




# Training needs assessment of European frontline health care workers on vaccinology and vaccine acceptance: a systematic review

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**Background:** The issue of reluctance towards vaccination is becoming more worrisome. Health care workers (HCWs) are the primary point of contact with individuals who make decisions about vaccination. Therefore, it is crucial that HCWs receive sufficient training and periodic updates. The main objective of this systematic review is to evaluate the HCWs' training needs in vaccination and vaccine uptake. **Methods:** In February 2022, a search was conducted on MEDLINE, Scopus and Google Scholar databases. The search included papers written in English, Italian, Portuguese, Spanish, French and Romanian, with a publication date ranging from 1 January 2011 to 24 February 2022 and conducted in Europe. To assess the methodological quality of the papers, the Appraisal tool for Cross-Sectional Studies was utilized. **Results:** The search of scientific literature yielded 640 outcomes on PubMed, 556 on Scopus and 15 on Google Scholar, for a total of 1211 records. After eliminating duplicates, screening titles and abstracts and evaluating the full text of the articles, only 25 of them were found suitable for inclusion. The studies' overall quality ranged from moderate to good. The majority of the research emphasized the need for improved knowledge of vaccine-preventable diseases, vaccine efficacy, immunization schedules and vaccine adverse effects. **Conclusions:** It is vital to prioritize educational programmes on vaccinology and vaccine hesitancy for HCWs, with the objective of improving their knowledge, awareness and attitudes. Addressing the diversity of educational backgrounds, roles and training requirements of HCWs involved in vaccination across Europe is a critical issue that must be tackled for future initiatives.

## Introduction

Vaccination has substantially contributed to the decrease in mortality and morbidity from several infectious diseases, being recognized as one of the major advances in public health.<sup>1</sup> However, successful vaccination programmes are undermined by scepticism towards vaccination, which in turn affects the achievement of adequate vaccination coverage, finally resulting in potential disease outbreaks, such as those of measles and of diphtheria, which already occurred in the last decade in some European countries.<sup>2</sup>

The reasons for this phenomenon can be attributed in part to lower confidence and acceptance of vaccination in general and in a worldwide increase of 'vaccine hesitancy', described as a major health threat by the World Health Organization (WHO) in 2019.<sup>3</sup> While the concept of 'vaccine hesitancy' should be used to refer to situations where people have doubts and concerns towards vaccinations, without referring to actual vaccine receipt,<sup>4</sup> vaccine acceptance is defined by 'the degree to which individuals accept, question or refuse vaccination'. Vaccine acceptance is a determinant of vaccine coverage rate, and consequently vaccine distribution success.<sup>5</sup> For instance, the acceptance of coronavirus disease 2019 (COVID-19) vaccination has been shown to be influenced by demographic factors such as age, sex, marital status and education level.<sup>6,7</sup>

Frontline health workers (FHWs) are health care workers at the frontline of interaction with those that are taking decisions around vaccination such as parents, adolescents and caregivers.

They include community health workers, midwives, pharmacists, nurses, doctors and other professionals that come in direct contact with the population.<sup>8,9</sup> FHWs play a crucial role in several steps throughout the entire immunization programme, ranging from the complex process of planning and management, to supply chain control, storage, counselling and vaccine administration. For their direct contact with patients and the provision of information and help in overcoming concerns, as well as finding ways to explain the benefits of vaccination, FHWs need adequate training and continuous education to address the questions and concerns of vaccine recipients.<sup>10,11</sup> Based on their role, FHWs are supposed to have specific skills on how to handle each individual vaccine, as well as how to deal with anaphylaxis and side effects, or how to properly inform patients and manage each situation correctly.<sup>12</sup> Highly trained FHWs are less likely to have misbelief about vaccine-related risks and vaccine safety, or distrust in scientific community, health authorities and pharma companies, but small percentages (about 10%) still have anti-vax positions, as also facts about COVID-19 vaccination have demonstrated.<sup>2,13</sup>

FHWs may also be directly involved in training, or in designing training curricula for health professionals, aiming at building skills for increasing vaccination acceptance in the general population. In this regard, the development and implementation of training programmes should be considered in a relevant way in order to address FHWs' expressed needs and concerns on updating their expertise

about the topic. However, structuring standardized training for vaccinology and vaccine acceptance is complicated, due to the heterogeneity described in the roles of FHWs at the European level.<sup>14</sup>

Therefore, courses on these topics should be designed to meet these diverse needs both in terms of FHWs' background and their roles, based on country-specific differences in the organization of immunization settings.<sup>12,15</sup>

Together with the issues related to the current pandemic and the high interest towards vaccination by stakeholders (including the general population, governments, etc.), the importance of increasing vaccine acceptance has become even more evident. It is necessary to provide FHWs with appropriate education, correct information and constant updates about immunization and how to communicate with specific target populations, in particular with hesitant people, trying as much as possible to understand which are the FHWs' learning and training needs on this topic.<sup>16</sup> In light of these considerations, we have conducted a systematic review aimed at assessing FHWs' training needs on vaccinology and vaccine acceptance.

## Methods

This systematic review was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines<sup>17</sup> and was performed for the European Centre for Disease Control (ECDC) under the specific contract No 1ECD.12108 ID.12922 implementing the framework contract number ECDC/2021/005.

### Search strategy

A search string was created based on the PICO model (P, population/patient; I, intervention/indicator; C, comparator/control; and O, outcome).

The scientific databases used for the search, performed in August 2022, were PubMed, Scopus and Google Scholar. As no MeSH terms about 'learning needs' were available, we used the keywords presented in the search strategy ([Supplementary Material S1](#)): 'vaccines'; 'vaccinology'; 'knowledge'; 'attitudes'; 'practice'; 'health care personnel'; 'health care workforce'; 'health care workers'.

### Inclusion/exclusion criteria

The following inclusion criteria were applied:

- (1) Papers and documents published over the last decade (from 1 January 2011 to 4 August 2022);
- (2) Literature and documents in the English language and other languages known to the authors (Italian, Portuguese, Spanish, French and Romanian); and
- (3) Europe has been chosen as a geographical area of interest with national and subnational data. The main focus was then on the national level.

### Study selection

After removing duplicate records, articles were screened first by title and abstract and then based on the full texts. Disagreements were resolved through discussion among the review team members. A search of further studies through official websites ([Supplementary Material S2](#)) has also been conducted. Finally, grey literature research was performed using Google as a search engine.

### Quality assessment

The methodological quality assessment of the selected articles was also performed. As the selected studies were all cross-sectional, the Appraisal tool for Cross-Sectional Studies (AXIS)<sup>18</sup> was applied.

To summarize the overall evidence quality, we grouped the articles into three categories: good (studies satisfying at least 75% of the quality criteria), moderate (studies satisfying between 55% and 74% of the quality criteria) and poor (studies satisfying <55% of the quality criteria) methodological quality.

## Results

### Results of the search strategy

In total, 1432 records were identified. The scientific literature search retrieved 661 results on PubMed, 748 on Scopus (644 after duplicate removal) and 23 on Google Scholar (15 after duplicate/citation removal). After the duplicate removal and the title/abstract assessment, 137 publications were assessed for eligibility.

Considering PubMed results, 82 articles were selected by title/abstract and only 17 were considered eligible for data extraction after reading the full text, all written between 2014 and 2021.<sup>19–35</sup> Considering Scopus results, 49 articles were retained after title/abstract selection and 8 were considered eligible for data extraction after reading the full text.<sup>11,36–42</sup> None of the Google Scholar results were selected. Finally, after the full-text assessment, 25 articles were selected for inclusion in the literature review; their main characteristics are summarized in [Supplementary Material S3](#).

The research of further studies through official websites finally retrieved no useful results.

In relation to grey literature search, only three articles were identified but they were ultimately excluded as they concerned courses in vaccinology and not learning needs in this area ([figure 1](#)).

### Quality assessment

Twenty out of 25 articles were evaluated as of 'good quality', while 5 out of 25 were evaluated as of 'moderate quality'. None of the selected papers had a scarce quality. The objectives of the study (question 1), the reference population (question 4), the presentation of the results (question 16), discussion and conclusions (question 17) were adequately described, and the study design (question 2) was appropriate for all the 25 studies. On the other hand, only two of the studies reported measures undertaken to address and categorize non-responders (question 7). For some of the studies (14 out of 25), the response rate raised concerns about non-response bias (question 13). Furthermore, 24 out of 25 articles clearly discussed the limitations emerging from their studies (question 18) and 24 articles met the quality criteria about methods reproducibility (question 11).

### Main findings of the included studies

Considering the field of vaccinology, the majority of studies (20 out of 25),<sup>19,20,22–38,40</sup> stressed the need to deepen general knowledge about vaccine-preventable diseases.

Moreover, other two important learning needs have been highlighted in most of the studies:

- the general safety of vaccines and the specific adverse events following vaccination (15 out of 25)<sup>11,19,21,23–25,27,30–32,36–38,40,41</sup>;
- the effectiveness of vaccines in preventing various diseases (12 out of 25)<sup>20,22–25,27,29,33,36–38,40,42</sup>; and
- adequate knowledge of the vaccination schedule (12 out of 25).<sup>19,21,23,26,27,30,31,34–36,38,40</sup>

Other knowledge needs that have been cited, but less frequently are:

- issues on the composition of vaccines (6 out of 25)<sup>21,22,25,27,35,37</sup>;
- issues on the route of administration (4 out of 25)<sup>23,27,34,40</sup>;
- vaccine types (3 out of 25)<sup>19,37,40</sup>;

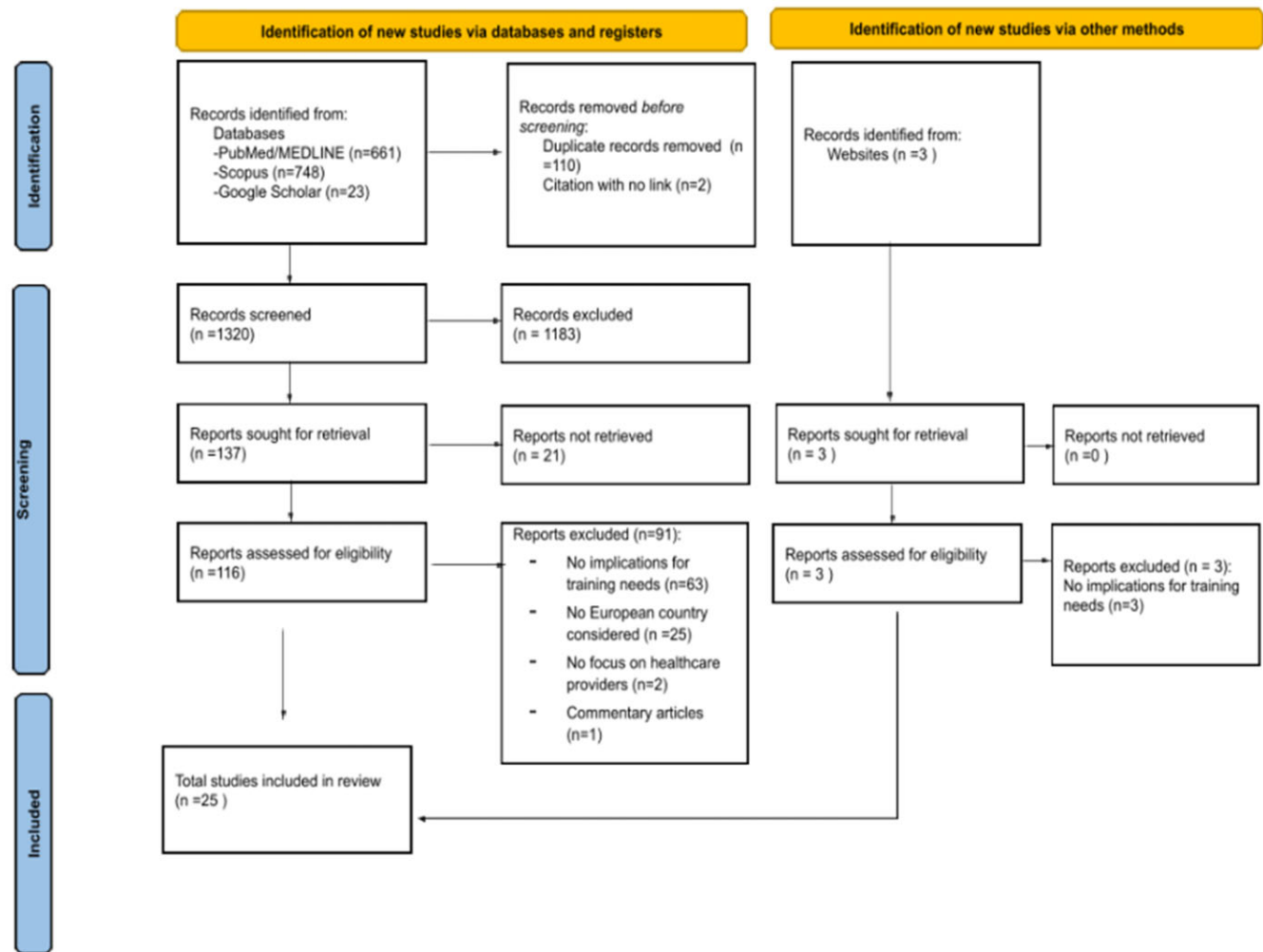


Figure 1 PRISMA 2020 flow diagram for updated systematic reviews, which includes searches of databases, registers and other sources

- vaccines development (1 out of 25)<sup>27</sup>;
- legal and ethical aspects (6 out of 25)<sup>19,23,27,34,38,40</sup>; and
- regulatory and programming issues (2 out of 25).<sup>27,38</sup>

Regarding the field of vaccine hesitancy, learning needs related to communication skills<sup>20,25,27,38–40</sup> arose in six studies and only one study issued needs related to ‘How to answer common questions on vaccination from people’.<sup>39</sup> Finally, the importance of finding trusted information about vaccines has been emphasized in two studies.<sup>28,31</sup>

As regards the search for documents in grey literature, three documents were taken into consideration but were ultimately excluded as they did not properly address knowledge needs or did not focus on European countries.

## Discussion

### Key results of the systematic review

Our review explored the main vaccination knowledge needs identified by FHWs. Most studies have highlighted the strong need to improve general knowledge not only about vaccine-preventable diseases but also about the efficacy and safety of vaccines and the risk of adverse events (e.g. how to treat immediate ones, legal considerations, etc.), which are of greatest concern in both FHWs and citizens who receive the vaccine. Considering the educational role of FHWs among the community on vaccine acceptance, improving their knowledge can make the professionals feel more qualified to answer questions and reassure hesitant or scared patients.

As a primary consideration about the findings of the present study, it should be noted that only one article dealt specifically with learning needs.<sup>40</sup> Most of the articles retrieved focused on surveys on general knowledge of vaccine-preventable diseases, vaccine efficacy, vaccination schedule and adverse effects of vaccines, as well as on the correlation between adequate knowledge, attitudes (i.e. willingness to receive and to recommend vaccination) and vaccination hesitancy. Consequently, only starting from these perceptions and their knowledge about vaccinology it is possible to identify learning needs to ensure that the most appropriate educational intervention is designed.

In the current scenario in which vaccines are losing public confidence, several international organizations (WHO, European Commission, European Centre for Disease Control and Prevention) warn against this growing phenomenon. In this perspective, promoting educational initiatives in vaccinology has not only educational purposes but may also contribute to strengthening the development, testing and use of vaccines, which remain the most efficient tool for infectious disease prevention.

Schmitt et al. noted that instruction on vaccination is subpar or nonexistent in the medical curriculum in the majority of western European nations, and they advise evaluating the quality of vaccine-related teaching in the formal education of health care providers at the moment.<sup>43</sup>

Additionally, Swennen et al.<sup>44</sup> requested special consideration be given to including courses on vaccines and vaccinology in the curricula of the universities and nurse schools.

Continuing education courses are a crucial tool for learning about or deepening this subject, and they should prioritize topics based on the trainees’ various levels of professional exposure and needs.<sup>45,46</sup>

Adequate training of health care professionals is paramount to addressing and reducing people's fears, concerns and apprehensions; therefore, vaccination training should increasingly include well-documented vaccine safety sessions.<sup>45</sup> Similarly important is that FHWs are appropriately educated also on the potential side effects of vaccination, including identification and quantification of risks, so that, by providing balanced and respectful information, they may contribute to the re-establishment of trust.<sup>47</sup> Overall, knowledge about specific vaccines and their efficacy and safety helps to build FHWs' own confidence in vaccines and their willingness to recommend vaccinations to others.

From the public health perspective, vaccinology training is needed to promote the appropriate use of vaccines (i.e. appropriate schedules, target groups and vaccine products) and optimize the effectiveness of immunization programmes (i.e. appropriate vaccination strategies, increased coverage and demand, avoidance of adverse effects due to programme errors, etc.).

Communication skills are also necessary to convey targeted accurate information about vaccines and their impact, including effectiveness and safety, and promote trust among all sectors of the population. In order to achieve and sustain high coverage rates, health care professionals' attitudes and abilities to promote and communicate vaccinations effectively and on time are crucial.<sup>48,49</sup>

In addition, they should refer patients to reliable sources of information regarding vaccines, as fake news and misinformation about vaccines often negatively affect public opinion.<sup>50</sup>

Vaccination is a primary prevention intervention carried out on healthy individuals, who sometimes do not fully understand the potential severity of the sickness the vaccine can prevent. Actually, one of the goals of communication is to enhance risk awareness and offer stakeholders with enough accurate information to make educated decisions and feel in charge of their own health and safety.

According to our working matrix, two relevant knowledge needs have not come up: the identification of the main barriers to patient's vaccination and how to address the main barriers to patient's vaccination. Further research on these topics is therefore needed in order to improve knowledge of these factors.

### Limitations and strengths

The present study has some strengths and limitations. One of the main strengths is that a systematic review was conducted using three different databases and supplemented by grey literature search to identify the training needs of the target population. Furthermore, as a complementary research, part of the overall project in collaboration with ECDC regarding the knowledge needs of health professionals and existing courses on vaccines and immunizations, which includes this systematic review, additional material was searched directly by consulting the official webpages of leading Public Health institutions offering vaccine hesitancy or vaccinology courses (both online and in person). Moreover, all studies finally included were judged of moderate to good quality.

One of the main limitations of the study is that all the research articles included were representing cross-sectional studies, which can be seen as snapshots of learning needs in each country/region, with different sampling strategies, which may only partly explain the differences in learning needs reported in various studies from a single country. Thus, the results should be interpreted with extreme caution since they cannot predict future changes in learning needs. In any case, the results of the present study can be used as an initial motivation and guide for future research in the field.

Finally, this review may be subject to publication bias, in that unsuccessful interventions may be less likely to be documented in either the peer-reviewed or the grey literature.

## Conclusions

In summary, the main points on learning needs for FHWs in the area of immunization arose from our literature search. The results obtained from the literature review indicate that the knowledge of FHWs in vaccine-preventable diseases in terms of epidemiology and clinical aspects is medium-low, including the knowledge of complications and risk groups and its usefulness for the ability to address the concerns of patients and parents.

The analysis of the results shows the specific knowledge to be acquired by professionals to improve communication skills and to deepen knowledge related to the production, efficacy and safety of vaccines, in order to enhance workers' confidence on the subject and transmit the acquired knowledge with greater confidence during vaccinations to patients.

## Supplementary data

Supplementary data are available at *EURPUB* online.

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This work was performed for the European Centre for Disease Control (ECDC) under the specific contract number 1ECD.12108 ID.12922 implementing the framework contract number ECDC/2021/005.

*Conflicts of interest:* None declared.

## Data availability

This peer-reviewed article has been written based on the reports 'Frontline health workers and immunisation programs: training needs assessment and Persona profiles' and 'Frontline health workers and immunization programmes: scoping review about the existing courses on vaccinology and vaccine acceptance', for which the European Centre for Disease Prevention and Control (ECDC) holds the copyright. The data underlying this article were provided by the European Centre for Disease Prevention and Control (ECDC) by permission. Data will be shared on request to the corresponding author with the permission of the European Centre for Disease Prevention and Control (ECDC).

### Key points

- In addition to being for educational purposes, encouraging educational activities in vaccinology may also contribute to enhancing the development, testing and administration of vaccines.
- Health care workers (HCWs) should be given priority in educational programmes on vaccination and vaccine hesitancy due to their role in the community on vaccine uptake.
- The main learning needs of HCWs are general knowledge of vaccine-preventable diseases, vaccine efficacy and safety, and vaccination schedule.

## References

- 1 Andre FE, Booy R, Bock HL, et al. Vaccination greatly reduces disease, disability, death and inequity worldwide. *Bull World Health Organ* 2008;86:140–6.
- 2 Cadeddu C, Daugbjerg S, Ricciardi W, Rosano A. Beliefs towards vaccination and trust in the scientific community in Italy. *Vaccine* 2020;38:6609–17.

- 3 WHO/Rada Akbar. Ten threats to global health in 2019. Available at: <https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019> (20 March 2023, date last accessed).
- 4 Dudley MZ, Privor-Dumm L, Dubé È, MacDonald NE. Words matter: vaccine hesitancy, vaccine demand, vaccine confidence, herd immunity and mandatory vaccination. *Vaccine* 2020;38:709–11.
- 5 Thomson A, Robinson K, Vallée-Tourangeau G. The 5As: a practical taxonomy for the determinants of vaccine uptake. *Vaccine* 2016;34:1018–24.
- 6 Sirikalyanpaiboon M, Ousirimanechai K, Phannajit J, et al. COVID-19 vaccine acceptance, hesitancy, and determinants among physicians in a university-based teaching hospital in Thailand. *BMC Infect Dis* 2021;21:1–12.
- 7 Regazzi L, Marziali E, Lontano A, et al. Knowledge, attitudes, and behaviors toward COVID-19 vaccination in a sample of Italian healthcare workers. *Hum Vaccin Immunother* 2022;18(6):2116206. <http://doi.org/10.1080/21645515.2022.2116206>.
- 8 Sallam M. COVID-19 vaccine hesitancy worldwide: a concise systematic review of vaccine acceptance rates. *Vaccines (Basel)* 2021;9:160.
- 9 Lazarus JV, Ratzan SC, Palayew A, et al. A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med* 2021;27:225–8.
- 10 Gordon C, Porteous D, Unsworth J. COVID-19 vaccines and vaccine administration. *Br J Nurs* 2021;30:344–9.
- 11 Karafillakis E, Dinca I, Apfel F, et al. Vaccine hesitancy among healthcare workers in Europe: a qualitative study. *Vaccine* 2016;34:5013–20.
- 12 Shimabukuro T, Nair N. Allergic reactions including anaphylaxis after receipt of the first dose of Pfizer-BioNTech COVID-19 vaccine—United States, December 14–23, 2020. *MMWR Morb Mortal Wkly Rep* 2023;70:46–51.
- 13 Music T. Protecting patients, protecting healthcare workers: a review of the role of influenza vaccination. *Int Nurs Rev* 2012;59:161–7.
- 14 European Observatory on Health Systems and Policies, Rechel B, Richardson E, McKee M (2018). The organization and delivery of vaccination services in the European Union: prepared for the European Commission. World Health Organization. Regional Office for Europe. <https://apps.who.int/iris/handle/10665/330345>.
- 15 Sturkenboom M, Bahri P, Chiucciuni A, et al. Why we need more collaboration in Europe to enhance post-marketing surveillance of vaccines. *Vaccine* 2020;38:B1–7.
- 16 Forni G, Mantovani A; COVID-19 Commission of Accademia Nazionale dei Lincei, Rome. COVID-19 vaccines: where we stand and challenges ahead. *Cell Death Differ* 2021;28:626–39.
- 17 Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. <http://doi.org/10.1136/bmj.n71>.
- 18 Downes MJ, Brennan ML, Williams HC, Dean RS. Development of a critical appraisal tool to assess the quality of cross-sectional studies (AXIS). *BMJ Open* 2016;6:e011458.
- 19 Arghittu A, Dettori M, Azara A, et al. Flu vaccination attitudes, behaviours, and knowledge among health workers. *Ijerp* 2020;17:3185.
- 20 Conte A, Quattrin R, Filiputti E, et al. Promotion of flu vaccination among healthcare workers in an Italian academic hospital: an experience with tailored web tools. *Hum Vaccin Immunother* 2016;12:2628–33.
- 21 Di Gennaro F, Murri R, Segala FV, et al. Attitudes towards Anti-SARS-CoV2 Vaccination among Healthcare Workers: results from a National Survey in Italy. *Viruses* 2021;13:371.
- 22 Domínguez A, Godoy P, Castilla J, et al.; CIBERES P Working Group for the Survey on Influenza Vaccination in Primary Health Care Workers. Knowledge of and attitudes to influenza in unvaccinated primary care physicians and nurses. *Hum Vaccin Immunother* 2014;10:2378–86.
- 23 Ferrara P, Stromillo L, Albano L. Awareness, attitudes, and practices toward meningococcal B vaccine among pediatricians in Italy. *Medicina (B Aires)* 2018;54:100.
- 24 Fila A, Bella A, D'Ancona F, et al. Childhood vaccinations: knowledge, attitudes and practices of paediatricians and factors associated with their confidence in addressing parental concerns, Italy, 2016. *Eurosurveillance* 2019;24(6):1800275. <http://doi.org/10.2807/1560-7917.ES.2019.24.6.1800275>.
- 25 Karlsson LC, Lewandowsky S, Antfolk J, et al. The association between vaccination confidence, vaccination behavior, and willingness to recommend vaccines among Finnish healthcare workers. *PLoS One* 2019;14:e0224330.
- 26 McSherry LA, O'Leary E, Dombrowski SU, et al.; ATHENS (A Trial of HPV Education and Support) Group. Which primary care practitioners have poor human papillomavirus (HPV) knowledge? A step towards informing the development of professional education initiatives. *PLoS One* 2018;13:e0208482.
- 27 Picchio CA, Carrasco MG, Sagué-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. *Eurosurveillance* 2019;24(6):1800117. <http://doi.org/10.2807/1560-7917.ES.2019.24.6.1800117>.
- 28 Pinto L, Falsaperla R, Villani A, et al. Influenza vaccination: opinions of health care professionals working in pediatric emergency departments. *Ital J Pediatr* 2019;45:47.
- 29 Pulcini C, Massin S, Launay O, Verger P. Knowledge, attitudes, beliefs and practices of general practitioners towards measles and MMR vaccination in southeastern France in 2012. *Clin Microbiol Infect* 2014;20:38–43.
- 30 Riccò M, Vezzosi L, Gualerzi G, et al. Pertussis immunization in healthcare workers: knowledge, attitudes and practices (KAP) of Occupational Physicians. Preliminary results from a web-based survey (2017). *J Prev Med Hyg* 2020;61:E66–66.
- 31 Signorelli C, Pezzetti F, Spagnoli F, et al. Human papillomavirus and vaccination: knowledge and attitudes of Italian general practitioners. *Eur J Public Health* 2014;38(6 Suppl 2):88–92. <http://doi.org/10.1093/eurpub/cku161.031>.
- 32 Riccò M, Cattani S, Casagrande F, et al. 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;58:141–54.
- 33 Tamburrano A, Mellucci C, Galletti C, et al. Improving nursing staff attitudes toward vaccinations through academic detailing: the HProImmune Questionnaire as a tool for medical management. *Ijerp* 2019;16:2006.
- 34 Torner N, Godoy P, Soldevila N, et al. Estudio actitudes sobre vacunación antigripal en profesionales sanitarios de atención primaria de Cataluña. *Aten Primaria* 2016;48:192–9.
- 35 Vishram B, Letley L, Jan Van Hoek A, et al. Vaccination in pregnancy: attitudes of nurses, midwives and health visitors in England. *Hum Vaccin Immunother* 2018;14:179–88.
- 36 Trabucco Aurilio M, Mennini FS, Gazzillo S, et al. Intention to be vaccinated for COVID-19 among Italian nurses during the pandemic. *Vaccines (Basel)* 2021;9:500.
- 37 Bauernfeind S, Hitzgenbichler F, Huppertz G, et al. Brief report: attitudes towards COVID-19 vaccination among hospital employees in a tertiary care university hospital in Germany in December 2020. *Infection* 2021;49:1307–11.
- 38 Paoli S, Lorini C, Puggelli F, et al. 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 (Basel)* 2019;7:201.
- 39 Scarpitta F, Restivo V, Bono CM, et al. The role of the community pharmacist in promoting vaccinations among general population according to the National Vaccination Plan 2017-2019: results from a survey in Sicily, Italy. *Ann Ig* 2019;31:25–35.
- 40 Serino L, Maurici M, D'Alò GL, et al.; Local Health Units Vaccination Group. Healthcare workers training courses on vaccinations: a flexible format easily adaptable to different healthcare settings. *Vaccines (Basel)* 2020;8:514.
- 41 References 41–50 are available in the Supplementary Material.