34.9% of nurses not vaccinated against HPV in **Turkey** stated not being at risk of HPV,⁴⁵ 70%–83.5% of HCPs from **Greece** and **Cyprus** stated they would accept HPV vaccination to protect themselves against HPV infection or cervical cancer.^{46,47}

Hcps' perceived risk of transmitting vaccine-preventable diseases to their patients

Influenza vaccines. Some studies looked at HCPs' perceived risk of transmitting vaccine-preventable diseases to their patients. Overall, between 81.1–97.5% of HCPs in **Italy**,³⁵ **Ireland**³³ and **Turkey**⁴⁸ believed that influenza vaccination of HCPs could protect patients and reduce their risk of infection. Additionally, 87.7% of GPs in **the Netherlands**³¹ but only 34% of HCPs in **Italy**²⁸ and 15.2% of nurses in **Ireland**³³ stated being vaccinated against influenza in order to protect their patients. Contrastingly, perceptions that the risk of transmitting influenza to patients is low was provided as a reason for

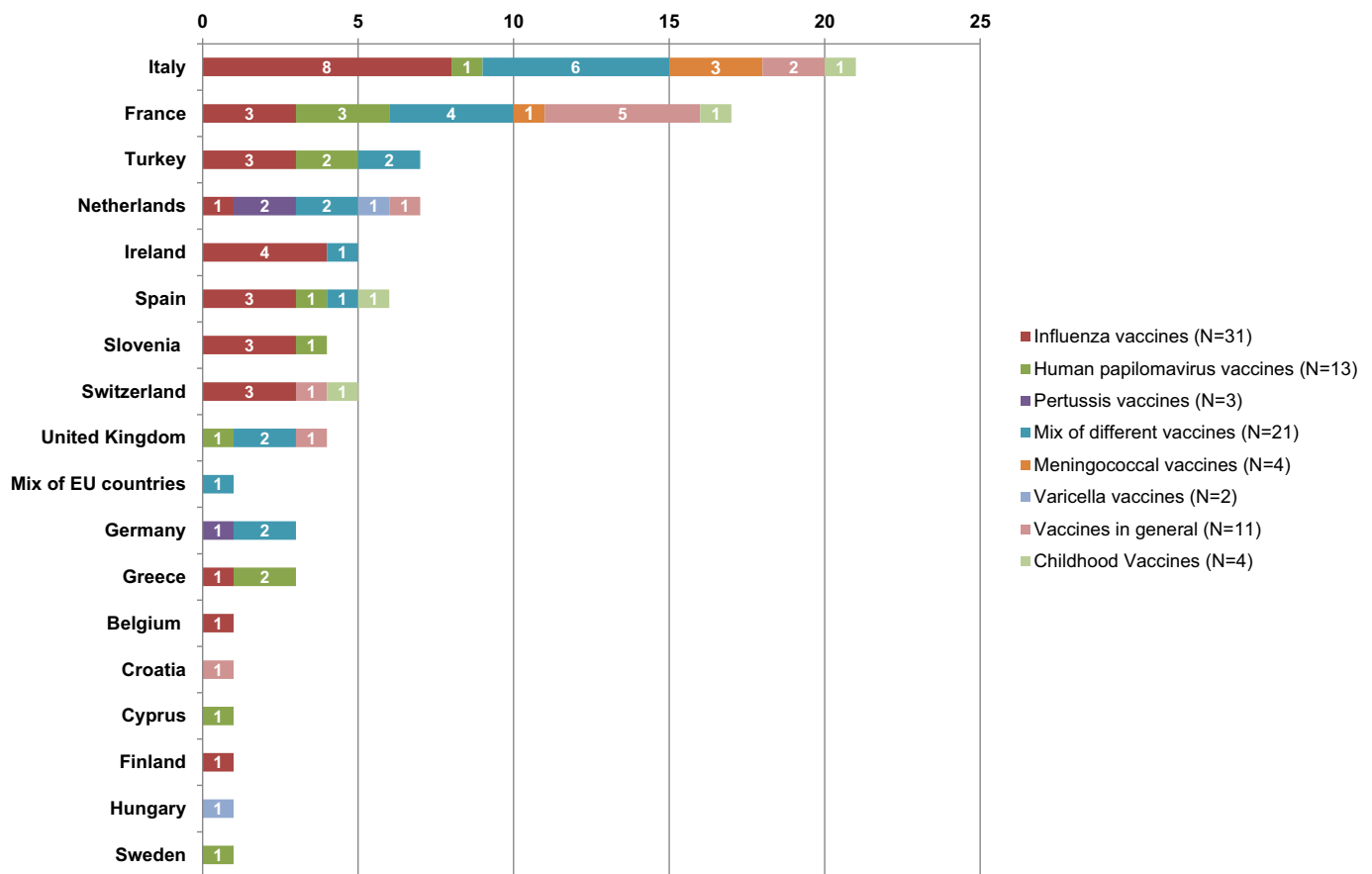


Figure 2. Number of studies by country and vaccine.

refusing influenza vaccination by 16.8% of HCPs in **Italy**,³⁹ with unvaccinated HCPs in **Spain** rating this perception with a mean score of 2.6 on a scale from 1 (completely disagree) to 5 (completely agree).⁴⁹

Other vaccines. In relation to other vaccines, 86.6% of **Italian** HCPs believed their own vaccination was important to protect patients, but only 36.5% considered themselves at high risk of transmitting infectious diseases during their activity.⁴² Three studies also looked at pertussis vaccination: only 13% of HCPs in **the UK** were vaccinated because they believed their role puts them at high risk of getting or passing on the infection⁵⁰ and midwives from **the Netherlands** also reported that their risk of transmitting pertussis to an infant was small.⁵¹ Another study from the **Netherlands** found that 71.2% of maternity assistants, 60.9% of midwives, and 48.5% of pediatric nurses felt morally responsible to prevent patients from contracting pertussis⁴⁴

Perceived severity of infectious diseases

Childhood vaccines. Some studies focused on the perceived severity of childhood vaccine-preventable diseases, with a study in **Spain** finding that 53.7% of primary HCPs with doubts about vaccination and 17.5% of those without doubts believed children should only be vaccinated for serious illnesses.⁵² Benefits of vaccination such as the prevention of severe diseases or the perception that the risk of diseases is high were provided by HCPs as reasons for recommending childhood vaccination in relation to Tdap (44.3–77.1%), rotavirus (57.7–94%) and

meningococcal (90.6%) vaccination in **Turkey**.⁵³ A study from **Hungary** also found that HCPs who had seen complications from varicella were significantly more likely to support vaccination than those who did not (100% if in their own child (OR 41,102.13) and 82.4% if in their patients (OR 2.8744), compared to 62.2% if they had not seen complications).⁵⁴ Additionally, 66–69.3% of HCPs in **Greece** were found to be willing to vaccinate their children against HPV to protect them and their partners from genital warts.⁴⁷ In **Spain**, the risk of contracting HPV was perceived as high, with 71.5% of primary care professionals stating that it is probable or very probable for an unvaccinated child to contract HPV.⁵²

Contrastingly, some HCPs listed a lack of benefits from vaccination (low prevalence, low severity) as a reason for not recommending vaccination to children: 90.4% for pertussis (**Turkey**),⁵³ 58.7% for HPV (**Turkey**) and 14–54% for meningococcal infection (**Turkey** and **France**).^{53,55} Additionally, while only 11% of HCPs in the **Netherlands** indicated that varicella is serious enough to vaccinate against, 91% agreed that varicella infection is mild in children.⁵⁶ A qualitative study with HCPs in **France** also found that vaccination recommendations were influenced by perceptions of low severity of disease (varicella) and low prevalence (Meningococcal C and HPV).⁵⁷ Some HCPs also questioned the benefits of HPV vaccination and risk of HPV-associated cancers for their own sons: 33.1% of HCPs from **Switzerland**⁵⁸ and 17.8–20.6% of HCPs in **Slovenia**.⁵⁹

Adult vaccines. Studies also explored HCPs' perceptions of the benefits of adult vaccination, with 37.6% of GPs from the **Netherlands** listing severity of infectious diseases as the most important factor for recommending vaccination to people in their 60s.⁶⁰ Overall, 47.3% of HCPs in **Italy**³⁷ and 72.5–97.5% in **Turkey**⁴⁸ perceived influenza as a potentially serious or dangerous disease, with 6.1–31% of HCPs in **Italy**^{28,61} and 47.9% in **Slovenia**⁶² stating not being vaccinated against influenza because they believed the disease was not severe or threatening. Additionally, when asked why they did not accept influenza vaccination, HCPs in **Spain** scored a median of 2.37 for the statement 'flu seems to me to be a mild illness, very minor, I am not afraid of it' (from 1= total disagreement, 5= total agreement).³² Perceptions that influenza is not a severe disease and doubts of the benefits of the vaccine were also provided as reasons for not recommending influenza vaccination to adults (35.9% of family physicians),²² patients >60 and chronically ill patients (12% of gynecologists),⁶³ and pregnant women (24% of gynecologists) in **Germany**.⁶³ Maternal vaccination was also explored in **the UK**, with 47% of GPs reporting that seriousness of infection in young children would be one of the main factors influencing their recommendation of a new vaccine for pregnant women⁶⁴ but only 5% of HCPs in another study stating that they got vaccinated against pertussis because they believed it was a serious disease in the UK.⁵⁰

Doubts about the usefulness and need of vaccines

Some studies reported HCPs' doubts about the utility or usefulness of vaccines for themselves or for their patients, with some HCPs in a qualitative study in **France** (in relation to HPV vaccination) but only 6% of HCPs in **Ireland** and 1.7–38.1% of HCPs in **Finland** reporting beliefs that vaccination is not useful or important.^{65–67}

Overall, between 16.3–68.7% of HCPs in **France, Italy, Switzerland, Germany, and Turkey** stated that doubts about influenza vaccine usefulness and importance was a barrier to their own or other HCP vaccination against influenza.^{30,35,43,61,63,68–71} Additionally, a study in **Italy** found that 59.3% of HCPs missed Hepatitis B vaccination because they believed the vaccine was unnecessary, compared to 10.4% for MMR vaccination and 20.3% for DTP vaccination.⁴³

Several studies identified that some HCPs do not recommend vaccination to patients due to their belief that specific vaccines are not needed, including 11.7–15.6% of HCPs in **Turkey** for HPV vaccination, compared to 29.2–47.2% for meningococcal vaccination and 30.8–50% for influenza vaccination.^{72,73} A study in **France** found that 86% of GPs who mostly had no doubts about the usefulness of vaccination reported recommending vaccination more frequently than GPs with average views.⁷⁴ Additionally, a study among **French** GPs found that 26.4% believed that some of the vaccines recommended by authorities today are useless, with GPs showing doubts about the utility of vaccines in general being less likely to recommend the HPV vaccine (OR .78, 95% CI [.71; .86]).⁷⁵

Vaccine effectiveness

Forty-five studies explored HCPs' perceptions of vaccine effectiveness. Despite one study reporting that 98–99% of HCPs had confidence in the ability of vaccination to protect against infectious diseases in **France**,⁷⁶ perceived lack of effectiveness

was one of the most commonly cited barrier to accepting or recommending vaccination in general among HCPs in many countries, including 17–46% of doctors and nurses in **Switzerland**,^{15,69} 37.3% of **Slovenian** HCPs,⁷⁷ 32.2% of nurses from **Ireland**,³³ 24% of HCPs from **Greece**,⁷⁸ 13% of midwives in **France**,²⁹ and 7.3%–9% of HCPs in **Italy**.^{39,79,80} Additionally, when GPs in **the UK** were asked to select the top three factors that would influence their recommendation of a new vaccine, 45–57% of them reported vaccine effectiveness.⁶⁴

HPV vaccines. Confidence in HPV vaccine effectiveness was high among **Italian** HCPs (83.5–92.6%).^{81,82} However, doubts about the effectiveness of HPV vaccination and the prevention of cervical cancer were raised by 25% of HCPs in **Turkey**,⁷³ 16.7–23.5% of GPs in **France**,^{75,83} 14.28% of HCPs who would refuse the vaccine in **Cyprus**,⁴⁶ and 65.7% of HCPs from **Spain**.⁵² Such doubts were also provided as a reason for doubting or not recommending HPV vaccination by 2.3–5.3% of HCPs in **Turkey**⁷² and by HCPs in **the UK**,⁸⁴ **Greece**⁸⁵ and **France**.⁵⁷

Influenza vaccines. Doubts about influenza vaccine effectiveness and beliefs it is possible to catch influenza after having been vaccinated were reported by 81–96.9% of HCPs in **Turkey**,^{48,49} 23.9–62.6% of HCPs in **Italy**,⁶¹ 23% of HCPs in **France**⁶⁸ and nurses and GPs from qualitative studies in the **Netherlands**,⁸⁷ **Switzerland**⁴¹ and **Slovenia**.⁴⁰ GPs and midwives in a qualitative study in the **UK**⁸⁶ and 20–29% of HCPs from studies from **Italy**^{43,87} and **France**⁷⁹ believed that influenza vaccines can cause influenza, while this was refuted by 53.3–63.8% of family physicians in **Turkey**.⁸⁸ Additionally, 30% of vaccinated **Italian** hospital doctors considered the influenza vaccine safe and effective²⁸ and HCPs in **Spain** scored a mean of 1.9 (from 1: completely disagree to 5: completely agree) for the statement "I got vaccinated in previous years but I caught the flu anyway".⁴⁹ A study with HCPs working in a residential care facility in **Ireland** found that while 65% of HCPs believed influenza vaccine was effective in preventing influenza, vaccine effectiveness was cited as a reason for not accepting influenza vaccination by 60% of unvaccinated HCPs.⁶⁵

Concerns about vaccine effectiveness were also listed as a reason for not recommending influenza vaccination by 16.7% of family physicians and 34.6% of pediatricians in **Turkey** (for adolescents),⁷² 40.6% of family physicians in **Germany** (for adults)²² and 14.2% of gynecologists in **Germany** (for pregnant women).⁸⁹ Additionally, confidence in influenza vaccination effectiveness was found to be positively associated with influenza vaccination uptake in **Slovenia** (OR 12.38, 95% CI [4.06–38.30])⁷⁷ and in **Italy** (OR 3.600, 95% CI [1.169–10.83])⁶¹ and to increase the likelihood of yearly vaccination among HCPs in **Turkey** by 6.31 times.⁸⁸ Two studies in **Turkey** also found that while 82.1–89.6% of vaccine compliant HCPs considered that the influenza vaccine was effective, only 36.6–65.1% of vaccine non-compliant HCPs reported similar beliefs.^{48,88} Additionally, a study conducted in **Italy** found that HCPs who had refused vaccination scored

a mean of 2 in response to the statement that they do not consider influenza vaccine effective (on a scale from 1=strongly disagree to 5=strongly agree).⁹⁰

Other vaccines. Doubts about vaccine effectiveness were less commonly raised in relation to other vaccines: 99.6% of **Italian** pediatricians expressed confidence in the effectiveness of the diphtheria-tetanus-acellular pertussis vaccine,⁸² with only 3–3.7% of HCPs in **Turkey** stating not recommending this vaccine to adolescents because of concerns about its effectiveness.⁷² Additionally, only 4.9% of gynecologists in **Germany** stated that limited vaccine effectiveness was the reason for not recommending pertussis vaccination.⁸⁹ Confidence in meningococcal vaccination was also high, with 55.9–62.9% of HCPs in **Italy** reporting vaccine effectiveness was one of the reasons for recommending the vaccine^{71,91} and 38.4% of nurses and physicians in another Italian study stating the vaccine is highly effective.⁹² Certain vaccines elicited more concerns among HCPs who did not support or recommend vaccination, including rotavirus (27.7% of pediatricians and family physicians in **Turkey**,⁵³ and varicella (32% of HCPs in **Hungary**⁵⁴ and HCPs in the **Netherlands**.^{44,93}

Perceived risks of vaccination

A total of 69 of the studies included in this review reported some findings on HCPs' perceptions of vaccine safety and possible side effects, with some describing general perceptions of vaccine safety and their influences on HCPs' decisions to accept or recommend vaccination and others exploring concerns about specific side effects such as those affecting the immune or the neurological system.

Perceptions of vaccine safety

HCPs' perceptions about vaccine safety and possible side effects of vaccination were explored in most studies in this review. While an **Italian** study reported that 38.4% of HCPs were not worried about vaccine adverse reactions,³⁶ concerns were found to significantly differ between different categories of HCPs,⁷⁰ with 2.5–26.3% of HCPs,^{39,43,79} 14.6% of pediatricians⁸² and 11–34.6% of nurses and midwives^{43,80} reporting concerns about side effects across various studies in **Italy**. A study from **Croatia** also found that 55.06% of HCPs agreed that vaccines can cause harmful side effects.⁹⁴ In a study in **France**, the theme 'risks' occurred in 6.19% of conversations with GPs, with most associated words negatively connoted.⁹⁵ Additionally, another study found that GPs in **France** did not consider links between vaccines and severe adverse effects very likely,²¹ and two other studies conducted in **France** found GPs with moderate or high hesitancy or those more susceptible to controversies expressed more doubts about vaccine safety than more confident GPs.^{74,96} Qualitative studies also reported some concerns about vaccine safety among HCPs in **Romania**, **Greece** and the **Netherlands**.^{18,97}

Influenza vaccines. Concerns about the safety of influenza vaccination were reported in qualitative studies with nurses in **Slovenia**, **Switzerland** and **Ireland**^{33,40,41} as well as by 6–

68.6% of HCPs in studies in **Ireland**, **Italy**, **Finland**, **Slovenia** and **France**.^{35,37,62,65,66,68,98,99} This compares to 32.5–96% of HCPs in studies in **Turkey**, **Italy**, **France** and the **UK**^{29,35,48,61,64,88,100} and 30% of vaccinated HCPs in **Italy**²⁸ who perceived influenza vaccination as safe or only causing local and short term side effects. These concerns were found to lead to 8.2–40% of HCPs in quantitative studies in **Italy**, **Greece**, **Ireland**, **France**, **Slovenia**, **Turkey** and a mix of European countries and nurses in a qualitative study in Switzerland to refuse influenza vaccination.^{24,29,30,35,37,39,41,61,62,65,77,78,87,90,101} However, HCPs in studies in **Spain** and **Ireland** were found to disagree or neither agree nor disagree with statements that concerns about vaccine safety constituted reasons for refusing influenza vaccination.^{32,49,102} In **Finland**, HCPs and nurses who perceived vaccines as both beneficial and safe were found to be more likely to recommend and to be vaccinated against influenza.⁶⁶ Concerns about side effects following influenza vaccination were listed as a reason for not recommending the vaccine by 10.7–39.6% of gynecologists in **Germany** in relation to pregnant women^{63,89} but only 1.8–9% of HCPs in **Germany** and **Turkey** in relation to vaccination of adolescents or high-risk groups.^{63,72}

HPV vaccines. While 25% of HCPs in **Turkey** perceived HPV vaccines as unnecessary because of side effects,⁷³ only 5% of HCPs in **Spain** believed the HPV vaccine was unsafe⁵² and 89% of HCPs in **Italy** considered the vaccine to be safe and well-tolerated.⁸¹ Yet, 7.4% of nurses in **Turkey**,⁴⁵ 55.12% of HCPs in **Cyprus**⁴⁶ and 53.8–69.4% of HCPs in **Greece**⁴⁷ stated refusing HPV vaccination for themselves or their children because of concerns about side effects and 2.3–9.6% of HCPs in **Turkey**⁷² and 21.1% of gynecologists in **Germany**⁶³ reported not recommending the vaccine for similar reasons.

Maternal vaccination. While a study from the **UK** found that 89% of GPs perceived antenatal pertussis vaccination to be safe,⁶⁴ qualitative studies with HCPs in the **UK**⁵⁰ and the **Netherlands**⁵¹ reported concerns about adverse effects following their own vaccination against pertussis, with some reports of anticipated regrets. Additionally, 10–20.8% of HCPs in **Spain**,¹⁰³ **Ireland**¹⁰⁴ and **Germany**⁸⁹ expressed not recommending or not feeling confident about recommending vaccines during pregnancy because of concerns about adverse events and 77% of GPs in the **UK** reported that the risk of side effects for the baby would be the main influence on their decisions to recommend a new vaccine to pregnant women.⁶⁴

Other vaccines. Only a small proportion of HCPs in **Italy** perceived the meningococcal vaccines as unsafe, with 29.6–36.2% of HCPs describing the vaccine as extremely safe^{71,91,92} and only 2.8% of pediatricians in **Turkey**⁷² stating concerns about side effects as a reason for not recommending the vaccine. Additionally, only 2.4% of physicians who did not recommend rotavirus vaccination to their patients in **Turkey** reported safety concerns⁵³ but concerns about side effects were provided as a reason for not supporting universal varicella vaccination by 28% of HCPs in **Hungary**.⁵⁴ A qualitative study in **France** also found that the risk of side-effects following BCG

vaccination influenced some GPs' vaccine recommendations to patients,⁵⁷ while vaccine safety in general was significantly and negatively associated with vaccine recommendations by GPs in another study.²¹ Finally, while 18.6% of pediatricians in an **Italian** study believed that the frequency of adverse reactions to childhood vaccines was underestimated,⁸² 79.5% of them also agreed that vaccines are among the safest and most tested medicinal products,⁸² compared to only 6.44–14.5% of pediatricians and pediatric nurses in **Spain**.⁵²

Perceptions that the risks of vaccines outweigh their benefits

The perceived balance between the risks and benefits of vaccination was explored in some studies, finding that only .8–6.1% of **Italian** HCPs but up to 57.1% of **Slovenian** HCPs believed vaccination does more harm than good.^{24,43,79,80} In relation to influenza vaccination specifically, 14.7% of **Italian** HCPs and 29.8% of **Slovenian** HCPs stated the risks posed by vaccines could be greater than the risk of influenza.^{35,62} One study in **France** also found that GPs with unfavorable perceptions of the risk-benefit balance for HPV vaccination were less likely to recommend the vaccine (OR .13, 95% CI [.09;.21]).⁷⁵

Perceptions of different types of side effects

Perceptions of short-term, local and systemic side effects.

Some studies reported HCP's perceptions of small, local, or short-term side effects following vaccination, including HCPs in a qualitative study in **the Netherlands**⁵¹ as well as 2.1–12% of HCPs in **Switzerland** and **Italy**.^{15,35,36} However, three other studies in **Sweden** and **Italy** found higher rates of concerns about vaccine short-term side effects (21.2–51.3%).^{35,37,105} Two studies also found that concerns about local or short-term adverse reactions constituted a reason for refusing influenza vaccination among 7–21.1% of unvaccinated HCPs in **Italy**^{37,61} and 44.1% of unvaccinated HCPs in **Switzerland**.¹⁵ In **Ireland**, vaccinated HCPs were found to be less likely to agree that the vaccination would make them unwell (OR .531, 95% CI [.436–.647]).¹⁰²

Perceptions of unknown and long-term side effects. Some HCPs in a qualitative study in **Greece**⁸⁵ and 40.6–60.5% of GPs in **France**^{75,83} as well as 60.2% of medical students and 44.1% of gynecologists in **Slovenia** (but only 4.8% of pediatricians)⁵⁹ raised concerns about unknown or long-term side effects of HPV vaccination. In **France**, doctors who did not recommend the vaccines raised such concerns more often than those who did.⁸³ Long-term or unknown side effects were also raised by HCPs in a qualitative study in the **Netherlands** in relation to pertussis vaccination,⁵¹ 10.1% of HCPs in **Italy** in relation to influenza vaccination,³⁵ and 1.6–20.1% of HCPs in **Italy** in relation to vaccination in general.^{43,79,80} Additionally, 21.5% of HCPs in **Switzerland** reported a fear of long-term sequela as a reason for not being vaccinated against influenza.¹⁵

Effects of vaccination on the immune system. Belief that vaccines can weaken, damage or overload immune systems or cause autoimmune diseases were reported by only 3.6% of pediatricians⁸² and 5.9–11.9% of unvaccinated HCPs and OBGYNs in **Italy**^{101,106} and 12.8% of pediatricians and pediatric nurses in **Spain**,⁵² but by up to 23.59% of HCPs in

Croatia⁹⁴ and 26.1–29.3% of occupational physicians in **Italy**.⁶¹ Nurses in **Switzerland** reported similar concerns, together with the belief that influenza could be beneficial for the immune system.⁴¹ Additionally, 7.4–15.6% of vaccinated compared to 27.9–42.5% of unvaccinated HCPs in **Belgium** and **Spain** believed influenza vaccination could weaken or be dangerous for their immune system.^{52,107} Contrastingly, 83.1% of unvaccinated and 92.6% of vaccinated primary care physicians in **Turkey** believed vaccination does not decrease immunity⁴⁸ while 33.5–58% of unvaccinated and 70.2–76.1% of vaccinated HCPs stated the risk of autoimmune diseases following influenza vaccination was extremely low.^{48,88}

The link between vaccines and multiple sclerosis was also raised by 14.1% of occupational physicians in **Italy**⁶¹ and 28.2–56.8% of nurses⁹⁸ but only 4.8% of GPs⁷⁵ in **France**. Additionally, studies in **Italy** found that while 28.3% of occupational physicians believed that vaccines could be the cause of allergic disorders in life,⁶¹ this was only reported by 6.2% of pediatricians.⁸²

Perceived risk of neurological adverse reactions.

Concerns that vaccination could lead to neurological adverse reactions such as Guillain-Barre syndrome or autism were reported by 13.3–30.4% of HCPs in **Italy**.^{35,36,61} The link between vaccination and autism was also explored in other studies, with only 2.9% of pediatricians in **Italy**⁸² stating vaccines could cause autism but 13.9% of nurses in **France**⁹⁸ and 10.9% of pediatricians and pediatric nurses with preexisting doubts about vaccination in **Spain**.⁵²

Concerns about the effects of adjuvants such as aluminum or thiomersal were raised by 34.1% of nurses in **France**⁹⁸ and 28.75–37.7% of pediatricians and pediatric nurses in **Spain**,⁵² but only 6.18% of HCPs in **Croatia**.⁹⁴

Trust

Mistrust of vaccines and reluctance to get vaccinated or to recommend vaccination to patients was reported in 21 studies, together with HCPs lack of trust in health authorities and pharmaceutical companies as well as in the information they provide.

Institutional and health authority trust

Associations between HCPs' trust in health authorities and vaccination uptake or patient recommendations were explored across Europe. In **France**, GPs who expressed stronger trust in institutions were found to be significantly more likely to recommend vaccines in general,²¹ with a qualitative study revealing some GPs were reluctant to recommend vaccines to their patients due to concerns about health authorities handling of various events and previous vaccination campaigns.¹⁰⁸ However, findings differed in studies focusing on HPV vaccination in **France**: while 26% of GPs expressed lack of trust in health authorities in relation to HPV vaccination,⁸³ no significant association between GP's trust in official sources and their recommendation of HPV vaccination was found in another **French** national survey.⁷⁵

In a **German study**, institutional trust was found to be associated with both HCP's own vaccination status and their recommendation behavior, with 85% of family physicians expressing trust in the German Standing Committee on Vaccination and 52.3% in their integrity.²² A **Slovenian study** found that influenza vaccination uptake was higher among physicians who expressed trust in professional recommendations: 93.6% agreed with this statement, 78.8% of which were vaccinated.⁶² While HCPs from **Greece, Romania, Croatia and France** participating in a qualitative study positively referred to trust in the government and health authorities, mistrust of the Greek Ministry of Health was reported among some interviewed HCPs from **Greece**.¹⁸ High trust in government and recommending bodies was reported by 88–93.5% of nurses in **Sweden** in relation to HPV vaccination.¹⁰⁵ In the **Netherlands**, semi-structured interviews with nurses and midwives showed that they trust government vaccination guidelines.⁵¹

Trust in the reliability of information provided by authorities

Some studies looked at HCPs' trust in the reliability of information provided by authorities. In **France**, a survey among GPs showed that the calculated score for trust in the reliability of information about vaccination provided by official or scientific sources varied by region, with the lowest score in South-eastern France (mean 12.5) and the highest in Central Western France (mean 13.2).¹⁰⁹ A qualitative study with **French** GPs identified that they consider information provided by scientific and medical papers trustworthy, but their perceptions of information from health institutions and pharmaceutical companies varied.⁵⁷ Another study from **France** found that trust in information about vaccination benefits and risks provided by the Ministry of Health was significantly higher among community (22.4–56.1%) than hospital (17.7–50.2%) nurses ($p < .001$).⁹⁸ Trust was higher in **Italy**, with 86.5% of pediatricians agreeing that vaccine information provided by health authorities and scientific societies is reliable.⁸² Hospital nurses involved in a qualitative study conducted in **Switzerland** showed doubts concerning the true motivations and credibility of those promoting influenza vaccination.⁴¹

Finally, while 37.9% of nurses and midwives in **France** believed vaccine adverse events are well reported,¹⁰⁰ some HCWs in **Italy** agreed that certain side effects are kept hidden (on a scale from 1 (I do not agree) to 4 (I totally agree), the mean score rated by physicians was 1.14 and 1.6 for nurses).²⁸

The influence of the pharmaceutical industry

Qualitative studies conducted with HCPs from several European countries including **Greece, Sweden and Slovenia** believed pharmaceutical companies have financial interests, pressure and influence HCPs, and do not provide sufficient information about side effects.^{18,40,41} Additionally, 54.7% of nurses and midwives in **France** questioned the safety of the production of vaccines.¹⁰⁰ Most of the HCPs from a study in **Italy** (81.5%) believed that pharmaceutical companies influence decisions about public health policies on influenza vaccination,³⁷ compared to only 23.6% of **Italian** pediatricians but up to 48.4–69% of **Spanish** pediatricians and 74.3% of **French** midwives in relation to vaccination in general.^{52,82,100}

GPs in **France** also only moderately agreed with the statement that French “Health authorities are not influenced by pharmaceutical industry” (the mean score was 2.3; no trust = 1, strong trust = 4).²¹ Additionally, 30% of **Spanish** HCWs believed that the commercial interests of pharmaceutical industry was the most important factor behind the commercialization of HPV vaccines.¹¹⁰ Mistrust of pharmaceutical industry and their financial interests was also provided as a reason for not getting vaccinated against influenza by **Spanish** HCPs (mean score of 3.3, Likert scale 1: completely disagree – 5: completely agree).⁴⁹ Furthermore, 14.6% of **Slovenian** physicians believed that influence of the pharmaceutical industry on vaccine decision-making bodies was very high, of which 51.2% were vaccinated against influenza (compared to 85.4% of vaccinated among those who disagreed (52%)).⁶²

Mandatory vaccination

The theme of mandatory HCPs vaccination was identified in 24 studies, with discussions of support for mandatory vaccination, HCPs perceiving vaccination as a duty or a prerequisite for their profession, and beliefs that vaccination should remain an autonomous decision.

Support for mandatory HCPs vaccination

The question of mandatory HCP vaccination was mainly discussed in relation to seasonal influenza. Overall, between 38.7% and 58.4% of HCPs agreed that influenza vaccination should be mandatory for HCPs in studies in **Ireland**,⁶⁵ the **Netherlands**,³¹ and **Italy**.^{35,37,99} Supporting mandatory vaccination was found to be significantly associated with vaccine uptake or intentions among HCPs in **Ireland**⁶⁵ and **Italy**,^{35,37} while statistically significant differences in support for mandatory HCP influenza vaccination were also identified between vaccinated and unvaccinated HCPs in **Belgium**,¹⁰⁷ **Turkey**,^{48,88} and **Ireland**.¹⁰² Among unvaccinated HCPs, support for mandatory vaccination ranged between 6.9% of hospital HCPs in **Belgium**¹⁰⁷ to 74.3% of primary care physicians in **Turkey**.⁴⁸ Among vaccinated HCPs, support for mandatory influenza vaccination was lower in **Belgium** (33–41.9%)¹⁰⁷ than in **Greece** (80%)⁷⁸ and **Turkey** (64.3%–96.9%).^{48,88} A study in **France** found that on a scale from 1 for ‘not at all’ to 10 for ‘absolutely yes’, the overall median support for mandatory vaccination stretched from 1 for physical therapists, to 4 for nurses, 8 for physicians and 9 for pharmacists.¹¹¹ One **European** study also found HCPs' support for mandatory vaccination in general was significantly different between medical doctors (76.8%), nurses (60.9%) and other HCPs (63.2%) ($P < .001$).²⁴

Vaccination as a duty for HCPs

For some HCPs, vaccination was seen as a prerequisite or a duty both in terms of acting as role models to their patients and in terms of protecting them from harm.^{51,85} In quantitative studies, these beliefs were reported by 41–90.2% of HCPs in **Italy, Turkey and Ireland**.^{39,43,48,79,80,99} Additionally, on a scale from 1 (I do not agree) to 4 (I totally agree), physicians in **Italy** scored a mean of 3.57 and nurses 3.53 in agreement with the sentence that vaccination is needed for their profession.²⁸ A study in **Belgium** also reported that vaccinated

HCPs more commonly perceived vaccination as a duty than unvaccinated ones (74.1% vs 21.4% of hospital staff (OR 10.5, 95% CI [9.1–12.1]), 69.8% vs 17.9% of nursing home staff (OR 10.6, 95% CI [7.3–15.5])).¹⁰⁷

Vaccination as an autonomous decision

The perception that HCP vaccination should be an autonomous decision was discussed in eight studies, with unvaccinated HCPs more commonly reporting it than vaccinated ones (65.2% vs 75.4% of physicians and nurses in **Turkey** (OR .49, 95% CI [.26–.94]),⁸⁸ 91% vs 70.1% of hospital staff in **Belgium** (OR .2, 95% CI [.2–.3]), and 85% vs 71% of nursing home staff in **Belgium** (OR .4, 95% CI [.3–.6]).¹⁰⁷ Additionally, 39.9% of unvaccinated HCPs in **Switzerland** reported refusing influenza vaccination because of their perceived right to self-determination.¹⁵ In the **Netherlands** 89.5–95% of pediatric nurses, midwives and maternity assistants believed they should be able to make an autonomous decision with regards to pertussis vaccination.⁴⁴

In qualitative studies, HCPs explained that their vaccination decisions should be based on self-determination and a personal critical appraisal of vaccination, with some raising concerns about feeling pressured and coerced into vaccination by their employers.^{33,41,51,108} Nurses in **Switzerland** also expressed the right to bodily integrity and falling ill,⁴¹ with nurses in **Ireland** perceiving threats of punitive action (e.g. having to take unpaid sick leave) as bullying.³³

Discussion

The aim of this review was to summarize evidence on factors influencing HCPs' confidence in vaccination in Europe between 2015 and 2020. Most of the studies reviewed in this paper were conducted in Italy and in France, similarly to a previous bibliometric analysis of global scientific literature on vaccine hesitancy.¹¹² This could suggest strong local interest in addressing vaccine hesitancy, especially as challenges with public vaccine confidence and with HCPs' confidence in specific vaccines such as HPV have been reported in these two countries.^{4,14} This review also found that most studies conducted on HCPs' confidence in vaccination focused on influenza vaccination, similarly to previous literature reviews.^{17,20} More than half of the studies in this review involved nurses and/or midwives, followed by HCPs working in hospitals, general/family practitioners and pediatricians. Levels of vaccine confidence and factors influencing vaccine acceptance can vary between types of HCPs¹⁵ and strategies to improve vaccination coverage should therefore be tailored to different categories of HCPs. For example, despite growing discussions around the role of community pharmacists in vaccination, especially in the context of vaccination against COVID-19,^{113,114} our review identified only a few studies exploring attitudes and beliefs toward vaccination among pharmacists. Furthermore, differences in attitudes could reflect disparities in healthcare and vaccination education in different countries and across different medical specialties. Similarly, different regulations and procedures in place in various healthcare settings (e.g. public/private hospitals, primary healthcare) could influence HCPs' knowledge and attitudes toward vaccination,

particularly mandatory vaccination. Studies focusing on HCPs attitudes toward vaccination should therefore address these specific differences, especially when conducted across Europe.

Four key themes were explored in this review: HCPs' perceptions of the benefits of vaccination, their perceptions of the risks of vaccination, the influence of trust on their confidence in vaccination, and their attitudes toward mandatory vaccination. Our study confirmed that all of these themes can constitute barriers to vaccination among HCPs, with differences identified by country and type of HCPs.

HCPs' perceptions of the benefits of vaccination are explored in the literature in relation to the risk of contracting vaccine preventable diseases and transmitting them to patients, the severity of vaccine preventable diseases, the importance and value of vaccines, and the effectiveness of vaccines in preventing diseases. While in most studies included in the review, the majority of HCPs expressed confidence in the benefits of vaccination, some raised questions and concerns. These concerns were found to be particularly prominent with regards to vaccination against influenza, which was not described as important or severe by HCPs in a range of countries. Furthermore, while the risk of transmitting influenza to patients was deemed important in countries such as Italy, Ireland and Turkey, it was not always associated with a higher vaccination rate among HCPs. Concerns about vaccine effectiveness and the possibility of getting influenza following influenza vaccination were also raised by some HCPs hesitant to vaccinate. These findings confirm those from a previous global review¹⁹ and are reflected in HCP's uptake of the vaccine, which remains below 50% in most European countries.^{24,115} Influenza vaccination is one of the most common vaccines given to HCPs as part of their professional functions, as HCPs can play a key role in the transmission of the virus within communities.¹¹⁶ While successful interventions have been identified to improve confidence and uptake of influenza vaccination among HCPs,¹¹⁷ more countries should ensure these are put into practice to motivate HCPs to accept and recommend influenza vaccination. Campaigns to improve uptake of influenza vaccination should address some of the key concerns that have been identified in this study, such as the lack of effectiveness of the vaccine against all strains of the virus, the role HCPs have in transmitting certain infections to patients and the importance of HCPs vaccination to prevent disease in patients.

HCPs also questioned the benefits of maternal vaccination in various European studies. While they did not often question the severity of infections during pregnancy, HCPs reported not feeling at risk of contracting diseases such as pertussis and transmitting it to their patients. Yet, HCPs are essential in recommending and reassuring pregnant women about maternal vaccination as a recent European study reported that the trust pregnant women place in their doctors or midwives can strongly influence their decisions to accept maternal vaccines.¹¹⁸ Ensuring HCPs' willingness to receive and recommend these vaccines is therefore essential as part of efforts to protect pregnant women against infectious diseases. Efforts to ensure all HCPs, including those who do not typically recommend vaccination such

as midwives or gynecologists, are included in continuous training around the need and importance of vaccines during pregnancy are therefore essential.

Perceived risks of vaccination were explored in relation to vaccine safety and possible side effects, including short-term localised side effects such as fever or pain at the site of injection as well as unconfirmed adverse events such as effects on the immune or nervous system. Such concerns were more prominent in certain countries, with HCPs from Greece and Cyprus for instance raising concerns about possible side effects following HPV vaccination. These concerns are important, as they can lead to HCPs failing to recommend or recommending against vaccination but could also influence how patients perceive and accept vaccines.²⁰ More research should be explored to understand how HCPs' hesitancy could affect patients' confidence in vaccination. This is particularly important as some HCPs still raised concerns about discredited conspiracies such as the link between vaccines and autism, as was identified in studies from Italy or the belief that Hepatitis B vaccination causes multiple sclerosis, which was reported in studies from France. While the impact of the negative media environment on beliefs and vaccine confidence among the general population has been established,¹¹⁹ its effect on HCPs is concerning and warrants further research. Specific concerns about vaccine side effects should also be addressed through continuous training or communication campaigns, to prevent HCPs spreading their concerns to patients and refusing or not recommending certain vaccines. Strong peer-to-peer engagement could be beneficial in such instances.

Some studies in this review showed significant differences between different types of HCPs, with nurses and midwives commonly reporting more concerns about possible vaccine side effects. Yet, midwives and nurses are sometimes perceived as more trustworthy than doctors, particularly among certain population groups such as pregnant women, due to their empathy, compassion and time taken to listen and respond to questions.¹²⁰ If HCPs perceived as more trustworthy are also more hesitant to recommend vaccination, this could contribute to vaccine hesitancy among the general population and to lower uptake rates of vaccines. Engagement of all HCPs should therefore be considered when implementing strategies to improve vaccine acceptance and confidence, with targeted approaches for different categories of professionals.

This review observed that lack of trust in health authorities, pharmaceutical companies, and in the information they provide can be an important barrier to HCPs acceptance or recommendation of vaccination. Differences were identified across countries, with associations between trust in institutions and uptake of vaccination reported in France, Slovenia, or Germany and questions about the reliability of information reported in studies from France and Switzerland, confirming findings from previous studies.^{6,121,122} In certain countries such as France, this mistrust comes from the mismanagement of previous health events and failure to engage HCPs in decision-making, such as during the 2009 H1N1 pandemic.¹²³ As HCPs are confronted with an ever-increasing amount of sources of information on vaccination,¹²⁴ strategies to improve the trustworthiness of health authorities and other institutions could significantly improve their confidence in vaccination.

While such initiatives require long-term investments, maintaining and restoring trust in key information sources on vaccination is important to address the mistrust identified in this review.

Mistrust of pharmaceutical companies was reported more consistently across countries, with concerns about their financial interests impacting policies and decision-makers as well as about a lack of transparency, for example in reporting side-effects. Although, the pharmaceutical industry operates in highly regulated environments and follows high quality standards for vaccine development and production, improving communication and transparency mechanisms could help address concerns among both professionals and the public.¹²⁵

HCPs' perceptions about mandatory vaccination for HCPs were divided, with studies from countries such as Greece or Turkey showing higher rates of HCPs support for such policies than studies from other countries such as Belgium. This division was also identified in another literature review that found that around 53% of HCPs from Europe were in favor of mandatory vaccination against influenza.²³ Ideological differences in the value of vaccination could explain these divisions, as some HCPs perceived vaccination as a professional and moral duty while others highlighted the importance of vaccination remaining an autonomous decision. The effect of these perceptions should be further investigated, particularly in relation to support for mandatory vaccination for patients as many countries such as France or Italy have started making childhood vaccination compulsory in an effort to increase vaccination rates.¹²⁶ This is also an important factor in decisions around COVID-19 vaccination: while a recent study found that support for mandatory vaccination among HCPs in Italy increased since the start of the COVID-19 pandemic,¹²⁷ there have been reports of HCPs becoming more hesitant since COVID-19 vaccines have been made mandatory in certain countries.¹²⁸ While it is essential to engage HCPs and give them an opportunity to discuss their concerns before policies mandating HCP vaccination are implemented, more research should also be conducted to establish the effectiveness of mandating vaccines on coverage as well as confidence in vaccination among HCPs.

Study limitations

While our review provides a valuable overview of factors influencing vaccine confidence among HCPs in Europe, some limitations should be reported. Firstly, there is a possibility of bias related to the search protocol, as studies that were not published in peer reviewed journal or that were only available in languages not spoken by the reviewers were excluded from the review. Furthermore, the studies included in this review used a wide variety of questionnaires, methodology, study outcomes and variables and analytical methods, which made the comparison of study findings results quite complex. Most studies included in this review also used a cross-sectional design and some collected data several years before the article was published. Results from such studies may have been influenced by external factors and should therefore be interpreted and compared to other studies carefully. Finally, all researchers in this review worked

independently on data extraction and analysis, which could have induced selection bias. This was minimized by regular discussions and precise study aim, objectives and inclusion and exclusion criteria.

Conclusion

This review examined HCPs' perceptions of the risks and benefits of vaccination, their levels of trust in different actors (i.e. health authorities, governments, pharmaceutical companies), and their perceptions of mandatory vaccination across Europe, Morocco and Turkey. Despite differences observed by country, type of HCP or type of vaccine, HCPs with doubts about benefits of vaccination, concerns about vaccine safety and mistrust of institutions were identified across all countries. Addressing these concerns is essential, as HCPs play a central role in recommending vaccines to the general population and sometimes addressing public vaccine hesitancy. Some countries have adopted policies mandating vaccines for HCPs or for the general population, yet such policies are not widely accepted and could lead to further mistrust or hesitancy, particularly among those who are already hesitant. Alternatives such as improving vaccination training for medical students and professionals or developing stronger engagement and communication mechanisms with all HCPs are therefore equally as important. Findings from this review can inform the development of context-specific interventions to improve vaccine confidence among HCPs in European countries.

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References

- Rodrigues CMC, Plotkin SA. Impact of vaccines. *Health Econ Soc Perspect Front Microbiol.* 2020;11:1526.
- Hadjipanayis A, van Esso D, Del Torso S, Dornbusch HJ, Michailidou K, Minicuci N, Pancheva R, Mujkic A, Geitmann K, Syridou G, et al. Vaccine confidence among parents: Large scale study in eighteen European countries. *Vaccine.* 2020;38:1505–12. doi:10.1016/j.vaccine.2019.11.068.
- Stoekel F, Carter C, Lyons BA, Reifler J. Association of vaccine hesitancy and immunization coverage rates in the European Union. *Vaccine.* 2021;39(29):3935–39. doi:10.1016/j.vaccine.2021.05.062.
- de Figueiredo A, Simas C, Karafillakis E, Paterson P, Larson HJ. Mapping global trends in vaccine confidence and investigating barriers to vaccine uptake: a large-scale retrospective temporal modelling study. *Lancet.* 2020;396(10255):898–908. doi:10.1016/S0140-6736(20)31558-0.
- Karafillakis E, Larson HJ, consortium A. The benefit of the doubt or doubts over benefits? A systematic literature review of perceived risks of vaccines in European populations. *Vaccine.* 2017;35:4840–50. doi:10.1016/j.vaccine.2017.07.061.
- Larson HJ, Clarke RM, Jarrett C, Eckersberger E, Levine Z, Schulz WS, Paterson P. Measuring trust in vaccination: A systematic review. *Hum Vaccin Immunother.* 2018;14(7):1599–609. doi:10.1080/21645515.2018.1459252.
- Wilson RJ, Paterson P, Jarrett C, Larson HJ. Understanding factors influencing vaccination acceptance during pregnancy globally: A literature review. *Vaccine.* 2015;33:6420–29. doi:10.1016/j.vaccine.2015.08.046.
- Karafillakis E, Simas C, Jarrett C, Verger P, Peretti-Watel P, Dib F, De Angelis S, Takacs J, Ali KA, Pastore Celentano L, et al. HPV vaccination in a context of public mistrust and uncertainty: a systematic literature review of determinants of HPV vaccine hesitancy in Europe. *Hum Vaccin Immunother.* 2019;15(7–8):1615–27. doi:10.1080/21645515.2018.1564436.
- Wilder-Smith AB, Qureshi K. Resurgence of Measles in Europe: a systematic review on parental attitudes and beliefs of measles vaccine. *J Epidemiol Glob Health.* 2020;10(1):46–58. doi:10.2991/jegh.k.191117.001.
- Yaqub O, Castle-Clarke S, Sevdalis N, Chataway J. Attitudes to vaccination: a critical review. *Soc Sci Med.* 2014;112:1–11. doi:10.1016/j.socscimed.2014.04.018.
- Benninghoff B, Pereira P, Vetter V. Role of healthcare practitioners in rotavirus disease awareness and vaccination – insights from a survey among caregivers. *Hum Vaccines Immunother.* 2020;16(1):138–47. doi:10.1080/21645515.2019.1632685.
- Czajka H, Czajka S, Bilas P, Palka P, Jedrusik S, Czapkiewicz A. Who or what influences the individuals' decision-making process regarding vaccinations? *Int J Environ Res Public Health [Electronic Resource].* 2020;17:21.
- Kilich E, Dada S, Francis MR, Tazare J, Chico RM, Paterson P, Larson HJ, Borrow R. Factors that influence vaccination decision-making among pregnant women: A systematic review and meta-analysis. *PLoS One.* 2020;15(7):e0234827. doi:10.1371/journal.pone.0234827.
- de Figueiredo A, Karafillakis E, Larson HJ. State of vaccine confidence in the EU+UK 2020. A report for the European Commission. European Commission; 2020.
- Durovic A, Widmer AF, Dangel M, Ulrich A, Battagay M, Tschudin-Sutter S. Low rates of influenza vaccination uptake among healthcare workers: Distinguishing barriers between occupational groups. *Am J Infect Control.* 2020;48(10):1139–43. doi:10.1016/j.ajic.2020.02.004.
- Attwell K, Wiley KE, Waddington C, Leask J, Snelling T. Midwives' attitudes, beliefs and concerns about childhood vaccination: A review of the global literature. *Vaccine.* 2018;36:6531–39. doi:10.1016/j.vaccine.2018.02.028.
- Paterson P, Meurice F, Stanberry LR, Glismann S, Rosenthal SL, Larson HJ. Vaccine hesitancy and healthcare providers. *Vaccine.* 2016;34:6700–06. doi:10.1016/j.vaccine.2016.10.042.
- Karafillakis E, Dinca I, Apfel F, Cecconi S, Wurz A, Takacs J, Suk J, Celentano LP, Kramarz P, Larson HJ. Vaccine hesitancy among healthcare workers in Europe: A qualitative study. *Vaccine.* 2016;34:5013–20. doi:10.1016/j.vaccine.2016.08.029.
- Dini G, Toletone A, Sticchi L, Orsi A, Bragazzi NL, Durando P. Influenza vaccination in healthcare workers: A comprehensive critical appraisal of the literature. *Hum Vaccin Immunother.* 2018;14(3):772–89. doi:10.1080/21645515.2017.1348442.
- Lin C, Mullen J, Smith D, Kotarba M, Kaplan SJ, and Tu P. Healthcare providers' vaccine perceptions, hesitancy, and recommendation to patients: a systematic review. *Vaccines.* 2021;9(7):713.
- Raude J, Fressard L, Gautier A, Pulcini C, Peretti-Watel P, Verger P. Opening the 'vaccine hesitancy' black box: how trust in institutions affects French GPs' vaccination practices. *Expert Rev Vaccines.* 2016;15:937–48. doi:10.1080/14760584.2016.1184092.

22. Neufeind J, Betsch C, Habersaat KB, Eckardt M, Schmid P, Wichmann O. Barriers and drivers to adult vaccination among family physicians – Insights for tailoring the immunization program in Germany. *Vaccine*. 2020;38(27):4252–62. doi:10.1016/j.vaccine.2020.04.052.
23. Gualano MR, Corradi A, Voglino G, Catozzi D, Olivero E, Corezzi M, Bert F, Siliquini R. Healthcare workers' (HCWs) attitudes towards mandatory influenza vaccination: A systematic review and meta-analysis. *Vaccine*. 2021;39:901–14. doi:10.1016/j.vaccine.2020.12.061.
24. Karnaki P, Baka A, Petralias A, Veloudaki A, Zota D, Linos A. Immunization related behaviour among healthcare workers in Europe: results of the HProImmune survey. *Cent Eur J Public Health*. 2019;27:204–11.
25. Maltezou HC, Katerelos P, Poufta S, Pavli A, Maragos A, Theodoridou M. Attitudes toward mandatory occupational vaccinations and vaccination coverage against vaccine-preventable diseases of health care workers in primary health care centers. *Am J Infect Control*. 2013;41(1):66–70. doi:10.1016/j.ajic.2012.01.028.
26. Schwartz JL. Evidence and ethics in mandatory vaccination policies. *Am J Bioeth*. 2013;13(9):46–48. doi:10.1080/15265161.2013.815023.
27. Larson HJ, Jarrett C, Eckersberger E, Smith DM, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: A systematic review of published literature, 2007–2012. *Vaccine*. 2014;32(19):2150–59. doi:10.1016/j.vaccine.2014.01.081.
28. Paoli S, Lorini C, Puggelli F, Sala A, Grazzini M, Paolini D, Bonanni P, Bonaccorsi G. Assessing vaccine hesitancy among healthcare workers: a cross-sectional study at an Italian Paediatric Hospital and the development of a healthcare worker's vaccination compliance index. *Vaccines*. 2019;7(4):29. doi:10.3390/vaccines7040201.
29. Loubet P, Nguyen C, Burnet E, Launay O, Angelillo IF. Influenza vaccination of pregnant women in Paris, France: knowledge, attitudes and practices among midwives. *PLoS ONE [Electronic Resource]*. 2019;14(4):e0215251. doi:10.1371/journal.pone.0215251.
30. Korkmaz N, Nazik S, Sule Gumustakim R, Uzar H, Kul G, Tosun S, Torun A, Demirbakan H, Seremet Keskin A, Bahar Kacmaz A, et al. Influenza vaccination rates, knowledge, attitudes and behaviours of healthcare workers in Turkey: a multicentre study. *Int J Clin Pract*. 2020;75(1):e13659. doi:10.1111/ijcp.13659.
31. Verhees RAF, Snellings R, Dinant GJ, Knottnerus JA. Influenza vaccination among Dutch general practitioners and their attitude toward influenza vaccination in the elderly. *Hum Vaccin Immunother*. 2020;16(11):2709–18. doi:10.1080/21645515.2020.1732728.
32. Queipo-Herías Y, Sanchez-Zaballos M, Zuazua-Rico D, Mosteiro-Díaz MP, Maestro-Gonzalez A. Health professionals' attitudes against influenza vaccination in a Spanish tertiary hospital. *Rev Esp Salud Pública*. 2019;93:08.
33. Flanagan P, Dowling M, Gethin G. Barriers and facilitators to seasonal influenza vaccination uptake among nurses: A mixed methods study. *J Adv Nurs*. 2020;76:1746–64. doi:10.1111/jan.14360.
34. Gianfredi V, Nucci D, Salvatori T, Orlacchio F, Villarini M, Moretti M, . GROUP PEIUS. "PERCEIVE in Umbria": evaluation of anti-influenza vaccination's perception among Umbrian pharmacists. *J Prev Med Hyg*. 2018;59:E14–E19.
35. Arghittu A, Dettori M, Azara A, Gentili D, Serra A, Contu B, Castiglia P. Int J Environ Res Public Health. Flu Vaccination Attitudes, Behaviours, and Knowledge Among Health Workers. 2020;17:3.
36. Tomboloni C, Tersigni C, de Martino M, Dini D, Gonzalez-Lopez JR, Festini F, Neri S, Ciofi D. Knowledge, attitude and disinformation regarding vaccination and immunization practices among healthcare workers of a third-level paediatric hospital. *Ital J Pediatr*. 2019;45:104. doi:10.1186/s13052-019-0684-0.
37. Durando P, Alicino C, Dini G, Barberis I, Bagnasco AM, Iudici R, Zanini M, Martini M, Toletone A, Paganino C, et al. Determinants of adherence to seasonal influenza vaccination among healthcare workers from an Italian region: results from a cross-sectional study. *BMJ Open*. 2016;6:e010779. doi:10.1136/bmjopen-2015-010779.
38. Torner N, Godoy P, Soldevila N, Toledo D, Rius C, Dominguez A. Estudio actitudes sobre vacunación antigripal en profesionales sanitarios de atención primaria de Cataluña. *Atención Primaria*. 2016;48(3):192–99. doi:10.1016/j.aprim.2014.09.014.
39. Montagna MT, De Giglio O, Napoli C, Fasano F, Diella G, Donnoli R, Caggiano G, Tafuri S, Lopalco PL, and Agodi A, et al. Adherence to vaccination policy among public health professionals: results of a national survey in Italy. *Vaccines*. 2020;8:11.
40. Pavlic DR, Maksuti A, Podnar B, Kokalj Kokot M. Reasons for the low influenza vaccination rate among nurses in Slovenia. *Primary Health Care Res Dev*. 2020;21:e38. doi:10.1017/S1463423620000419.
41. Pless A, McLennan SR, Nicca D, Shaw DM, Elger BS. Reasons why nurses decline influenza vaccination: a qualitative study. *BMC Nurs*. 2017;16:20. doi:10.1186/s12912-017-0215-5.
42. Pelullo CP, Della Polla G, Napolitano F, Di Giuseppe G, and Angelillo IF. Healthcare workers' knowledge, attitudes, and practices about vaccinations: a cross-sectional study in Italy. *Vaccines*. 2020;8:26.
43. Di Martino G, Di Giovanni P, Di Girolamo A, Scamporrì P, Cedrone F, D'Addezio M, Meo F, Romano F, Di Sciascio MB, and Staniscia T. Knowledge and attitude towards vaccination among healthcare workers: a multicenter cross-sectional study in a Southern Italian region. *Vaccines*. 2020;8:24.
44. Visser O, Hulscher M, Antonise-Kamp L, Akkermans R, van der Velden K, Ruiters RAC, Hautvast JLA. Assessing determinants of the intention to accept a pertussis cocooning vaccination: A survey among healthcare workers in maternity and paediatric care. *Vaccine*. 2018;36:736–43. doi:10.1016/j.vaccine.2017.12.021.
45. Karasu AFG, Adanir I, Aydin S, Ilhan GK, Ofli T. Nurses' knowledge and opinions on HPV vaccination: a cross-sectional study from Istanbul. *J Cancer Educ*. 2019;34:98–104. doi:10.1007/s13187-017-1272-x.
46. Christodoulou A, Ajzajian J, Su D, Wang H, Roupá Z, Farazi PA. Awareness of human papilloma virus and cervical cancer prevention among Cypriot female healthcare workers. *Ecancermedicalscience*. 2019;13:978. doi:10.3332/ecancer.2019.978.
47. Farazi PA, Hadji P, Roupá Z. Awareness of human papilloma virus and cervical cancer prevention among Greek female healthcare workers. *Eur J Cancer Prev*. 2017;26:330–35. doi:10.1097/CEJ.0000000000000254.
48. Akan H, Yavuz E, Yayla ME, Kulbay H, Kaspar EC, Zahmacioglu O, Badur S. Factors affecting uptake of influenza vaccination among family physicians. *Vaccine*. 2016;34(14):1712–18. doi:10.1016/j.vaccine.2016.01.057.
49. Perez-Ciordia I, Guillen-Grima F, Aguinaga Ontoso I, Garcia Garcia P, Ezenarro Muruamendiáraz A, Aguinaga Ontoso E, Brugos Larumbe A. Vaccination and factors that influence the attitude of health professionals towards the anti-flu vaccination. *Vacunas*. 2017;18:3–10.
50. Paranthaman K, McCarthy N, Rew V, van Zoelen S, Cockerill L. Pertussis vaccination for healthcare workers: staff attitudes and perceptions associated with high coverage vaccination programmes in England. *Public Health*. 2016;137:196–99. doi:10.1016/j.puhe.2016.02.033.
51. Visser O, Hautvast JL, van der Velden K, Hulscher ME, Hozbor DF. Intention to accept Pertussis vaccination for cocooning: a qualitative study of the determinants. *PLoS ONE [Electronic Resource]*. 2016;11(6):e0155861. doi:10.1371/journal.pone.0155861.

52. Picchio CA, Carrasco MG, Sague-Vilavella M, Rius C. Knowledge, attitudes and beliefs about vaccination in primary healthcare workers involved in the administration of systematic childhood vaccines, Barcelona, 2016/17. *Euro Surveill.* 2019;24(6):24. doi:10.2807/1560-7917.ES.2019.24.6.1800117.
53. Catakli T, Duyan-Camurdan A, Aksakal-Baran FN, Guven AE, Beyazova U. Attitudes of physicians concerning vaccines not included in the national immunization schedule. *Turk J Pediatr.* 2018;60(3):290–97. doi:10.24953/turkjped.2018.03.009.
54. Huber A, Gazder J, Dobay O, Meszner Z, Horvath A. Attitudes towards varicella vaccination in parents and paediatric healthcare providers in Hungary. *Vaccine.* 2020;38:5249–55. doi:10.1016/j.vaccine.2020.05.091.
55. Levy C, Bechet S, Cohen R. Introduction d'une vaccination contre le méningocoque B (Bexsero®) en France : perception et expérience des médecins quelques mois après l'autorisation de mise sur le marché. *Archives de Pédiatrie.* 2016;23(1):27–33. doi:10.1016/j.arcped.2015.09.011.
56. van Lier A, Tostmann A, Harmsen IA, de Melker HE, Hautvast JL, Ruijs WL. Negative attitude and low intention to vaccinate universally against varicella among public health professionals and parents in the Netherlands: two internet surveys. *BMC Infect Dis.* 2016;16:127. doi:10.1186/s12879-016-1442-1.
57. Martinez L, Tugaut B, Raineri F, Arnould B, Seyler D, Arnould P, Benmedjahed K, Coindard G, Denis F, Gallais JL, et al. L'Engagement des médecins généralistes français dans la vaccination : l'étude DIVA (Déterminants des Intentions de Vaccination). *Santé Publique.* 2016;28(1):19–32. doi:10.3917/spub.161.0019.
58. Schuler M, Schaedelin S, Aebi C, Berger C, Crisinel PA, Diana A, Niederer-Loher A, Siegrist CA, Vaudaux B, Heininger U. Attitudes of Swiss Health Care providers toward childhood immunizations. *Pediatr Infect Dis J.* 2017;36(6):e167–e174. doi:10.1097/INF.0000000000001522.
59. Troha M, Sterbenc A, Mlakar M, Poljak M. Human papillomavirus (HPV) infection and vaccination: knowledge and attitudes among healthcare professionals and the general public in Slovenia. *Acta Dermatovenerol Alp Panonica Adriat.* 2018;27:59–64.
60. Lehmann BA, Eilers R, Mollema L, Ferreira J, de Melker HE. The intention of Dutch general practitioners to offer vaccination against pneumococcal disease, herpes zoster and pertussis to people aged 60 years and older. *BMC Geriatr.* 2017;17(1):122. doi:10.1186/s12877-017-0511-7.
61. Ricco M, Cattani S, Casagrande F, Gualerzi G, Signorelli C. Knowledge, attitudes, beliefs and practices of occupational physicians towards seasonal influenza vaccination: a cross-sectional study from North-Eastern Italy. *J Prev Med Hyg.* 2017;58:E141–E154.
62. Ucakar V, Kraigher A. Acceptance of seasonal influenza vaccination among Slovenian physicians, 2016. *Zdravstveno Varstvo.* 2019;58:47–53. doi:10.2478/sjph-2019-0006.
63. Bodeker B, Seefeld L, Buck S, Ommen O, Wichmann O. Implementation of seasonal influenza and human papillomavirus vaccination recommendations in gynecological practices in Germany. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz.* 2016;59(3):396–404. doi:10.1007/s00103-015-2303-6.
64. Wilcox CR, Little P, Jones CE. Current practice and attitudes towards vaccination during pregnancy: a survey of GPs across England. *Br J General Pract.* 2020;70:e179–e185. doi:10.3399/bjgp20X708113.
65. Halpin C, Reid B. Attitudes and beliefs of healthcare workers about influenza vaccination. *Nurs Older People.* 2019;31:32–39. doi:10.7748/nop.2019.e1154.
66. Karlsson LC, Lewandowsky S, Antfolk J, Salo P, Lindfelt M, Oksanen T, Kivimäki M, Soveri A, Angelillo IF. The association between vaccination confidence, vaccination behavior, and willingness to recommend vaccines among Finnish healthcare workers. *PLoS ONE [Electronic Resource].* 2019;14(10):e0224330. doi:10.1371/journal.pone.0224330.
67. Lefevre H, Schrimpf C, Moro MR, Lachal J. HPV vaccination rate in French adolescent girls: an example of vaccine distrust. *Arch Dis Child.* 2018;103:740–46. doi:10.1136/archdischild-2017-313887.
68. Hulo S, Nuvoletti A, Sobaszek A, Salembier-Trichard A. Knowledge and attitudes towards influenza vaccination of health care workers in emergency services. *Vaccine.* 2017;35:205–07. doi:10.1016/j.vaccine.2016.11.086.
69. Dass von Perbandt E, Hornung R, Thanner M. Influenza vaccination coverage of health care workers: a cross-sectional study based on data from a Swiss gynaecological hospital. *GMS Infect Dis.* 2018;6:Doc02. doi:10.3205/id000037.
70. Scatigna M, Fabiani L, Micolucci G, Santilli F, Mormile P, Giuliani AR. Attitudinal variables and a possible mediating mechanism for vaccination practice in health care workers of a local hospital in L'Aquila (Italy). *Hum Vaccines Immunother.* 2017;13(1):198–205. doi:10.1080/21645515.2016.1225638.
71. Ferrara P, Stromillo L, Albano L. Awareness, attitudes, and practices toward meningococcal B Vaccine among Pediatricians in Italy. *Medicina.* 2018;54:03. doi:10.3390/medicina54060100.
72. Kara Elitok G, Bulbul L, Altuntas SB, Altuntas B, Gunindi G, Haltas M, Yuvarlan A, Toprak D, Bulbul A. Recommending immunizations to adolescents in Turkey: a study of the knowledge, attitude, and practices of physicians. *Hum Vaccines Immunother.* 2020;16:1132–38. doi:10.1080/21645515.2020.1715146.
73. Unlu A, Kalenderoglu MD, Ay H, Kabaoglu C, Koc ZL, Erkan DO, Gunduz S, Kirca O, Kilickap S, Ozdogan M. National survey study on the approaches of pediatricians, family physicians, medical oncologists and gynecologists to the HPV vaccine. *J Oncol Sci.* 2018;4(2):74–79. doi:10.1016/j.jons.2018.04.002.
74. Verger P, Collange F, Fressard L, Bocquier A, Gautier A, Pulcini C, Raude J, Peretti-Watel P. Prevalence and correlates of vaccine hesitancy among general practitioners: a cross-sectional telephone survey in France, April to July 2014. *Euro Surveill.* 2016;21(47):24. doi:10.2807/1560-7917.ES.2016.21.47.30406.
75. Collange F, Fressard L, Pulcini C, Sebbah R, Peretti-Watel P, Verger P. General practitioners' attitudes and behaviors toward HPV vaccination: a French national survey. *Vaccine.* 2016;34:762–68. doi:10.1016/j.vaccine.2015.12.054.
76. Bakhache P, Virey B, Bienenfeld C. Knowledge and practices regarding infant vaccination: results of a survey of French physicians. *Eur J Pediatr.* 2019;178:533–40. doi:10.1007/s00431-018-03314-3.
77. Petek D, Kamnik-Jug K. Motivators and barriers to vaccination of health professionals against seasonal influenza in primary healthcare. *BMC Health Serv Res.* 2018;18:853. doi:10.1186/s12913-018-3659-8.
78. Kopsidas I, Tsopela GC, Maroudi-Manta S, Kourkouni E, Charalampopoulos D, Sirogianni A, Collins ME, Lourida A, Kourlaba G, Zautis TE, et al. Increasing healthcare workers' uptake of seasonal influenza vaccination in a tertiary-care pediatric hospital in Greece with a low-cost, tailor-made, multifaceted strategy. *Vaccine.* 2020;38(29):4609–15. doi:10.1016/j.vaccine.2020.05.021.
79. Squeri R, Genovese C, Trimarchi G, Palamara MAR, La Fauci V. An evaluation of attitude toward vaccines among healthcare workers of a University Hospital in Southern Italy. *Annali di Iggiene.* 2017;29(6):595–606. doi:10.7416/ai.2017.2188.
80. Tamburrano A, Mellucci C, Galletti C, Vitale D, Vallone D, Barbara A, Sguera A, Zega M, Damiani G, Laurenti P. Improving nursing staff attitudes toward vaccinations through academic detailing: the HProImmune questionnaire as a tool for medical management. *Int J Environ Res Public Health [Electronic Resource].* 2019;16:5.
81. Trucchi C, Restivo V, Amicizia D, Fortunato F, Manca A, Martinelli D, Montecucco A, Piazza MF, Prato R, Tisa V, et al. Italian health care workers' knowledge, attitudes, and practices regarding human papillomavirus infection and prevention. *Int J Environ Res Public Health.* 2020;17:1–12. doi:10.3390/ijerph17155278.

82. Filia A, Bella A, D'Ancona F, Fabiani M, Giambi C, Rizzo C, Ferrara L, Pascucci MG, and Rota MC. Childhood vaccinations: knowledge, attitudes and practices of paediatricians and factors associated with their confidence in addressing parental concerns, Italy, 2016. *Euro Surveill.* 2019;24(6): 1800275.
83. Bouvret P, Mouglin C, Pretet JL, Meurisse A, Bonnetain F, Fiteni F. Pratiques et attitudes des médecins généralistes de besançon vis-à-vis de la vaccination anti-HPV. *Journal de Gynécologie Obstétrique Et Biologie de la Reproduction.* 2016;45(8):972–78. doi:10.1016/j.jgyn.2015.12.002.
84. Sherman SM, Cohen CR, Denison HJ, Bromhead C, Patel H. A survey of knowledge, attitudes and awareness of the human papillomavirus among healthcare professionals across the UK. *Eur J Public Health.* 2020;30:10–16. doi:10.1093/eurpub/ckz113.
85. Karamanidou C, Dimopoulos K. Greek health professionals' perceptions of the HPV vaccine, state policy recommendations and their own role with regards to communication of relevant health information. *BMC Public Health.* 2016;16:467. doi:10.1186/s12889-016-2831-5.
86. Wilson R, Paterson P, Larson HJ. Strategies to improve maternal vaccination acceptance. *BMC Public Health.* 2019;19:342. doi:10.1186/s12889-019-6655-y.
87. Gramegna A, Dellafiore S, Contarini M, Blasi F, Aliberti S, Tosatto R, Mantero M. Knowledge and attitudes on influenza vaccination among Italian physicians specialized in respiratory infections: an Italian Respiratory Society (SIP/IRS) web-based survey. *J Prev Med Hyg.* 2018;59:E128–E131.
88. Asma S, Akan H, Uysal Y, Pocan AG, Sucakli MH, Yengil E, Gereklioglu C, Korur A, Bashan I, Erdogan AF, et al. Factors effecting influenza vaccination uptake among health care workers: a multi-center cross-sectional study. *BMC Infect Dis.* 2016;16(1):192. doi:10.1186/s12879-016-1528-9.
89. Bohm S, Robl-Mathieu M, Scheele B, Wojcinski M, Wichmann O, Hellenbrand W. Influenza and pertussis vaccination during pregnancy – attitudes, practices and barriers in gynaecological practices in Germany. *BMC Health Serv Res.* 2019;19(1):616. doi:10.1186/s12913-019-4437-y.
90. Rabensteiner A, Buja A, Regele D, Fischer M, Baldo V. Healthcare worker's attitude to seasonal influenza vaccination in the South Tyrolean province of Italy: barriers and facilitators. *Vaccine.* 2018;36:535–44. doi:10.1016/j.vaccine.2017.12.007.
91. Ponticelli D, D'Ambrosio A, Cancellieri M, Agozzino E. Do HCWs adequately know about meningitis and 4cmenb vaccine and recommend its use to parents? A cross sectional analysis in Campania region, Italy. *J Prev Med Hyg.* 2019;60:E147–E157.
92. Di Giuseppe G, Pelullo CP, Della Polla G, and Pavia M. Meningococcal disease and related vaccinations: knowledge, attitudes, and practices among healthcare workers who provide care to patients with underlying high-risk medical conditions. *Vaccines.* 2020;8:18.
93. Doornekamp L, de Jong W, Wagener MN, Goeijenbier M, van Gorp ECM. Dutch healthcare professionals' opinion on vaccination and education to prevent infections in immunocompromised patients: A mixed-method study with recommendations for daily practice. *Vaccine.* 2019;37:1476–83. doi:10.1016/j.vaccine.2019.01.075.
94. Salamun S, Puharic Z, Eljuga K, Grabovac D, Vnucec K. Health care professionals' attitudes and knowledge about vaccination. *Infektoloski Glasnik.* 2019;38:39–44. Croatian.
95. Myotte-Duquet P, Charissou A. Social representations of mandatory vaccination in patients and general practitioners in Moselle, France. *Archives de Pédiatrie.* 2019;26(8):466–72. doi:10.1016/j.arcped.2019.09.002.
96. Le Marechal M, Fressard L, Agrinier N, Verger P, Pulcini C. General practitioners' perceptions of vaccination controversies: a French nationwide cross-sectional study. *Clin Microbiol Infect.* 2018;24(8):858–64. doi:10.1016/j.cmi.2017.10.021.
97. Eilers R, Krabbe PF, de Melker HE. Attitudes of Dutch general practitioners towards vaccinating the elderly: less is more? *BMC Fam Pract.* 2015;16:158. doi:10.1186/s12875-015-0377-8.
98. Wilson R, Zaytseva A, Bocquier A, Nokri A, Fressard L, Chamboredon P, Carbonaro C, Bernardi S, Dube E, Verger P. Vaccine hesitancy and self-vaccination behaviors among nurses in southeastern France. *Vaccine.* 2020;38:1144–51. doi:10.1016/j.vaccine.2019.11.018.
99. Quintyne KI, Daly E, Brabazon E, Finnegan P, Kavanagh P. Attitudes and uptake of seasonal influenza vaccination for Health Service Executive (HSE) Staff. *Ir Med J.* 2018;111:749.
100. Massot E, Epaulard O. Midwives' perceptions of vaccines and their role as vaccinators: the emergence of a new immunization corps. *Vaccine.* 2018;36:5204–09. doi:10.1016/j.vaccine.2018.06.050.
101. Desiante F, Caputi G, Cipriani R, Nanula C, Aprile I, Pesare A, Conversano M. Assessment of coverage and analysis of the determinants of adherence to influenza vaccination in the general practitioners of Taranto. *Annali di Igiene.* 2017;29(4):256–63. doi:10.7416/ai.2017.2157.
102. Hogan V, Lenehan M, Hogan M, Natin DP. Influenza vaccine uptake and attitudes of healthcare workers in Ireland. *Occup Med (Oxford).* 2019;69:494–99.
103. Vilca LM, Martinez C, Burballa M, Campins M. Maternal care providers' barriers regarding influenza and Pertussis vaccination during pregnancy in Catalonia, Spain. *Matern Child Health J.* 2018;22:1016–24. doi:10.1007/s10995-018-2481-6.
104. Barrett T, McEntee E, Drew R, O'Reilly F, O'Carroll A, O'Shea A, Cleary B. Influenza vaccination in pregnancy: vaccine uptake, maternal and healthcare providers' knowledge and attitudes. A quantitative study. *BJGP Open.* 2018;2:bjgpopen18X101599. doi:10.3399/bjgpopen18X101599.
105. Grandahl M, Larsson M, Tyden T, Stenhammar C, Grce M. School nurses' attitudes towards and experiences of the Swedish school-based HPV vaccination programme – A repeated cross sectional study. *PLoS ONE [Electronic Resource].* 2017;12(4):e0175883. doi:10.1371/journal.pone.0175883.
106. Ricco M, Vezzosi L, Gualerzi G, Balzarini F, Capozzi VA, Volpi L. Knowledge, attitudes, beliefs and practices of obstetrics-gynecologists on seasonal influenza and pertussis immunizations in pregnant women: preliminary results from North-Western Italy. *Minerva Ginecol.* 2019;71:288–97. doi:10.23736/S0026-4784.19.04294-1.
107. Boey L, Bral C, Roelants M, De Schryver A, Godderis L, Hoppenbrouwers K, Vandermeulen C. Attitudes, beliefs, determinants and organisational barriers behind the low seasonal influenza vaccination uptake in healthcare workers – A cross-sectional survey. *Vaccine.* 2018;36(23):3351–58. doi:10.1016/j.vaccine.2018.04.044.
108. Wilson RJI, Vergelys C, Ward J, Peretti-Watel P, Verger P. Vaccine hesitancy among general practitioners in Southern France and their reluctant trust in the health authorities. *Int J Qual Stud Health Well-Being.* 2020;15:1757336. doi:10.1080/17482631.2020.1757336.
109. Collange F, Zaytseva A, Pulcini C, Bocquier A, Verger P. Unexplained variations in general practitioners' perceptions and practices regarding vaccination in France. *Eur J Public Health.* 2019;29:2–8. doi:10.1093/eurpub/cky146.
110. Perez MRO, Violeta VB, Del Campo AV, Ruiz C, Castano SY, Conde LPP, Lopez JSJ. Cross-Sectional study about primary health care professionals views on the inclusion of the vaccine against human papillomavirus in the vaccine schedules Clinical oncology. *Infect Agent Cancer.* 2015;10(1). no pagination. doi:10.1186/s13027-015-0034-9.
111. Pichon M, Gaymard A, Zamolo H, Bazire C, Valette M, Sarkozy F, Lina B. Web-Based analysis of adherence to influenza vaccination among French healthcare workers. *J Clin Virol.* 2019;116:29–33. doi:10.1016/j.jcv.2019.04.008.
112. Sweileh WM. Bibliometric analysis of global scientific literature on vaccine hesitancy in peer-reviewed journals (1990–2019). *BMC Public Health.* 2020;20(1). doi:10.1186/s12889-020-09368-z.

113. Shen AK, Peterson A. The pharmacist and pharmacy have evolved to become more than the corner drugstore: a win for vaccinations and public health. *Hum Vaccin Immunother.* 2020;16(5):1178–80. doi:10.1080/21645515.2019.1660119.
114. Paudyal V, Fialová D, Henman MC, Hazen A, Okuyan B, Lutters M, Cadogan C, da Costa FA, Galfrascoli E, Pudritz YM, et al. Pharmacists' involvement in COVID-19 vaccination across Europe: a situational analysis of current practice and policy. *Int J Clin Pharm.* 2021;43(4):1139–48. doi:10.1007/s11096-021-01301-7.
115. Blank PR, van Essen GA, Ortiz de Lejarazu R, Kyncl J, Nitsch-Osuch A, Kuchar EP, Falup-Pecurariu O, Maltezu HC, Zavadská D, Kristufkova Z, et al. Impact of European vaccination policies on seasonal influenza vaccination coverage rates: an update seven years later. *Hum Vaccines Immunother.* 2018;14:2706–14.
116. Orr P. Influenza vaccination for health care workers: A duty of care. *Can J Infect Dis.* 2000;11(5):225–26. doi:10.1155/2000/461308.
117. Lytras T, Kopsachilis F, Mouratidou E, Papamichail D, Bonovas S. Interventions to increase seasonal influenza vaccine coverage in healthcare workers: A systematic review and meta-regression analysis. *Hum Vaccin Immunother.* 2016;12(3):671–81. doi:10.1080/21645515.2015.1106656.
118. Karafillakis E, Paterson P, Larson HJ. 'My primary purpose is to protect the unborn child': Understanding pregnant women's perceptions of maternal vaccination and vaccine trials in Europe. *Vaccine.* 2021;39(39):5673–79. doi:10.1016/j.vaccine.2021.07.099.
119. Stahl JP, Cohen R, Denis F, Gaudelus J, Martinot A, Lery T, Lepetit H. The impact of the web and social networks on vaccination. New challenges and opportunities offered to fight against vaccine hesitancy. *Médecine Et Maladies Infectieuses.* 2016;46(3):117–22. doi:10.1016/j.medmal.2016.02.002.
120. Perriman N, Davis DL, Ferguson S. What women value in the midwifery continuity of care model: A systematic review with meta-synthesis. *Midwifery.* 2018;62:220–29. doi:10.1016/j.midw.2018.04.011.
121. Miyachi T, Takita M, Senoo Y, Yamamoto K. Lower trust in national government links to no history of vaccination. *Lancet.* 2020;395(10217):31–32. doi:10.1016/S0140-6736(19)32686-8.
122. Lee C, Whetten K, Omer S, Pan W, Salmon D. Hurdles to herd immunity: Distrust of government and vaccine refusal in the US, 2002–2003. *Vaccine.* 2016;34(34):3972–78. doi:10.1016/j.vaccine.2016.06.048.
123. Schwarzinger M, Verger P, Guerville MA, Aubry C, Rolland S, Obadia Y, Moatti JP. Positive attitudes of French general practitioners towards A/H1N1 influenza-pandemic vaccination: a missed opportunity to increase vaccination uptakes in the general public? *Vaccine.* 2010;28(15):2743–48. doi:10.1016/j.vaccine.2010.01.027.
124. Rosselli R, Martini M, Bragazzi NL. The old and the new: vaccine hesitancy in the era of the Web 2.0. Challenges and opportunities. *J Prev Med Hyg.* 2016;57:E47–50.
125. Black S, Rappuoli R. A crisis of public confidence in vaccines. *Sci Transl Med.* 2010;2(61):61mr61. doi:10.1126/scitranslmed.3001738.
126. Attwell K, Navin MC, Lopalco PL, Jestin C, Reiter S, Omer SB. Recent vaccine mandates in the United States, Europe and Australia: a comparative study. *Vaccine.* 2018;36:7377–84. doi:10.1016/j.vaccine.2018.10.019.
127. Ledda C, Costantino C, Cuccia M, Maltezu HC, Rapisarda V. Attitudes of healthcare personnel towards vaccinations before and during the COVID-19 Pandemic. *Int J Environ Res Public Health.* 2021;18(5):2703.
128. Gur-Arie R, Jamrozik E, Kingori P. No jab, No job? Ethical issues in mandatory COVID-19 vaccination of healthcare personnel. *BMJ Glob Health.* 2021;6(2):6. doi:10.1136/bmjgh-2020-004877.