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# PUBLIC HEALTH AUTHORITIES' PERCEPTIONS OF, AND STRATEGIES FOR, COMMUNICATING AND ADDRESSING VACCINE HESITANCY WITH AND AMONG HEALTHCARE WORKERS IN EUROPE:

A mixed methods analysis of the European Joint Action on Vaccination survey, "VACCINE HESITANCY AND UPTAKE: FROM RESEARCH AND PRACTICES TO IMPLEMENTATION"

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ABSTRACT

David Carranza: “Public health authorities' perceptions of, and strategies for, communicating and addressing vaccine hesitancy with and among healthcare workers in Europe.”
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Reaching public health goals requires comprehensive and dependable communication strategies. The public is usually the target of public health communication, including vaccination communication. As the body of evidence grows showing vaccine hesitancy is best combatted through interpersonal relationships, such as between physician and patient, the need for effective public health communication directed at healthcare workers (HCWs) becomes prominent. Using a mixed methods analysis of a survey tool developed by the European Joint Action on Vaccination, this study attempts to understand how public health authorities in 28 European countries perceive and address vaccine hesitancy through communication activities.

First, the respondents elaborated on their definitions of vaccine hesitancy, which were mostly tantamount to a lack of confidence in vaccinations. Next, they perceived HCWs as a population that largely posed a limited risk of contributing to overall vaccine hesitancy. This trust in HCWs was reiterated as they were reported to be a prominent strategy in delivering vaccine information to the public. Health authorities communicated with HCWs primarily through seminars and training events, along with similar strategies used for the public, such as official websites. Furthermore, among the shared strategy of informational brochures, HCW-focused communication was emphasized less than those aimed at the public ($p<0.001$). Lastly, regardless of reported barriers to conducting vaccine hesitancy-related work or other factors within the survey, a statistical relationship could not be established to explain the level of emphasis health authorities place on vaccine communication aimed at HCWs. Overall, current perceptions of and the work on vaccine hesitancy remains non-specific and focused more on the public than on HCWs. Due to a small sample size and a narrow focus on European countries, a larger study of health authorities should be conducted to better understand how they perceive and address vaccine hesitancy via HCW-focused communication activities.

Keywords: vaccine hesitancy, public health communication, vaccine communication, healthcare workers, survey, mixed methods

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ABBREVIATIONS

DTaP: diphtheria, tetanus, and pertussis

E-health: electronic health

EU-JAV: European Joint Action on Vaccination

HCW: healthcare worker (or health care worker)

HepB: hepatitis B

Hib: *Haemophilus influenzae B*

HPV: human papillomavirus

MMR: measles, mumps, and rubella

PCV: pneumococcal conjugate vaccine

Td: tetanus, diphtheria

TDaP or Tdap: tetanus, diphtheria, and pertussis

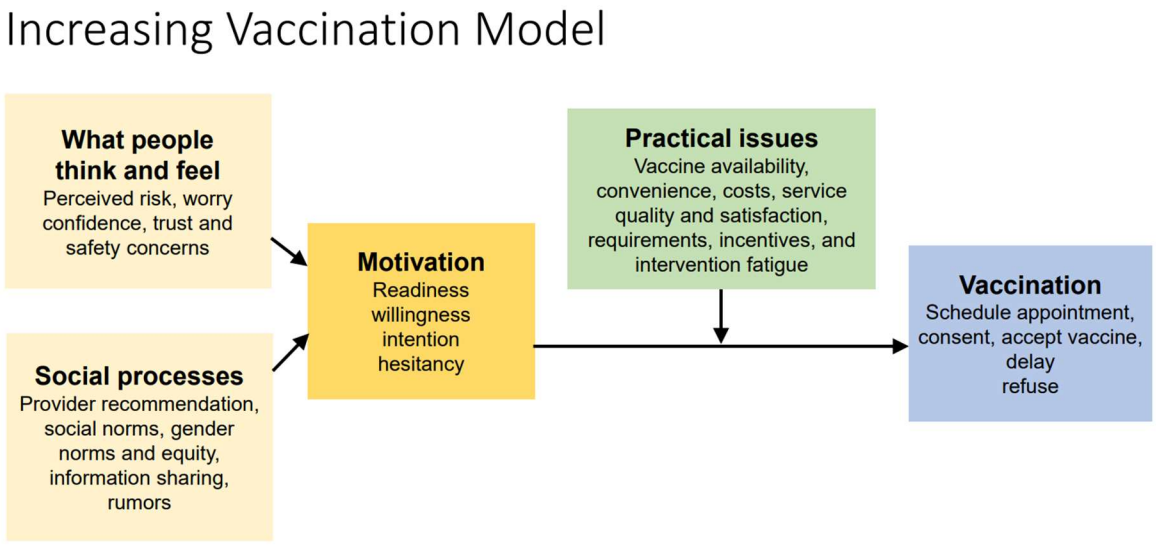
VPD: vaccine-preventable disease

WHO: World Health Organization

# 1 INTRODUCTION

Defined by the World Health Organization (WHO) as a delay in acceptance or refusal of vaccines despite the availability of vaccination services, vaccine hesitancy's root causes and its impact on public health are growing more prominent in both scholarly and popular media. In 2019, the vaccine hesitancy issue was realized as one of the WHO's ten threats to global public health. (WHO, 2019) The rationale behind vaccine hesitancy and refusal has been widely studied and can be summarized as a complex function that includes complacency, convenience, and confidence, otherwise known as the three C's of vaccine hesitancy. These findings are incorporated in the 'Increasing Vaccination Model' (See Figure 1) created by the WHO expert group, Measuring Behavioural and Social Drivers of Vaccination (BeSD). (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015 & The BeSD Expert Working Group, 2017)

**Figure 1: The BeSD Expert Working Group's Increasing Vaccination Model**

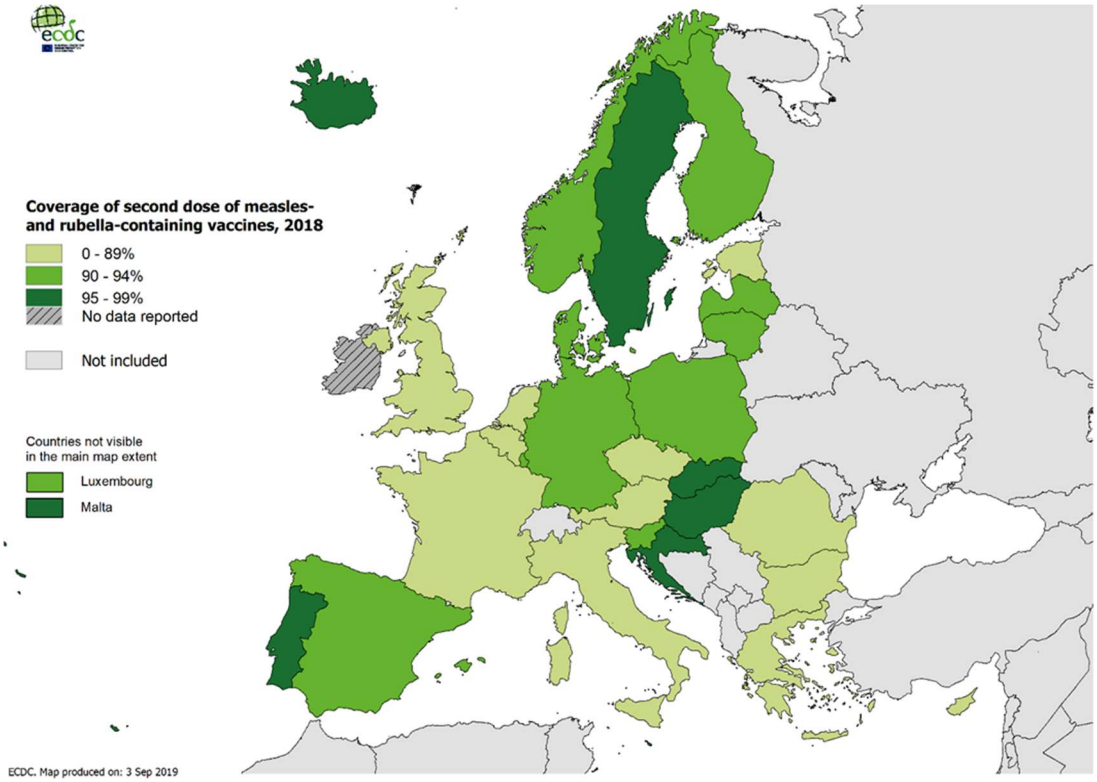



Coordinated national and global vaccination strategies have been used in the past to curb the spread of lethal diseases such as smallpox and polio, and newly with the COVID-19. The public health outcome of vaccine hesitancy has been borne out in recent history through increasingly worrying signs. A global increase in outbreak events of vaccine-preventable diseases (VPDs) has been seen in areas with declining rates of vaccine uptake. Outbreaks of measles, for example, have even occurred in countries where it had been once considered eradicated, and 2018 saw the highest number of confirmed cases of measles globally in 20 years (Robert et al., 2019).

Though vaccination rates remain relatively high in Europe, for example, many countries fall short of the recommended targets set by the WHO. Again, in the case of measles, the WHO recommends that 95% of children receive 2 doses of the measles vaccine to reach the herd immunity threshold (WHO Regional Office of Europe, 2018). Failing to meet the threshold increases the risk of outbreaks particularly with a highly infectious disease such as measles. In 2018, the European Centre for Disease Prevention and Control (ECDC) reported that vaccine coverage failed to meet WHO recommendations in most of Europe (ECDC, 2019). These findings, illustrated in Figure 2, show that a failure to reach the recommend vaccine coverage level is not limited to any single region of Europe.

Addressing low vaccine uptake, including when it is due to vaccine hesitancy, is among the primary goals of public health authorities globally. Numerous strategies have been implemented to inform the public on the benefits of vaccination, tackling concerns regarding the safety of vaccines, and ultimately encourage the decision to vaccinate. Some strategies inevitably involve engagement with healthcare workers (HCWs), not only as the personnel responsible for administering vaccines but as trusted medical advisors from whom their patients will take guidance. HCWs who act as vaccine advocates allow the health authorities' vaccine communication efforts to reach more people, and with greater depth.

**Figure 2: Second-dose measles and rubella vaccination coverage in the EU in 2018**



Yet, despite this overarching goal, there have been few studies looking directly at the communication strategies that health authorities use to deliver vaccine information to HCWs. This study attempts to create a landscape of current practices of health authorities in Europe in communicating vaccine information to HCWs, along with to the public, and relate this finding to other contextual factors such as the understanding of the definition and scope of vaccine hesitancy, the perceived risk of vaccine hesitancy among HCWs, and current practices and challenges to improve vaccine confidence and uptake.

# 2 LITERATURE REVIEW

## 2.1 Background

The current literature on vaccine hesitancy is largely split into two broad areas: literature on the determinants of vaccine hesitancy and policy solutions towards improving vaccine confidence. As previously mentioned, the WHO notes vaccine hesitancy is composed of a triumvirate of complacency, inconvenience, and a lack of confidence.

First, the complacency aspect of vaccine hesitancy has already been addressed largely through the implementation of various vaccination schemes. Governments aim to achieve desirable levels of vaccine coverage by, for example, linking the vaccination status of children to entrance into public schools or by imposing fines on parents that fail to vaccinate their children. Programs for mandatory vaccination exist in many countries in Europe, but there is a high degree of variation between the vaccine schedules and recommendations between countries. For example, receiving the two-dose series of measles is considered mandatory in the vaccine schedule for France and Italy, while the vaccine series remains only recommended in Sweden and Portugal. Some routine vaccinations, such as influenza, and most adult vaccinations are not considered mandatory for the general population anywhere in Europe. (ECDC Vaccine Scheduler, 2020)

The literature on mandatory vaccination programs is quick to point out that one of its shortfalls is the increase over time of non-medical exemptions (NMEs). These exemptions may be granted for religious or personal objections to a certain vaccine or can act as a blanket exemption on all vaccines. A recent study focusing on exemptions in Europe found that mandatory vaccination was only associated with decreased measles incidence for countries without NMEs (although no significant relationship was not found for pertussis), and that the magnitude of fines for non-compliance was also associated with higher vaccination coverage (Vaz, et al., 2020). Another troubling conclusion was drawn from a study in California that concluded that vaccine refusal via NMEs is a self-reinforcing and spatially diffusive process – in other words growing fastest in areas with high refusal and then spreading to neighboring areas (Delamater, Leslie, & Yang, 2018). Therefore, addressing complacency through mandatory vaccination schemes has been well-researched and has been found to result in mixed effects. Despite that, it remains a popular policy tool to reduce vaccine hesitancy and improve vaccine uptake in Europe.

Second, the literature focused on the inconvenience of vaccination is scarcer, partly due to the inconsistency in the definition. Broadly, inconvenience is represented by a function of financial and non-financial costs associated with vaccination (i.e., transportation to a vaccination clinic, time spent off work to receive a vaccine) as well as issues regarding vaccine access and degree of interaction with a health service. Though it is listed as one of the most prominent determinants of vaccine uptake in patients (Schmid et al., 2017), it is listed as a rare determinant of hesitancy among health care workers (HCWs) – who are the focus of this thesis - given the proximity and amount of contact that HCWs have to health system infrastructure that would make vaccines more readily available to them compared to other segments of the population.

Third, the literature on "lack of confidence" is perhaps the most dynamic due to the unorganized approach in methodology and recommendations coinciding with rapid growth in the body of research. The most popular methods to improve confidence revolve around interventions to raise awareness and among patients on the importance, efficacy, and safety of vaccines. Though well-intentioned, the wholesale dispensing of education may add to the deluge of information that patients receive from both credible and non-credible sources (McClure, Cataldi, & Sean T O'Leary, 2017).

In contrast to the importance of improving vaccine confidence among patients as a means of increasing vaccine uptake, there is much less clear information about the efforts to improve vaccine confidence among HCWs. Communicating vaccine information with HCWs and educating them on the latest information are increasingly being studied as potential solutions to the confidence problem. However, no studies have drawn comparisons on how many health authorities perceive the threat of vaccine hesitancy among HCWs and which educational programs they pursue because of those perceptions. If a coordinated regional or global effort to educate HCWs is to exist, a baseline of risk and current programs must first be established.

This literature review will briefly examine the causes and impacts of vaccine hesitancy among HCWs, the results of studies aimed at improving vaccine confidence among HCWs, and the research gap that exists on HCW-focused vaccine communication and education.

## 2.2 Healthcare workers as determiners of vaccine uptake

The implications and public health impact that HCWs have on influencing vaccine-hesitant patients have been well-documented. Recommendations from HCWs play a large role in a patient's decision to vaccinate themselves or their children (Giambi et al., 2018; Kassianos et al., 2018), If a provider recommendation is trusted and well-informed, it may help assuage vaccine-hesitant patients to participate in immunization. In a literature review of vaccine hesitancy and HCWs, HCWs were found to be "the most trusted advisor and influencer of vaccination decisions." Yet, the same review finds that HCWs may lack the resources and institutional support to take the time to discuss vaccine hesitancy with their patients. (Paterson et al., 2016)

Time constraints among the HCWs prevent them from acting in the ever-changing vaccine information landscape. The proliferation of inaccurate or incomplete information devolves into a situation that might promote vaccine hesitancy among patients (Kestenbaum Lori & Feemster Kristen, 2015). This situation is made more precarious since social media and social networks are major sources of vaccine information for many (Wheelock, Miraldo, Thomson, Vincent, & Sevdalis, 2017). Besides combating disinformation, HCWs must juggle regularly changing vaccine schedules and recommendations with the introduction of new practice guidelines, recent clinical trial safety, and efficacy data, or the introduction of a novel vaccine product or formulation. Because individual vaccine recommendations are directly related to comorbid chronic health conditions (for example, diabetes), changes in specific disease treatment guidelines may also require an update of the vaccination schedule. If a provider is not updated on changes recommended by the latest clinical guidelines, or safety and effectiveness data on vaccines, the providers' credibility is questioned, weakening the recommendation to vaccinate.

## 2.3 Vaccine hesitancy among healthcare workers

Identification of determinants of vaccine hesitancy is also a well-studied area. As mentioned before, the three "C's" of vaccine hesitancy and newer models have been constructed to explain how individuals make the decision to vaccinate themselves or their children. These models are general in that they are not focused on local/contextual circumstances nor on precise segments of the population, such as HCWs. A focus in the literature on the specific determinants of vaccine hesitancy among HCWs is a much newer, yet rapidly growing, field. Many vaccines for practicing HCWs are mandatory, particularly those working within larger institutions (for example hospitals or clinics). Despite this, and even if they may have higher reported vaccine uptake rates than the public, several studies

have found HCWs had suboptimal vaccine uptake for both mandatory and non-mandatory vaccines. Likewise, though fewer HCWs would report being hesitant about vaccines than the public, hesitancy in the HCW population remains a stubborn issue for many countries (Tafuri et al., 2014). Vaccine hesitant HCWs contribute to overall suboptimal vaccine uptake twofold by failing to vaccinate themselves and by being less likely to recommend or encourage their patients to vaccinate (Karlsson et al., 2019).

Determinants among HCWs appear to be as diverse as their patients. Following the earlier understanding of the definition of vaccine hesitancy, confidence, convenience, and complacency all play a role in an HCW's decision to vaccinate. For example, in one study, HCWs that expressed vaccine hesitancy described vaccine safety as their main determinant, particularly when there was a lack of communication or transparency from health authorities or pharmaceutical companies on the safety of new vaccines (Karafillakis et al., 2016).

Sometimes the hesitancy arises from a specific vaccine. For example, one study of Italian HCWs found that the perceived ineffectiveness of the influenza vaccine in preventing the seasonal flu was the main reason HCWs used to justify refusal of receiving the influenza vaccination (Arghittu et al., 2020). An additional study on Italian HCWs looked at the attitudes and uptake of four vaccines – DTP, HepB, MMR, and influenza. Among the top reasons for failing to take these vaccines were lack of knowledge (DTP), the vaccine was considered to be unnecessary (HepB), and the perceived uselessness of the vaccine (influenza). A concerning finding was that over 70% of HCWs who missed vaccination reported that were immunized. (Di Martino et al., 2020)

Outside of concerns of particular vaccines, institutional barriers and issues have also contributed to vaccine hesitancy in HCWs. A study in Singapore concluded that in addition to misperceptions and cognitive biases at the individual level, a lack of overt vaccine promotion at the institutional level is a major determinant for vaccine hesitancy. The study continues, saying that without a regular flow of targeted vaccine education, HCWs can be susceptible to vaccine hesitancy, which will have a limiting effect on vaccine uptake. (Sundaram et al., 2018).

Overall, vaccine hesitancy among HCWs, just as in their patients, is determined through multiple interacting factors and is an undeniable public health challenge contributing to vaccine hesitancy in the greater population.

### 2.4 Intervention targets of and for healthcare workers

Since the emphasis placed on a provider recommendation as a decision whether to vaccinate is great, providers are an ideal target for intervention to improve vaccine uptake and confidence. As mentioned before, mandatory vaccination policies for HCWs seem to be a popular intervention across health systems. However, mandatory vaccination does not necessarily address the determinants of vaccine hesitancy described above.

Health communication directed at HCWs as a method to improve vaccine confidence is still a growing field in scientific literature. It seems intuitive that a well-informed HCW workforce would be confident in vaccines and would be proactive in promoting vaccine uptake in their patients. Clear communication on vaccinations, including through non-conventional channels such as social networks and mass media have been identified as crucial to combatting vaccine hesitancy among HCWs (Genovese et al., 2019).

Many studies have experimented with a wide range of programs to boost vaccine confidence among HCWs and strengthen the effects of their recommendations to vaccinate. One large survey conducted among HCWs in the United States found that knowledge of vaccine policy and on-site vaccine access was associated with vaccine acceptance. Furthermore, the study found that activities to increase access to vaccines have positive results on vaccine acceptance and concluded that focused communication to increase awareness and understanding of vaccine policy could increase vaccination acceptance. (Eaton et al., 2017). Similarly, a combined education campaign with a free-of-cost vaccination drives improved uptake of the influenza vaccine among HCWs working in long-term care facilities (Kimura et al., 2007). A broader literature review conducted in Europe also found that training and education aimed at improving vaccine knowledge among HCWs resulted in improved rates of vaccine uptake (Dubé et al., 2015).

Recent efforts have even extended to studying vaccine confidence and hesitancy among students in the health sciences. Introducing discussions on vaccine hesitancy into the academic curriculum can empower healthcare students who will eventually become practicing HCWs. A recent cross-sectional study conducted among Croatian medical students revealed that only 33% of respondents believed that they received enough education on vaccination and vaccines during their undergraduate students (Bralic & Pivalica, 2019). In France, a study found that younger students in health care studies felt more positive towards vaccine safety and efficacy and mandatory vaccine policy, but those perceptions declined with age as they advanced through their academic program (Daudel, Mary, & Epaulard, 2020).

As these examples illustrate, the timing of vaccine education is crucial. Interventions among these health students have also led to the positive effects seen with the practicing HCWs. One pharmacy school in the United States utilized simulated patient interview training to practice vaccine counseling on vaccine-hesitant patients. The program reported that students undergoing the simulation reported increased confidence and improved ability to persuade a patient who was vaccine-hesitant (Vyas et al., 2018). Vaccine hesitancy is certainly discussed among HCWs and through popular media sources but equipping HCWs and future HCWs with knowledge early on in their career can instill them with greater confidence in vaccines, and further empower them to be confident vaccine promoters who will confront vaccine concerns when they inevitably encounter vaccine hesitancy among their patients.

Lastly, it is important to note that no two educational programs or communication strategies are alike. This literature review has laid out the case for the justification to pursue a communication-based approach towards combatting vaccine hesitancy. Yet it has also shown that the types of approaches rely on the setting of HCWs and the environment around them. Moreover, some studies find that increased HCW education alone is insufficient to produce a goal of increase vaccine uptake among HCW or their patients (Kimura, Nguyen, Higa, Hurwitz, & Vugia, 2007; McClure et al., 2017).

Overall, it is evident that vaccine hesitancy among HCWs has become more acknowledged and the subject of interventions in recent history. Focused communication and educational materials appear to be a promising strategy to reduce vaccine hesitancy and improve vaccine uptake. Yet, the relationship greatly depends on other factors surrounding the situation and the type of education.

## 2.5 Research protocol

The main aim of this thesis is to observe and analyze mechanisms that European countries employ to communicate and educate HCWs on vaccine effectiveness and safety and how this relates to other factors surrounding the understanding and work conducted to improving vaccine confidence and uptake. The purpose of this thesis is to establish a landscape and investigate the relationship between the perceptions of the threat of vaccine hesitancy among HCWs and subsequent actions taken by governments to address it.

The data for this thesis was collected in the form of a survey via an ongoing effort by the European Joint Action on Vaccination (EU-JAV) to gather data on current programs aimed at combatting vaccine hesitancy. Using a mixed-methods approach, this thesis will review activities to help establish a landscape of the efforts to employ communication efforts and education as tools against vaccine hesitancy among the survey respondents. The findings should make an important contribution to the field of describing and evaluating vaccine hesitancy-related work related to HCWs.

## 2.6 Research questions

This thesis will offer important insights into the relationship between respondents' perceptions of vaccine hesitancy and their actions through five research questions:

(1) How do the respondents define vaccine hesitancy?

(2) To what extent is the lack of vaccine confidence among HCWs perceived by the respondents to be a determinant of vaccine hesitancy?

(3) What type of communication strategies regarding vaccine safety or effectiveness directed at HCWs are most pursued and emphasized by the respondents?

(4) What difference exists in the emphasis of vaccine communication strategies aimed at HCWs compared to methods of delivering vaccine information to the public directly? And lastly,

(5) How is the emphasis placed on vaccine communication strategies aimed at HCWs associated with the perceived lack of vaccine confidence among HCWs, strategies pursued by the respondents to improve vaccine confidence/ uptake, and barriers to such work?

**2.7 Research hypotheses**

The WHO definition of vaccine hesitancy has been discussed before, however, that definition is by no means universal. The first research question does not have a testable hypothesis; however, the respondents' understood definition of vaccine hesitancy will be reflected in their responses and therefore will impact the analysis of the other research questions. Any discrepancies among the respondents would result in different interpretations of the perceived link between HCWs and vaccine hesitancy.

The following two research questions also do not have testable hypotheses. Answering these questions will instead be useful in building the landscape for a present-day understanding of vaccine hesitancy among HCWs and the current vaccine communication strategies targeting HCWs among the respondents.

By contrast, the last two questions can be evaluated through a hypothesis framework. This study first hypothesizes that communications directed at HCWs are emphasized in a similar manner as communication with the public. Second, respondents who report a greater emphasis on HCW communication activities will report a greater perceived threat posed by the lack of vaccine confidence among HCWs, will more greatly emphasize conducting work that relates to HCWs and will report fewer barriers to work on vaccine hesitancy.

This thesis does not engage with establishing a comparative effectiveness argument between communication strategies or public health interventions. Therefore, no recommendation can be made, nor can any conclusions be drawn, on the superiority or inferiority of any specific activities. Nor does this study attempt to place a target level of the necessary amount of emphasis needed for communication strategies to be effective. Nevertheless, it is imperative to identify the current perception and activity landscape to make meaningful decisions on interventions for the future.

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## ARTICLE MANUSCRIPT


## ABSTRACT

Reaching public health goals requires comprehensive and dependable communication strategies from public health authorities. As the body of evidence grows showing vaccine hesitancy is best combatted through interpersonal relationships, such as between provider and patient, the need maintaining vaccine communication with HCWs becomes increasingly relevant. Using a mixed methods analysis of a survey tool from the European Joint Action on Vaccination, this study gathers the perceptions of and actions to address vaccine hesitancy as it relates to HCWs among health authorities in 28 European countries.

The respondents' definitions of vaccine hesitancy was mostly synonymous with a lack of confidence in vaccinations. They perceived HCWs as a population that posed a limited risk of contributing to vaccine hesitancy, and preferred communicating with HCWs through seminars and training events. When comparing identical communication strategies, such as informational brochures, HCWs were emphasized less than the public. Regardless of reported barriers to conducting vaccine hesitancy-related work, a relationship could not be established to explain the level of emphasis health authorities place on vaccine communication aimed at HCWs. Overall, the health authorities' perceptions of vaccine hesitancy remain narrow, which corresponds to broad, unspecific approaches to their HCW-focused communication tactics.

## INTRODUCTION

Defined by the World Health Organization (WHO) as a delay in acceptance or refusal of vaccines despite the availability of vaccination services, vaccine hesitancy's root causes and its impact on public health are growing more prominent in both scholarly and popular media. In 2019, the vaccine hesitancy issue was realized as one of the WHO's ten threats to global public health. (WHO, 2019) The rationale behind vaccine hesitancy and refusal has been widely studied and can be summarized as a complex function that includes complacency, convenience, and confidence, otherwise known as the three C's of vaccine hesitancy. These findings are incorporated in the 'Increasing Vaccination Model' (See Figure 1) created by the WHO expert group, Measuring Behavioural and Social Drivers of Vaccination. (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015 & The BeSD Expert Working Group, 2017)

Coordinated national and global vaccination strategies have been used in the past to curb the spread of lethal diseases such as smallpox and polio, and newly with the COVID-19. The public health outcome of vaccine hesitancy has been borne out in recent history through increasingly worrying signs. A global increase in outbreak events of vaccine-preventable diseases (VPDs) has been seen in areas with declining rates of vaccine uptake. Outbreaks of measles, for example, have even occurred in countries where it had been once considered eradicated, and 2018 saw the highest number of confirmed cases of measles globally in 20 years (Robert et al., 2019).

Though vaccination rates remain relatively high in Europe, for example, many countries fall short of the recommended targets set by the WHO. Again, in the case of measles, the WHO recommends that 95% of children receive 2 doses of the measles vaccine to reach the herd immunity threshold (WHO Regional Office of Europe, 2018). Failing to meet the threshold increases the risk of outbreaks particularly with a highly infectious disease such as measles. In 2018, the European Centre for Disease Prevention and Control (ECDC) reported that vaccine coverage failed to meet WHO recommendations in most of Europe (ECDC, 2019). These findings, illustrated in Figure 2, show that a failure to reach the recommend vaccine coverage level is not limited to any single region of Europe.

Addressing low vaccine uptake, including when it is due to vaccine hesitancy, is among the primary goals of public health authorities globally. Numerous strategies have been implemented to simultaneously inform the public on the benefits of vaccination and address concerns regarding the safety of vaccines to ultimately encourage the decision to vaccinate. Some strategies inevitably involve engagement with healthcare workers (HCWs) as the personnel responsible for administering vaccines but as trusted medical advisors from whom their patients will take guidance.

HCWs who act as vaccine advocates allow the health authorities' vaccine communication efforts to reach more people, and with greater depth.

Yet, despite this overarching goal, there have been few studies looking directly at the communication strategies that health authorities use to deliver vaccine information to HCWs. This study attempts to create a landscape of current practices of health authorities in Europe in communicating vaccine information to HCWs, along with to the public, and relate this finding to other contextual factors such as the understanding of the definition and scope of vaccine hesitancy, the perceived risk of vaccine hesitancy among HCWs, and current practices and challenges to improve vaccine confidence and uptake.

## MATERIALS AND METHODS

### Data source

The data in this study is derived from a European Joint Action on Vaccination (EU-JAV) survey entitled "EU Joint Action on Vaccination – Vaccine hesitancy and uptake. From research and practices to implementation." This survey was distributed among the 32 European countries with the stated goal of "develop[ing] a systematic overview and analysis of the current situation of activities related to vaccine hesitancy and uptake, including best practices and lessons learned in the Member States and their regions." (EU-JAV, 2018). Responses were collected from the respondents between November 2019 and June 2020.

Each country designated one person to respond to the survey, ultimately resulting in 28 respondents. The respondents are public health professionals in their countries, though no inclusion criteria were outlined.

The survey tool contains 77 items with a mixture of Likert scale, yes/no, and free-response questions. The questions cover many areas of vaccine hesitancy, from perceived determinants of hesitancy, institutional and health system barriers that prevent work on vaccine uptake, and the efforts undertaken by governments to assuage their country's vaccine hesitancy problem through communication and other strategies. The survey in its entirety can be found in the appendix. Respondents were not required to answer any of the survey items, leaving many items with missing data. This was more evident among the qualitative survey items. Missing data was dropped from analysis.
As this is a mixed-method type of analysis, this thesis will analyze both the quantitative and qualitative data found within the survey. The methodologies employed and visualizations used follow an earlier report on the same report from the same authors (Carranza, et al., 2021).

### Description of quantitative analysis

Quantitative data come from multiple-choice, Likert scale-type, and yes/no questions. The responses to this type of question were coded into a scale of 1-5, with 1 representing the response "No,", 2-4 representing increasing agreement with the statement, and 5 representing the response, "I do not know."

Using the numerical values from the Likert Scale, resulting Spearman correlation statistics reveal relationships between responses in the survey. To create a meaningful correlation statistic, all responses coded as a 5 in the Likert Scale ("I do not know") were dropped from the analysis. The Spearman correlation statistics are evaluated under the framework of an alpha error of 0.05. Due to the small sample size of this survey, correlation statistics should not be used definitively to conclude a relationship exists between two variables. Instead, an observed trend found in the data may be worthy of further, more rigorous, investigation.

In another type of analysis, the raw totals (summation) of every respondent were gathered for each Likert Scale question. Like the correlation analysis, all responses coded with a 5 were dropped, as they would falsely inflate the extent to which the respondents agree to the statement. In addition, all responses coded as 1 ("No extent") were dropped because if the respondent believes the proper response was 'no extent,' then it should not increase the total value of the respondent's summed total. This type of analysis should be understood as the summation of ordinal rather than cardinal values, showing greater total extent scores on a relative, rather than absolute, scale and should be interpreted as such.

Friedman tests were utilized to test for the presence of statistical differences between the extent scores of communication strategies aimed at HCWs and the public. The Friedman test was chosen because it tests groups that are not independent since the same respondents answered each of these questions. To evaluate any differences between communication strategies that were not captured in the overall Friedman tests, post hoc Wilcoxon signed-rank tests were used. These tests were conducted using IBM SPSS Statistics 26, under an alpha value of 0.05.

**Description of qualitative analysis**

Qualitative data was defined by responses to questions with free text. The free text was entered either as a specification for a quantitative question or in response to a standalone question. A conventional content analysis method was used to analyze the free response answers found in the survey. Though mostly used in interviews, a conventional content analysis method is useful when an existing theory or research literature on a phenomenon is limited (Hsieh & Shannon, 2005). As previously discussed, this study encounters gaps in the literature regarding perceptions of public health officials (rather than the public or HCWs) and on the landscape and determinants of vaccine communication to HCWs. Therefore, theory or *a priori* themes are not always available for the responses

found in the survey. One exception, however, is using related literature (such as the well-researched definition of vaccine hesitancy) to break down the responses through a systematic approach for coding.

The overall coding process began with reading completely through the free-text responses of every respondent. On a second reading, keywords or phrases that had been repeated at least once were highlighted. These keywords then became grouped into relevant codes that would best encapsulate and summarize several similar keywords or phrases. For questions that asked respondents to clarify or specify a vaccine or vaccine-preventable disease, if enough responses were gathered for a question, the responses were first counted. Repeated responses, or ones that overlapped sufficiently, were counted together into an inclusive category each time the response appeared in that question.

Similarly, responses that listed a vaccine that contains multiple products, the responses were grouped together as a single response by their most inclusive product. For example, when a response included the hexavalent vaccine (diphtheria, tetanus, pertussis, poliovirus, *Haemophilus influenzae* B, and Hepatitis B), any other response for that question that mentioned the component vaccines or a combination of several, but not all, vaccines, was coded as hexavalent vaccine. The same method was used when respondents specified types of institutions they collaborate with or communication strategies that are employed.

When there were insufficient number of variety of responses to a free text prompt, the data was not analyzed. There was no discrete threshold on the number or variety of responses for this procedure, rather the decision was made on a question-by-question basis.

## RESULTS

### Definition of Vaccine Hesitancy

Before understanding the issues surrounding vaccine hesitancy, it is important to understand how vaccine hesitancy is defined and understood among respondent and their countries. The respondents were first asked about the how vaccine hesitancy is defined and understood (see Figure 3 below and Figures 4-5 in the Appendix). Then, they provided their own definitions, which are summarized in Figure 6.

Lastly, respondents were asked to identify discrepancies between the WHO definition of vaccine hesitancy and the terminology used in their countries along with explaining the implications for the discrepancies. The respondents listed several concerns, including the untranslatable nature of the term vaccine hesitancy in their countries' official language(s), the presence of a terminology gap between public health officials/researchers and the public, and that a lack of consistent terminology creates barriers to studying and conducting work to address vaccine hesitancy.

### Perception of vaccine hesitancy among HCWs

The respondents were asked about the extent that 13 determinants of vaccine hesitancy affect suboptimal vaccine uptake in their country. For the sake of comparison, the total extent scores (listed as percentages of a maximum extent score of 81) are listed together in Figure 7.

Figure 8 separates the data specific to the responses on the determinant of vaccine hesitancy among HCWs and visualizes the results onto a map (Figure 9 in the Appendix). Respondents were also asked to specify the vaccine type that most related to the issue of vaccine confidence among HCWs. These results are visualized in Figure 9. Figure 10 lists the responses that respondents believe that is responsible for HCW-based hesitancy.

### Types of communication strategies aimed at HCWs

The total extent scores are summarized in Figure 11. A correlation matrix (Figure 12) was created to evaluate the relationship between the different strategies. The Spearman correlation was used to test if the correlations were statistically significant. Too few responses were gathered from the free-text portion of the Likert Scale which asked

respondents to specify vaccine, VPD, or the communication strategy. While these results are not visualized, the findings are elaborated upon in the discussion section. Lastly, Figure 13 is a summary of the standalone question that asked respondents to elaborate on how vaccine information is communicated to HCWs in their country.

**Comparison of HCW-focused versus public-focused vaccine communication**

The survey tool separates public communication on vaccines into two areas: general information, and safety information. However, the options for the strategies within the Likert-type scale are identical in these two areas. Some of these outlined strategies overlap entirely with those for HCW communication.

The data collected are summarized in the following series of figures. In Figure 14, a table of both the total and median extent scores summarizes the landscape of vaccine communication to the public. To compare the differences that shared communication strategies are pursued between HCWs and the public, total and median extent scores were compared for each communication strategy (Figure 15). Statistical tests were used to compare the medians of these extent scores. The results of these tests are found in Figures 16 and 17.

**Associations between HCW-focused communication and determinants of vaccine hesitancy, and barriers/strategies to improve vaccine uptake**

Figure 17 contains the descriptive statistics of the HCW communication score, followed by a histogram of the communication scores for all respondents (see Figure 19 in the appendix). These HCW communication scores were analyzed against other responses to discover any trends between the extent of HCW communication strategies and other factors, summarized in Figure 20 (and broken down by variable in Figures 21-32 in the Appendix).

**Figure 3: Matrix of vaccine hesitancy definition responses**

| | **How well do you think this definition corresponds to how you understand the meaning of the term 'vaccine hesitancy' in your country/region?** | | | |
|---|---|---|---|---|
| **Is there a specific term/are there specific terms describing vaccine hesitancy in your country?** | Limited extent | Some extent | Great extent | Total |
| Yes | 2 | 5 | 12 | 19 |
| No | 0 | 0 | 6 | 6 |
| I do not know | 1 | 0 | 2 | 3 |
| Total | 3 | 5 | 20 | 28 |

**Figure 6: Codes gathered from the definitions of vaccine hesitancy**

| **Code** | | **Count** | **Details** |
|---|---|---|---|
| **Determinants** | Questioning/Doubt | 10 | Part of the WHO definition |
| | Complacency | 4 | Part of the WHO definition |
| | Inconvenience | 4 | Part of the WHO definition |
| | Opposition/Resistance | 3 | |
| | Discomfort | 1 | |
| | Reluctance | 1 | |
| | Fear | 1 | |
| | Distrust | 1 | |
| **Outcomes** | Refusal/rejection | 8 | Part of the WHO definition |
| | Delay | 7 | Part of the WHO definition |
| | Increase in the unvaccinated population | 4 | |
| | Increase in VPD prevalence | 1 | |

**Figure 7: Total extent scores of the determinants of suboptimal vaccine uptake**

| Determinant | % of Maximum Extent Score |
|---|---|
| Lack of confidence in vaccine safety | 52% |
| Specific groups within the population | 46% |
| Perceived risk of VPDs | 46% |
| Lack of confidence in vaccine effectiveness | 40% |
| Ideological reasons | 37% |
| Public perception of specific vaccines | 36% |
| Lack of confidence among HCWs | 23% |
| Lack of institutional confidence | 19% |
| Poor access of vaccination services | 17% |
| Inconvenience of vaccination services | 11% |
| Religious reasons or groups | 11% |
| Vaccine shortages | 9% |
| **Vaccine safety-related crisis** | 7% |

**Figure 8: Quantitative Responses to Perceptions of HCW-based Vaccine Hesitancy**

| | No extent | Limited Extent | Some Extent | Great Extent | No response |
|---|---|---|---|---|---|
| **N (% of total respondents)** | 12 (44%) | 12 (44%) | 2 (7.4%) | 1 (3.7%) | 5 |

**Figure 10: Free-Text Responses to Perceptions of HCW-based Vaccine Hesitancy**

| Vaccine type | % of Maximum Extent Score (N=14) |
|---|---|
| Influenza | 47% |
| PCV | 13% |
| HPV | 13% |
| MMR | 13% |
| All vaccines | 7% |
| Varicella | 7% |

**Figure 11: Summary of Extent Scores of HCW-targeted Communication Strategies**

| Strategy | Total Extent Score Max = 84 | Median Extent Score Max = 4 |
|---|---|---|
| Official website(s) | 74 | 4 |
| Meetings/lectures/training events | 65 | 4 |
| Official written communication | 57 | 3.5 |
| E-mail service | 51 | 3 |
| Post diploma education and/or continuous/updating training | 46 | 3 |
| Telephone service/hotline to public health institute or other | 44 | 3 |
| Informational brochures/pamphlets/leaflets | 39 | 2 |
| News media, including print and broadcast media, and online newspapers | 35 | 2 |
| Social media | 27 | 2 |
| E-health (electronic health services) | 11 | 1 |

**Figure 12: Correlation Matrix of HCW-focused Vaccine Communication Strategies**

| Communication Strategy | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Informational brochures, pamphlets, leaflets | - | | | | | | | | | |
| 2. Meetings, lectures, training events | 0,32 | - | | | | | | | | |
| 3. Official website(s) | 0,08 | 0,24 | - | | | | | | | |
| 4. News media | 0,49** | 0,36 | 0,10 | - | | | | | | |
| 5. Social media | 0,39 | 0,43* | 0,22 | 0,55** | - | | | | | |
| 6. Telephone service/hotline | 0,16 | 0,32 | 0,14 | 0,19 | 0,29 | - | | | | |
| 7. E-mail service | 0,25 | 0,54** | 0,61** | 0,05 | 0,50* | 0,34 | - | | | |
| 8. Official written communication | 0,27 | -0,03 | 0,54** | 0,04 | 0,05 | 0,17 | 0,39 | - | | |
| 9. E-health | 0,35 | -0,01 | -0,20 | 0,18 | 0,33 | 0,06 | 0,08 | 0,04 | - | |
| 10. Post diploma education and/or continuous/updating training | 0,28 | 0,30 | -0,15 | 0,32 | -0,08 | 0,36 | -0,14 | 0,11 | 0,11 | - |

*Spearman's correlation significant at the 0,05 level, **at the 0,01 level (two-tailed)

**Figure 14: Summary of Extent Scores of Public Communication Strategies**

| Strategy | Total Score (General) Max = 84 | Median Score (General) Max = 4 | Total Score (Safety) Max = 84 | Median Score (Safety) Max = 4 |
|---|---|---|---|---|
| Informational brochures, pamphlets, leaflets | 67 | 4 | 51 | 3 |
| School education | 29 | 2 | 19 | 2 |
| Official website(s) | 75 | 4 | 70 | 4 |
| News media | 53 | 3 | 41 | 3 |
| Social media | 50 | 3 | 36 | 2 |
| HCW when meeting with patient | 70 | 4 | 61 | 4 |
| Advertisements or campaigns | 51 | 3 | 20 | 2 |
| E-health | 34 | 2 | 7 | 1 |

**Figure 15: Summary of Extent Scores of Communications to the Public and HCWs**

| Strategy | Total Score (HCW) | Median Score (HCW) | Total Score (General) | Median Score (General) | Total Score (Safety) | Median Score (Safety) |
|---|---|---|---|---|---|---|
| Informational brochures, pamphlets, leaflets | 39 | 2 | 67 | 4 | 51 | 3 |
| Official website(s) | 74 | 4 | 75 | 4 | 70 | 4 |
| News media | 35 | 2 | 53 | 3 | 41 | 3 |
| Social media | 27 | 2 | 50 | 3 | 36 | 2 |
| E-health | 11 | 1 | 34 | 2 | 7 | 1 |

**Figure 16: Results of the Friedman Tests**

| Strategy | N | Chi-square | Asymp. Significance |
|---|---|---|---|
| Informational brochures, pamphlets, leaflets | 19 | 15.784 | <0.001 |
| Official website(s) | 27 | 1.286 | 0.526 |
| News media | 17 | 2.150 | 0.341 |
| Social media | 13 | 5.636 | 0.060 |
| E-health* | 1 | - | - |

*An insufficient number of cases (N=1), results in the inability to calculate a chi-square statistic.

**Figure 17: Results of the Wilcoxon Signed Ranks Tests**

| Strategy | HCW vs. General | | HCW vs. Safety | | General vs. Safety | |
|---|---|---|---|---|---|---|
| | *Z* | Sig. | *Z* | Sig. | *Z* | Sig. |
| Informational brochures, pamphlets, leaflets | -3.017 | 0.003** | -1.540 | 0.124 | -3.127 | 0.002** |
| Official website(s) | -0.277 | 0.782 | -1.000 | 0.317 | -1.155 | 0.248 |
| News media | -1.428 | 0.153 | -0.905 | 0.366 | -1.732 | 0.083 |
| Social media | -2.309 | 0.021* | -0.623 | 0.527 | -2.309 | 0.021* |

*p<0.05, **p<0.01

**Figure 18: Descriptive Statistics of HCW Communication Scores**

| | N | Mean | Median | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|---|
| HCW Comm Score | 28 | 16.04 | 16.00 | 5.65 | 6.00 | 26.00 |

**Figure 20: Mean and Median HCW Extent Scores by Strategies and Barriers**

| Survey Item | Statistic | No Extent | Limited Extent | Some Extent | Great Extent |
|---|---|---|---|---|---|
| Extent Lack of Confidence among HCWs Related to Suboptimal Vaccine Uptake | N | 12 | 12 | 2 | 1 |
| | Mean (95% CI) | 15.08 (11.82-18.35) | 16.50 (12.57-20.43) | 14.89 (9.59-20.19) | N/A |
| Extent Vaccine Work is Related to HCWs | N | 0 | 5 | 9 | 14 |
| | Mean | N/A | 13.00 (8.35-17.65) | 14.89 (9.59-20.19) | 17.86 (14.89-20.73) |
| Extent that a Lack of Funding Prevents Vaccine Work | N | 6 | 6 | 7 | 8 |
| | Mean | 16.33 (9.48-23.19) | 12.00 (5.88-18.12) | 18.14 (13.69-22.59) | 17.50 (13.28-21.72) |
| Extent that a Lack of Staff Prevents Vaccine Work | N | 11 | 7 | 7 | 3 |
| | Mean | 15.73 (11.79-19.67) | 14.57 (9.51-19.63) | 16.57 (10.63-22.51) | 19.33 (8.13-30.53) |
| Extent that a Lack of Mandate Prevents Vaccine Work | N | 18 | 6 | 4 | 0 |
| | Mean | 15.56 (12.68-18.43) | 16.50 (10.72-22.28) | 17.50 (7.07-27.93) | N/A |
| Extent that Organizational Limits Prevents Vaccine Work | N | 4 | 3 | 8 | 13 |
| | Mean | 16.25 (8.20-24.30) | 13.33 (5.35-21.32) | 18.00 (12.66-23.34) | 15.38 (11.80-18.96) |
| Extent that General Vaccine Information is Distributed via HCWs | N | 2 | 2 | 4 | 20 |
| | Mean | 12.00 (-13.41-37.41) | 7.50 (-11.56-26.56) | 13.00 (6.38-19.62) | 17.90 (15.47-20.43) |
| Extent that Safety Vaccine Information is Distributed via HCWs | N | 2 | 2 | 7 | 15 |
| | Mean | 12.00 (-13.41-37.41) | 7.50 (-11.56-26.56) | 15.29 (11.30-19.27) | 18.67 (15.75-21.58) |
| Survey Item | **Statistic** | **Yes** | | **No** | |
| Presence of Long-Term Strategies | N | 19 | | 9 | |
| | Mean | 15.89 (12.95-18.84) | | 16.33 (12.59-20.08) | |
| Presence of Collaborations on Vaccine Information | N | 6 | | 19 | |
| | Mean | 18.17 (12.88-23.45) | | 14.47 (11.80-17.15) | |
| Presence of Dedicated Staff for Vaccine Work | N | 13 | | 15 | |
| | Mean | 15.38 (11.93-18.83) | | 16.60 (13.42-19.78) | |
| Ability to Conduct Vaccine Work to Meet Needs | N | 13 | | 15 | |
| | Mean | 16.31 (13.14-19.47) | | 15.80 (12.38-19.22) | |

## DISCUSSION

### How do the respondents define vaccine hesitancy?

Most respondents reported having a term used to define vaccine hesitancy in their country (19/28). In addition, most believe the WHO definition of vaccine hesitancy is understood in their country to a great extent (20/28). Despite the absence of a-specific term for vaccine hesitancy among many respondents, respondents report the use of terms analogous for vaccine hesitancy.

The responses to question on the meaning of the term 'vaccine hesitancy' can be divided into two halves. The respondents defined vaccine hesitancy as both a sum of determinants that ultimately compose the concept and with the outcomes of suboptimal vaccine uptake.

On the determinant half, the responses gathered from the survey indicate that lack of vaccine confidence is considered tantamount with vaccine hesitancy itself. While vaccine hesitancy is composed of the "3 C's" of confidence, complacency, and convenience, clearly confidence plays an outsized role in the perception of vaccine hesitancy. This perception can, in turn, influence strategies pursued to increase vaccine uptake. If vaccine hesitancy is mainly addressed by boosting vaccine confidence, vaccine hesitancy is not fully nor comprehensively addressed.

On the outcome half, many responses shared the exact WHO definition including the phrase, '*delay in acceptance or refusal of vaccines.'* Some countries include more information, such as that the delay or refusal is due to non-medical reasons Another respondent notes that vaccine hesitancy alters the timing or number of doses of a vaccine administered.

When asked about the specific term, 'vaccine hesitancy,' many respondents reported that it cannot be directly translated into the official or prominent languages in their countries. Without direct translation, respondents gave analogs that often overlooked the nuance in the WHO definition. Specifically, the analogs of vaccine hesitancy provided were narrower in their definition and would translate more closely to vaccine skepticism, rejection, or refusal. The anti-vaccine movement, for example, was also repeatedly mentioned as a stand-in for vaccine hesitancy. Faced with this, many respondents reported an outright adoption of the terminology found in the WHO definition in their official communication to health professionals, though the popular understanding is more aligned with negative

terms. Without a consistent term or terms, communication strategies may be too narrow or confusing for both HCWs and their patients. Any study of vaccine hesitancy should arrive at an understood definition because it precludes addressing this public health issue.

**How is the threat of vaccine hesitancy among HCWs perceived?**

The results indicate that the lack of confidence in vaccines among HCWs is rarely perceived as a major determinant of vaccine hesitancy among the respondents. This is true of the overall results and even when looking at the different geographic regions. The responses were split evenly among countries that reported "no extent" and those that reported "limited extent.," with 12 responses each. The remaining 3 responses were higher than "limited extent."

Diminished perceptions of the risk of vaccine hesitancy in HCWs may be a sign that HCWs are trusted to be messengers and good examples of vaccine efficacy, safety, and acceptance. This could also be a sign that public health officials underappreciate the connection between individuals and healthcare providers in the decision to seek and receive vaccine services. If either or both are true, this can affect the amount of emphasis placed on the HCWs as a resource in combatting vaccine hesitancy. The connection between the two concepts will be explored in greater detail in the fifth research question.

When asked to specify which vaccines are responsible for hesitancy among HCWs, the influenza vaccine received a plurality of the responses (6 out of 14, or 43%), followed by a three-way tie for the second-most commonly cited vaccine between MMR, HPV, and PCV (all 2 out of 14). These findings are observed in figure 11. Hesitancy mostly directed at the influenza vaccine, which is in line with previously discussed studies. However, more research is needed to see if the MMR, HPV, and PCV vaccines are emerging as vaccines of concern among HCWs and targetable through public health intervention.

**How is vaccine information delivered to HCWs?**

A strong and trusted relationship between HCWs and their patients can be used to encourage vaccine uptake by tackling common drivers of poor vaccine uptake and vaccine hesitancy. HCWs themselves are not immune to vaccine hesitancy, and vaccine-hesitant providers may be less willing to address vaccine hesitancy among their patients.

The most-reported strategy to communicate vaccine information to HCWs is through official websites, followed by meetings/lectures/training events. These two strategies were the only ones with a median score of 4, indicating that the median response claimed that the respondent reported that the communication strategy was used "to a great extent." The least emphasized strategy involved the use of e-health (electronic health services). The e-health strategy was the only strategy with a median score of 1, indicating that the median response was that it was not used at all.

As seen in the correlation matrix in Figure 15, most of the correlations were positive, but no correlation could be classified as strongly positive or negative. The strongest correlation, at +0.61, was between an official website(s) and an e-mail service. This correlation statistic was found to be significant at the 0.01 level. Several other correlations were found to have statistical significance, but the strength of the association was less powerful. Overall, the correlation matrix does not provide any meaningful insight into the relationship between every mode of communication, but it does reaffirm that using official websites is the among preferred strategies for communicating vaccine information to HCWs.

Respondents also specified the vaccines or VPDs that are the focus of HCW communications as well as the communication method itself. Generally, specific vaccines or VPDs were not identified and instead many modes of communication were used for all vaccines or VDPs, with "all vaccines," serving as a popular response across respondents. However, it must be noted that very few responses were gathered in this free-text section of the communication strategies, with fewer than half of the respondents recording a response on each of the individual strategies. These findings indicate that many communication strategies employed by national health agencies and directed at HCWs are not vaccine or VPD-specific.

Turning to the individual methods, the responses revealed a lack of unique communication methods created for HCWs. For example, concerning websites, the qualitative data give no further clarification on whether there are websites designed especially for communication with HCWs or if they are aimed at any visitor on the website. Likewise, respondents' answers revealed that governments did not utilize news or social media platforms to communicate vaccine information with HCWs in a manner outside the extant methods of public health communication. This may explain why news and social media communications were among the least emphasized strategies. This observation will play an important role in the next research question.

Another popular strategy of disseminating vaccine information was the use of regional or other local health officials as communication liaisons between the national public health agencies and HCWs. This strategy may be valuable, relying on the more numerous local health professionals compared to their national counterparts. These local officials and experts would also be expected to have a closer connection to frontline HCWs and the communities they serve.

Lastly, when asked to elaborate in free text, the results are once again like previous responses. Meetings/seminars, websites, and training events are among the most common methods.

**How do communication strategies differ when targeting HCWs versus the public?**

This research question pulls from several questions to gather a better understanding of the determinants of the overall extent that communication strategies with HCWs are emphasized. As mentioned before, official websites were decidedly the most common strategy with communicated vaccine information to HCWs.

Communication of general and safety vaccine information was conducted through three main methods: official website(s), HCW when meeting with patients, and informational brochures/pamphlets. These results mirror the results of HCW communication strategy questions.

The strong emphasis on HCWs to be a channel of delivering vaccine information is a finding that should be considered when interpreting the results when answering this research question and in the last research question. To briefly return to the second research question, this result aligns with the finding that vaccine hesitancy among HCWs is perceived to have little to no impact on the overall vaccine confidence issues in Europe. In other words, HCWs are trusted by the respondents with the task of delivering vaccine information and improving vaccine confidence and uptake.

The communication options were not identical between the public and HCWs, therefore, evaluating a difference in total extent scores would lead to a poor interpretation. Instead, identical methods can be compared, and the sum of those identical methods would provide a clearer interpretation in determining if public or HCW communication takes precedence and is given more emphasis. General information directed at the public is the most emphasized of the three types of communication areas. On most occasions, vaccine safety information communicated to the public is also more emphasized than with vaccine communication to HCWs.

To test if there is a statistical difference in these three total extent scores (HCW, general information for the public, safety information for the public), the Friedman test was used. From the results of the Friedman test (see Figure 22), it appears that the only statistically significant difference between these three groups is found in the strategy of communicating via brochures, pamphlets, or leaflets. Compared to communication with the public, HCWs are less communicated with through this method. However, there was no statistical difference in the use of websites, news media, and social media.

The Wilcoxon signed ranked test reveals the difference in emphasis is statistically significant when comparing HCW-targeted communications and the public-targeted communication of general information, but not with safety information. Though social media did not initially meet the overall threshold for statistical significance, the post hoc test indicated the same as with prior findings – general information for the public is more emphasized than information for HCWs and safety information for the public. Unfortunately, there were too few responses mentioning the utilization of e-health for analysis. Only one respondent (from Iceland) reported utilizing e-health to at least some extent for all three of the communication options.

In the free-text sections of the scale-type questions, the response rate was low with no more than half of the respondents giving a response under each strategy. Like what was found in the previous research question, the "all vaccines" response appears in every question where respondents specified the vaccine or VPD target of a communication strategy. In fact, in every question, it is the most or second-most common response. Another frequent grouped response was "childhood vaccines." This finding indicates that many communication strategies targeted to the public are also not vaccine or VPD-specific.

There are some exceptions to this trend when a segment of the population is specifically targeted by a communication strategy. For example, children and young adults are specified targets of school-based communication strategies and social media. With respect to these two communication strategies, information on the HPV vaccine is listed as regularly or even more regularly than the catch-all response of "all vaccines." Since the HPV vaccine is administered to children and young adults, the communication strategy appears to correspond well with its audience.

Another communication strategy with more specification is that of advertisements and campaign, where the influenza vaccine is the commonly reported target. One possible explanation of why the influenza vaccine is targeted with this strategy is owing to its recommended regular, annual vaccination schedule. This method of communication was not

an option for HCW-focused communication, furthering the possibility that the vaccine-specific communication methods are mostly ones that targeted the public.

From comparing the landscapes of the communication strategies, we can gather a few conclusions. First, among shared modes of communication, there is only one method that has a meaningful statistical difference in emphasis between the public and HCWs – informational brochures, pamphlets, and leaflets. This communication strategy was found to be less emphasized with HCWs compared to the public. However, due to the small sample size, the results of the statistical tests cannot be taken alone into consideration when answering this research question, but rather in combination with other findings.

Second, the qualitative results reveal that there are undifferentiated strategies of communication activities aimed at HCWs and the public. Shared strategies of communicating vaccine information, such as websites, news, and social media, are largely identical regardless of the target audience. This finding relates to the first conclusion – there are few notable differences in the emphasis placed on communication strategies because the communication strategies are largely the same already.

Third and lastly, the communication activities aimed at HCWs and the public are largely unspecified for a vaccine or VPD target. Every strategy contains some responses (sometimes the most responses under that strategy) indicating that "all vaccines" are targeted with that strategy. Together with the first two conclusions, the finding is that vaccine communication strategies are generalized to reach all audiences and target several, sometimes, all vaccines.

All the findings when taken together indicate that there may be no statistical or characterizable difference in vaccine communication strategies between HCWs and the public with respect to the types of communication strategies that are pursued, or which vaccines are targeted.

**What determines the amount of emphasis placed on HCW communication?**

The calculation of an HCW communication score allows for a generalized summary of each respondents' characterization of the emphasis their country places on communication activities aimed at HCWs. In other words, the HCW communication score is a proxy for the extent that vaccine information is communicated with HCWs using all the strategies listed in the survey tool.

Using the same data from answering the third research question, the resulting HCW communication scores are highly variable across respondents. The maximum possible HCW communication score is 30, and while some respondents did approach this value, most of the respondents did not surpass a score of 20. The mean score was approximately 16, the same as the median. The standard deviation of this score was 5.65. The overall HCW communication score cannot be described as normally distributed. Instead, there appears to be a bimodal distribution, with both peaks close to the average. This phenomenon may only be a feature of the small number of respondents rather than an actual trend.

The overall statistical conclusion of this research question is that the HCW communication score is not statistically significantly different based on the tested factors of determinants of suboptimal vaccine uptake, type of vaccine-related work conducted, nor barriers to such work. This, once again, may be the result of having too few respondents to make a statistical distinction. Despite that, there are still some observable trends that may indicate the direction of a possible association between HCW communication score, and the factors tested. These trends are discussed in the next several paragraphs.

The answer to the second research question is that vaccine hesitancy among HCWs was not perceived to be a great threat to vaccine confidence or uptake among the respondents. Finding meaningful statistical differences between HCW communication scores was a difficult task to complete as the respondents were not evenly divided between groups. Twelve respondents stated that vaccine hesitancy among HCWs does not contribute whatsoever to suboptimal vaccine uptake, with another twelve reported the effect occurs to a limited extent. The results show that there is no visible trend in the relationship between HCW communication scores and vaccine hesitancy among HCWs, as was hypothesized. This finding serves to emphasize that the link between vaccine hesitancy among HCWs and suboptimal vaccine uptake is de-emphasized among the respondents.

The survey tool dedicates several questions to the type of work that is practiced addressing vaccine hesitancy and uptake issues. However, only the “work related to HCWs” is analyzed in this research question. Perhaps this might make the scope too narrow to observe differences in HCW action on vaccine hesitancy, but it is the only method listed that explicitly involves HCWs. Regardless, with this factor, there certainly appears to be a trend. As vaccine confidence and uptake work related to HCWs is pursued to a higher extent, the HCW communication score also tends to increase. This is rather intuitive, a respondent that reports that this type of work is conducted to a great extent is

likely also highly emphasizing their communication strategies with HCWs. Though the relationship may not appear statistically significant, with more data points, it could become a more well-defined positive linear relationship.

The next two factors related to vaccine-related work, the presence or absence of long-term plans on vaccine hesitancy and uptake and cross-border collaborative efforts, seem to be unable to predict the extent to which HCWs are communicated with.

The next factors tested relate to the barriers the respondents face to conducting vaccine confidence/uptake-related work along with the resources needed to conduct such work. Unlike previous factors, these have a relationship that seemingly contradicts the hypothesis. Respondents that report being limited more greatly by barriers to vaccine work also report higher HCW communication scores. For example, respondents that reported a lack of funding or staffing causing a barrier to vaccine work to some or a great extent had, on average, higher HCW communication scores than respondents reporting that they are unaffected by these issues. A possible explanation of this trend might be that respondents who report having greater barriers to their work assume they are conducting communication activities to great enough extent to come across these barriers. Before drawing any conclusions, however, it is important to note that the differences between response groups were not meaningfully significant across any of the barriers.

A similar relationship was seen in question of the presence of staff dedicated to vaccine work. Respondents that report a lack of dedicated staff to work on vaccine hesitancy reported having a higher HCW communication score. The results from the barriers section of this research question may also once again be a statistical peculiarity of a small population size of 28. Intuitively, respondents that report fewer barriers to conduct vaccine work should be conducting more vaccine work.

The one exception in the barrier group was seen in the question of whether the respondents were able to meet the needs related to vaccine work in their countries. Respondents that reported that they can meet their needs had, on average, a slightly higher HCW communication score than respondents who reported being unable to meet their needs in this area. This relationship is understandable as a higher HCW communication score implies that there are fewer communication activities that could be more emphasized among the respondents who claim to be able to meet their vaccine work needs.

Finally, HCW communication scores were compared against the extent to which vaccine information is communicated to the public via HCWs. Most respondents reported relying on HCWs to communicate vaccine information to their patients "to a great extent." As a result, the subgroups of the respondent's answers, like many other previous questions, were typically skewed to a certain side of the Likert Scale of options.

The HCW communication scores appear to follow an upward trend as the HCWs are relied on to a greater extent as messengers of vaccine information to the public. However since the "no extent" and the "limited extent" groups consist of only 2 respondents each, not much can be deduced from these findings statistically. However, from just the descriptive statistics alone, the findings agree with the premise of this comparison. Countries with public health authorities that communicate vaccine information with HCWs to a greater extent also rely on HCWs to deliver similar information to the public.

Overall, the answer to this research question remains inconclusive and in need of further studies. While there is a multitude of factors that ultimately determine the ability to communicate vaccine information to HCWs, it does not appear that the most likely determinants found in this survey tool are indicators of this ability.

**Limitations and next steps**

The main limitation of this study is the limited number of respondents available. A small sample size of 28 respondents provides a direct challenge to demonstrating statistically significant differences that the research questions sought. The variability in the richness of qualitative data also provides a challenge in attempting to accurately represent the collective views of all the respondents, especially in instances of missing qualitative data.

This study represents a novel effort to capture perceptions and communication strategies regarding vaccine hesitancy across multiple countries simultaneously. The survey tool is correspondingly broad and covers many topics, some of which were outside of the scope of this study. For example, this survey tool contains rich information on examples of best practices and on the perceptions of the barriers and benefits of international efforts to address vaccine hesitancy. These unexamined data is worth further examination to gain a better understanding of the current landscape of vaccine uptake-related work that is being conducted across Europe.

In addition to the additional areas for research with the data that was already gathered, there are opportunities to increase the number and scope of the respondents. A modified version of the survey tool, for example, was released later and aimed at non-governmental European organizations who conduct vaccine-related work. Including the perspectives of non-government actors along with regional and local health officials can better describe the vaccine hesitancy situation and the work being conducted throughout Europe. Increasing the number of respondents has the added benefit of bolstering efforts to review the quantitative data is a more statistically rigorous method.

## CONCLUSIONS

From each of the research questions, a through-line can be found in the relationship between the understanding of the definition of vaccine hesitancy to the communication strategies used to deliver vaccine information to HCWs. Throughout the survey, vaccine hesitancy is understood, perceived, and addressed by health professionals in generalizations rather than with specifics.

First, the respondents typically relied on broad, generalized definitions of vaccine hesitancy or used the WHO definition word-for-word. This resulted in an over-representation of vaccine confidence in these definitions. Sometimes, heuristics or stereotypes were used in place of definitions, such as anti-vaccine, as respondents acknowledged that the verbatim WHO definition is not always understood completely given the local language or context.

The discrepancies in defining vaccine hesitancy – in how it is defined by both national and local health authorities and how it is understood by the public – deserve further investigation. The impact that perceptions around the definition of vaccine hesitancy have on influencing the specific types of studies conducted and work directed at understanding and confronting vaccine hesitancy is also worth further research.

Second, vaccine hesitancy among HCWs is perceived as a minimal to non-existent threat to vaccine confidence and uptake. Though some respondents mention that HCWs can struggle with maintaining good vaccine uptake with the influenza vaccine, something found in other studies, those results serve only as a minor footnote in the overall perceptions that health authorities shared regarding the relationship between vaccine hesitancy and HCWs. It appears that respondents trust HCWs to be messengers of vaccine information to their patients as seen with their communication strategies. Furthermore, as a lack of vaccine confidence was largely conflated with vaccine hesitancy in its entirety, the respondents appear to depend on HCWs to primarily address vaccine confidence issues with their patients.

Third, HCWs are communicated through a broad portfolio of communication strategies. This is a positive finding in that health authorities are adapting to relatively newer platforms, such as social media. However, individual vaccines or VPDs are rarely a focal point of the different communication channels and, instead, communication strategies are broadened to cover all vaccines. Though respondents point to concerns with the uptake and confidence of specific

vaccines (for example, MMR, HPV, influenza) in multiple questions throughout the survey tool, they also report a lack of focused vaccine information communication strategies for HCWs. In addition, among the types of communication strategies that are shared between the public and HCWs, such as news and social media, the strategies are not tailored to the audience. The result is that many HCW communication strategies are trying to engage with everyone regardless of if they are HCWs or not.

Lastly, when comparing against multiple factors, the extent to which HCWs are communicated with appears to be largely independent of the perceived risk of vaccine hesitancy among HCWs, the type of work conducted by health authorities, and the barriers to conducted work related to vaccine hesitancy. This last point is hindered by the reality that the sample size of this survey was small. With only 28 respondents, a study that can obtain more respondents from local, rather than just national, health authorities, can better define the relationship between local context and the pursuit of HCW communication strategies.

In conclusion, the survey results indicate that the surveyed group of national health officials place a high degree of trust in HCWs to deliver vaccine information to the public. They also prefer to deliver such information to them focusing on the vaccine confidence aspect of vaccine hesitancy while being unfocused on specific vaccines or VPDs.

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## APPENDIX

**Figure 1: The BeSD Expert Working Group's Increasing Vaccination Model**

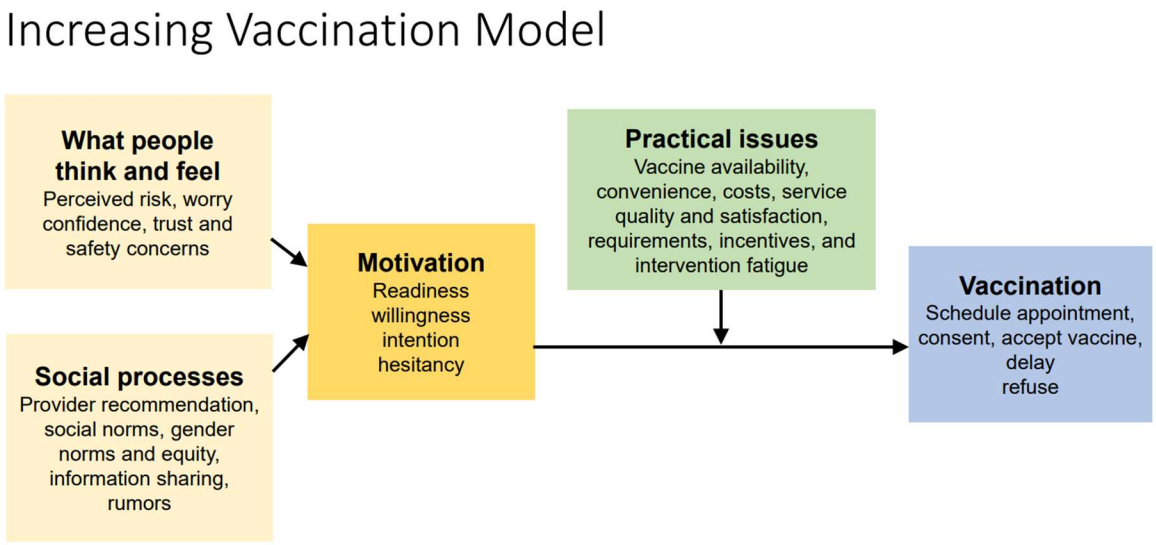


**Figure 2: Second-dose measles and rubella vaccination coverage in the EU in 2018**

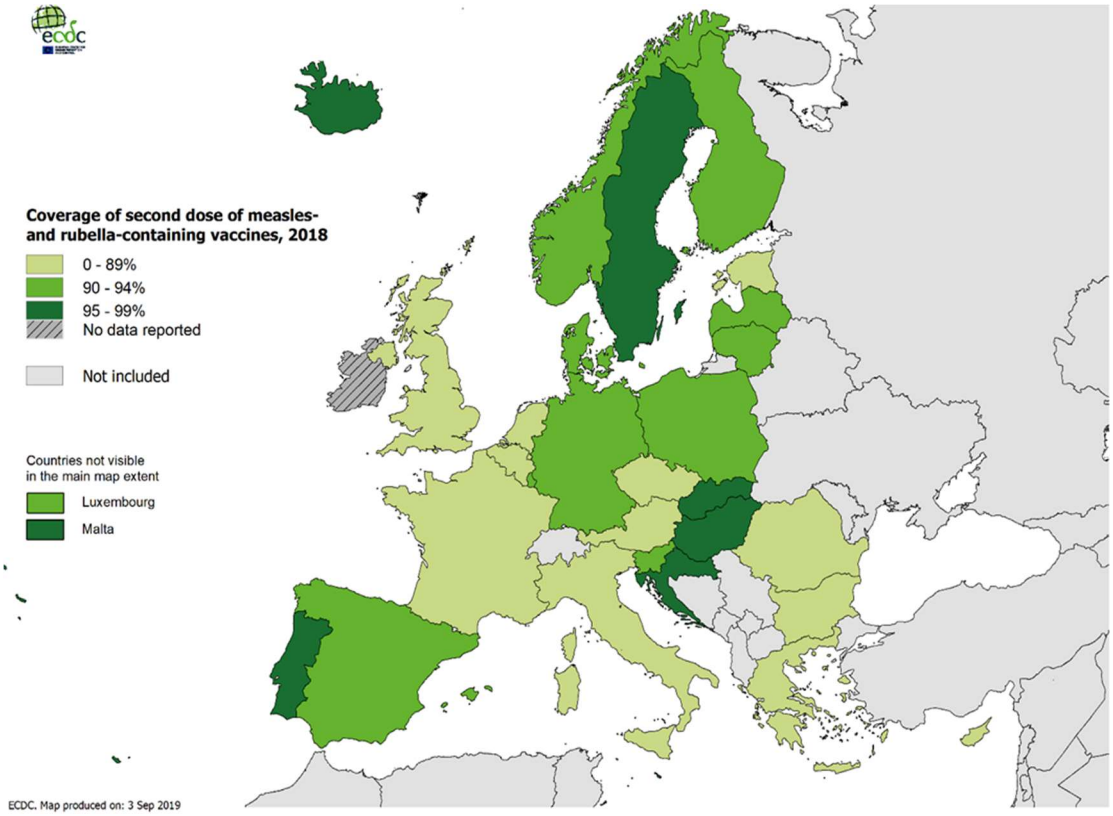

**Figure 4: Map of the presence of vaccine hesitancy terminology**

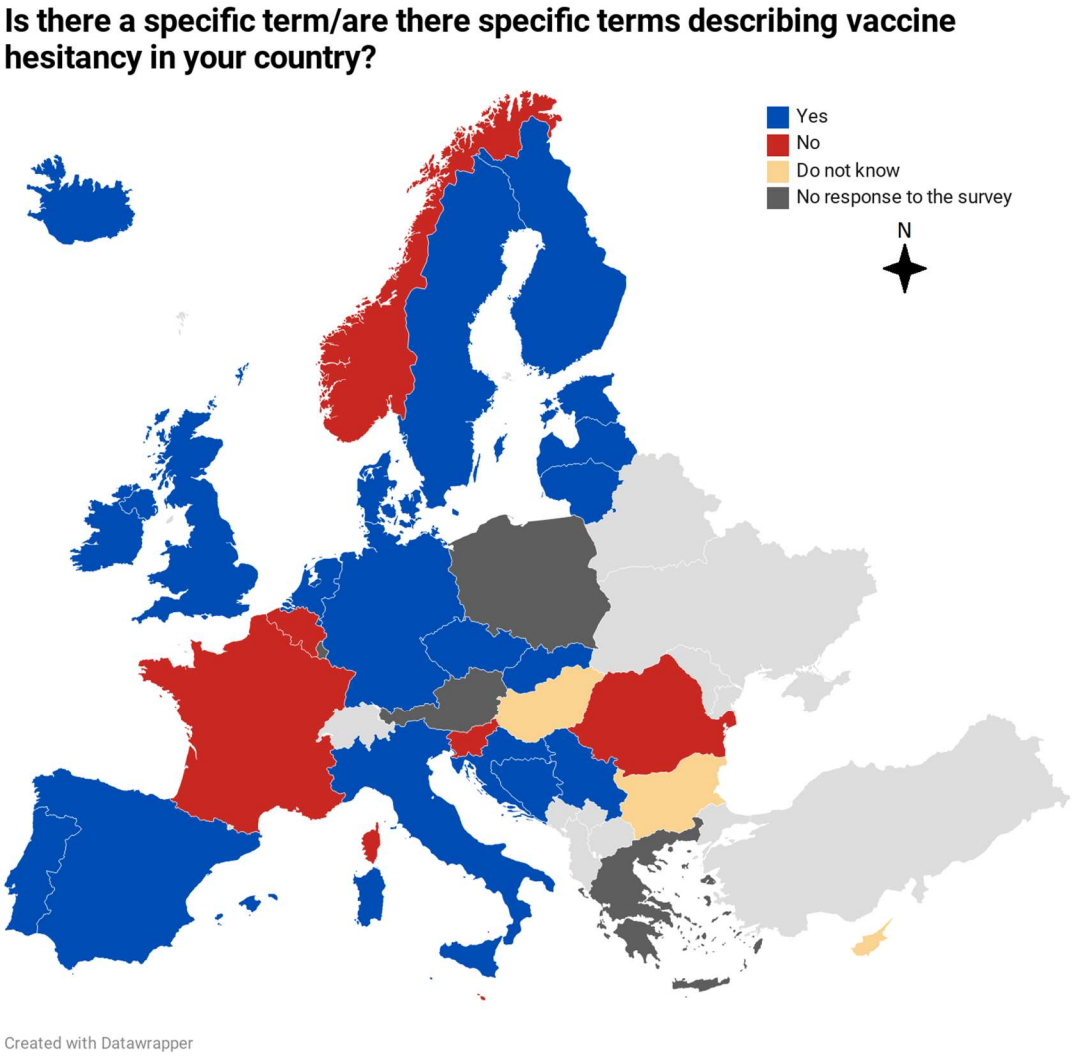

**Figure 5: Map of concurrence with WHO definition of vaccine hesitancy**

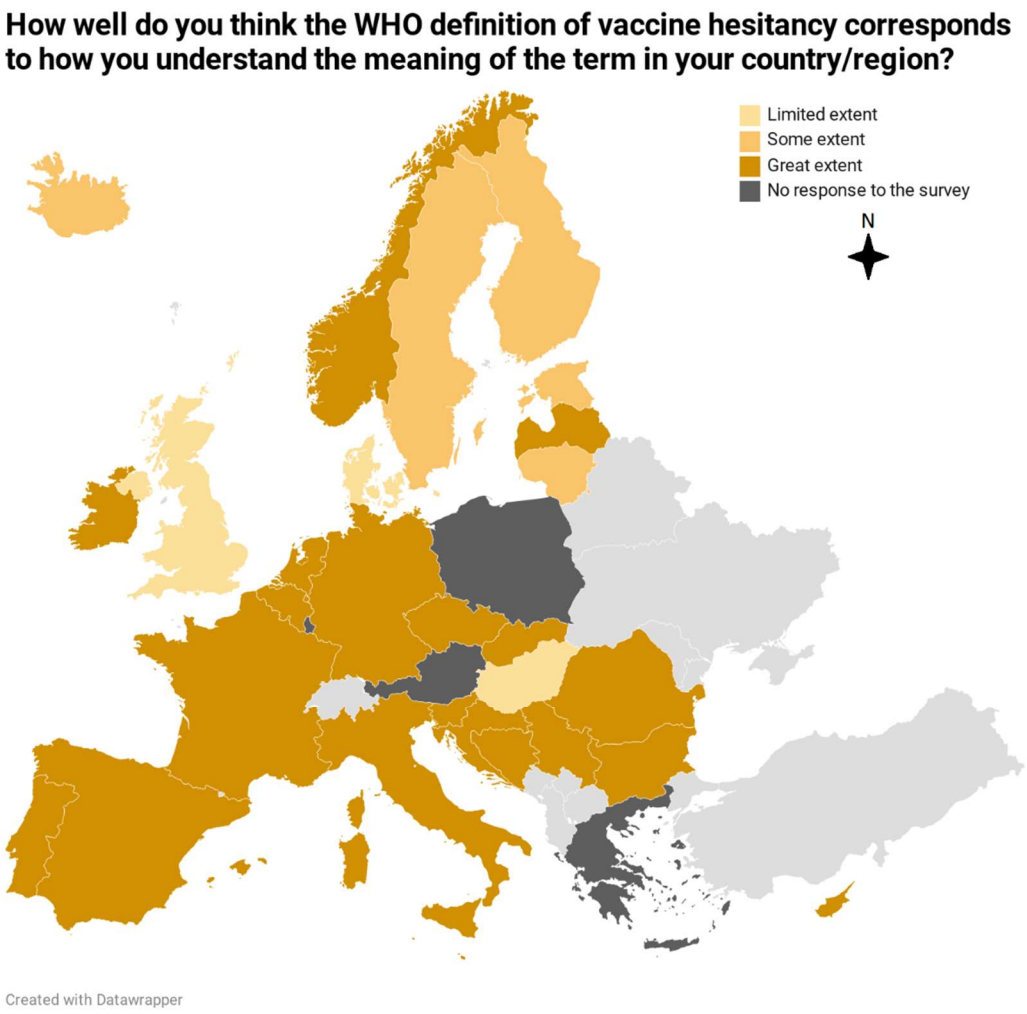

**Figure 9: Map of the extent that HCW vaccine confidence affects vaccine uptake**

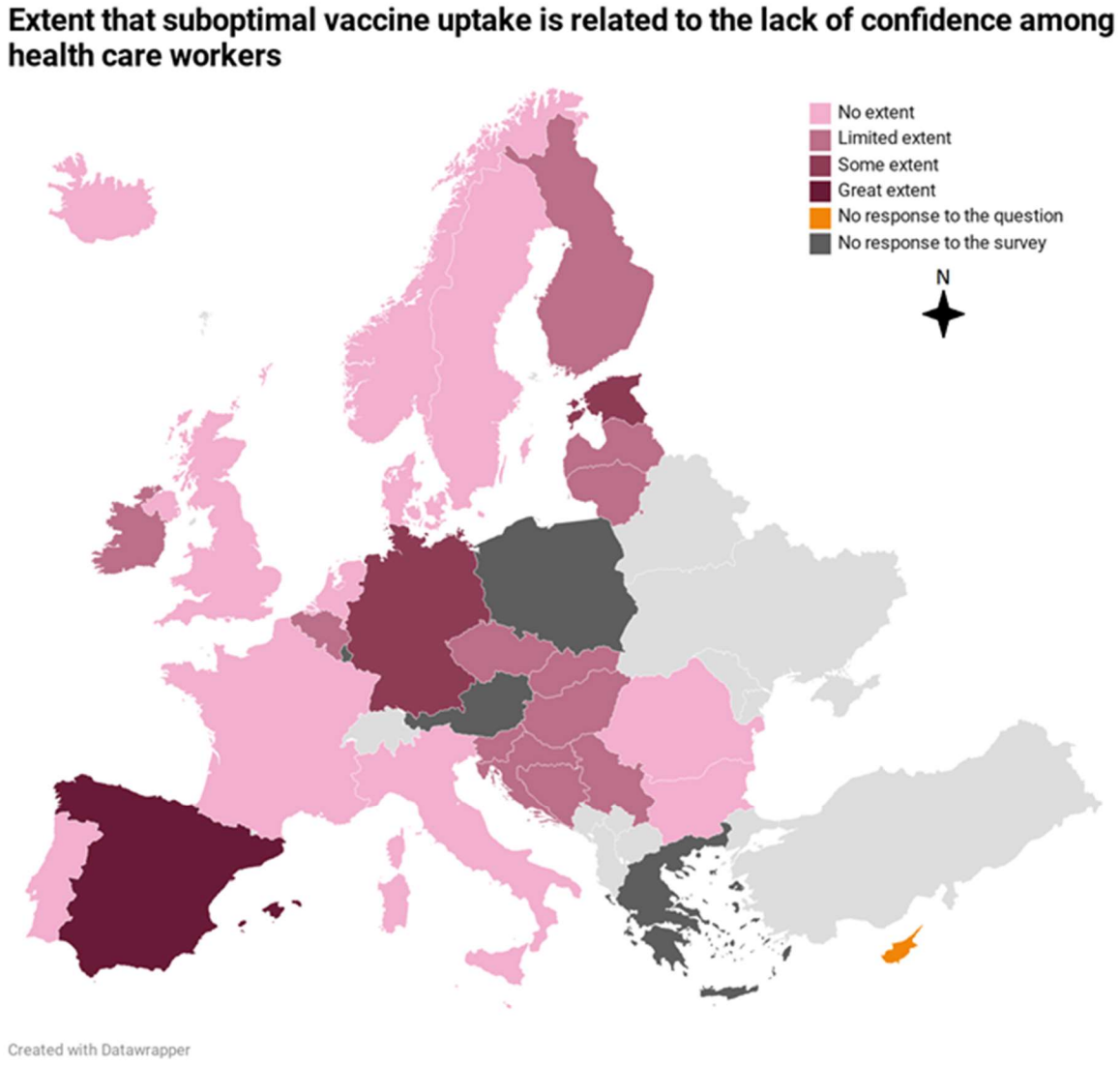


**Figure 13: Summary of Free-Response Vaccine Communication Strategies**

| Strategy | Percent of Total Responses (N=29) |
|---|---|
| Seminars, conferences, meetings | 28% |
| Website | 17% |
| Email | 14% |
| Training events, continuous education | 14% |
| Guidance documents | 14% |
| Hotline | 7% |
| Local health officials | 7% |

**Figure 19: Distribution of HCW Communication Scores**

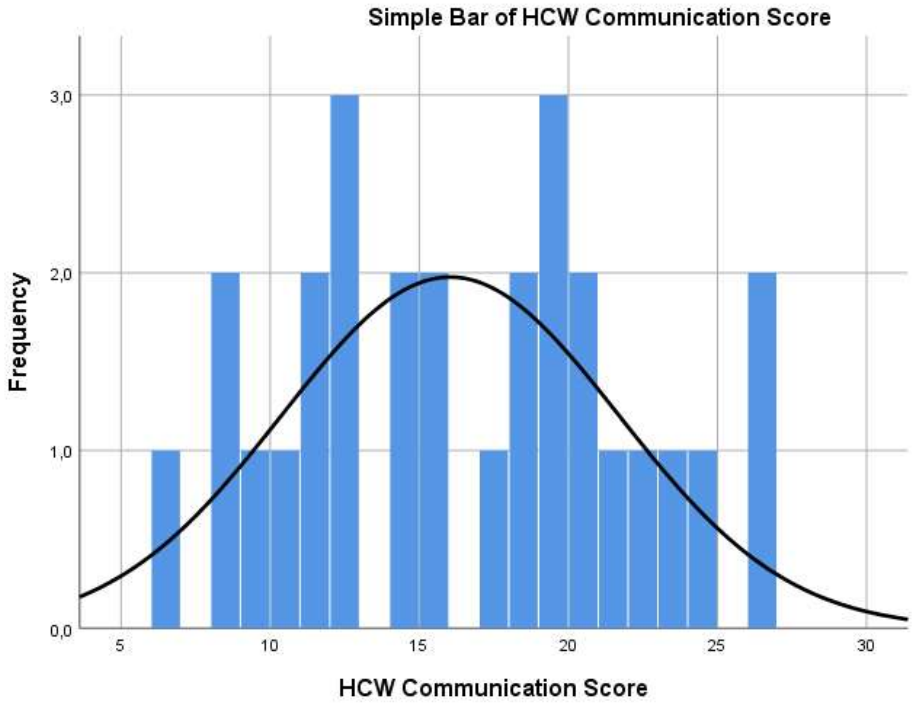


**Figure 21: Median HCW Communication Score by Extent that Suboptimal Vaccine Uptake is Related to the Lack of Confidence among HCWs**

| | No Extent | Limited Extent | Some Extent | Great Extent |
|---|---|---|---|---|
| N | 12 | 12 | 2 | 1 |
| Mean HCW Comm Score | 15.08 (11.82-18.35) | 16.50 (12.57-20.43) | 14.89 (9.59-20.19) | N/A |
| Median HCW Comm Score | 14.50 | 19.00 | 15.00 | N/A |

**Figure 22: HCW Communication Scores by Extent Vaccine Work is Related to HCWs**

| | No Extent | Limited Extent | Some Extent | Great Extent |
|---|---|---|---|---|
| N | 0 | 5 | 9 | 14 |
| Mean HCW Comm Score | N/A | 13.00 (8.35-17.65) | 14.89 (9.59-20.19) | 17.86 (14.89-20.73) |
| Median HCW Comm Score | N/A | 12.00 | 14.00 | 19.00 |

**Figure 23: HCW Communication Scores by Presence of Long-Term Strategies**

| | Yes | No |
|---|---|---|
| N | 19 | 9 |
| Mean HCW Comm Score | 15.89 (12.95-18.84) | 16.33 (12.59-20.08) |
| Median HCW Comm Score | 17.00 | 15.00 |

**Figure 24: HCW Communication Scores by Collaboration on Vaccine Information**

| | Yes | No |
|---|---|---|
| N | 6 | 19 |
| Mean HCW Comm Score | 18.17 (12.88-23.45) | 14.47 (11.80-17.15) |
| Median HCW Comm Score | 18.50 | 14.00 |

**Figure 25: HCW Communication Scores by Lack of Funding for Vaccine Work**

| | No Extent | Limited Extent | Some Extent | Great Extent |
|---|---|---|---|---|
| N | 6 | 6 | 7 | 8 |
| Mean HCW Comm Score | 16.33 (9.48-23.19) | 12.00 (5.88-18.12) | 18.14 (13.69-22.59) | 17.50 (13.28-21.72) |
| Median HCW Comm Score | 17.50 | 10.50 | 19.00 | 18.50 |

**Figure 26: HCW Communication Scores by Lack of Staff for Vaccine Work**

| | No Extent | Limited Extent | Some Extent | Great Extent |
|---|---|---|---|---|
| N | 11 | 7 | 7 | 3 |
| Mean HCW Comm Score | 15.73 (11.79-19.67) | 14.57 (9.51-19.63) | 16.57 (10.63-22.51) | 19.33 (8.13-30.53) |
| Median HCW Comm Score | 17.00 | 14.00 | 14.00 | 19.00 |

**Figure 27: HCW Communication Scores by Lack of Mandate for Vaccine Work**

| | No Extent | Limited Extent | Some Extent | Great Extent |
|---|---|---|---|---|
| N | 18 | 6 | 4 | 0 |
| Mean HCW Comm Score | 15.56 (12.68-18.43) | 16.50 (10.72-22.28) | 17.50 (7.07-27.93) | N/A |
| Median HCW Comm Score | 16.00 | 16.00 | 16.50 | N/A |

**Figure 28: HCW Communication Scores by Organizational Limits for Vaccine Work**

| | No Extent | Limited Extent | Some Extent | Great Extent |
|---|---|---|---|---|
| N | 4 | 3 | 8 | 13 |
| Mean HCW Comm Score | 16.25 (8.20-24.30) | 13.33 (5.35-21.32) | 18.00 (12.66-23.34) | 15.38 (11.80-18.96) |
| Median HCW Comm Score | 16.50 | 12.00 | 19.00 | 15.00 |

**Figure 29: HCW Communication Scores by Dedicated Staff for Vaccine Work**

| | Yes | No |
|---|---|---|
| N | 13 | 15 |
| Mean HCW Comm Score | 15.38 (11.93-18.83) | 16.60 (13.42-19.78) |
| Median HCW Comm Score | 15.00 | 18.00 |

**Figure 30: HCW Communication Scores by Ability to Meet Needs of Vaccine Work**

| | Yes | No |
|---|---|---|
| N | 13 | 15 |
| Mean HCW Comm Score | 16.31 (13.14-19.47) | 15.80 (12.38-19.22) |
| Median HCW Comm Score | 17.00 | 15.00 |

**Figure 31: HCW Communication Scores by Vaccine Info. Delivered via HCW**

| | No Extent | Limited Extent | Some Extent | Great Extent |
|---|---|---|---|---|
| N | 2 | 2 | 4 | 20 |
| Mean HCW Comm Score | 12.00(-13.41-37.41) | 7.50 (-11.56-26.56) | 13.00 (6.38-19.62) | 17.90 (15.47-20.43) |
| Median HCW Comm Score | 12.00 | 7.50 | 13.00 | 19.00 |

**Figure 32: HCW Communication Scores by Vaccine Safety Info. Delivered via HCW**

| | No Extent | Limited Extent | Some Extent | Great Extent |
|---|---|---|---|---|
| N | 2 | 2 | 7 | 15 |
| Mean HCW Comm Score | 12.00(-13.41-37.41) | 7.50 (-11.56-26.56) | 15.29 (11.30-19.27) | 18.67 (15.75-21.58) |
| Median HCW Comm Score | 12.00 | 7.50 | 14.00 | 19.00 |

**Figure 33: EU-JAV Survey**

EU Joint Action on Vaccination Vaccine hesitancy and uptake.
From research and practices to implementation

1. Contact information *First name

| | |
|---|---|
| Last name | |
| Position | |
| Email | |
| Organisation | |
| Country | |

2. Is there a specific term/are there specific terms describing vaccine hesitancy in your country? * ◯ Yes

◯ No

◯ I do not know

3. How do you understand the meaning of the term 'vaccine hesitancy'? *

4. Please elaborate on your answers to the two previous questions (2 and 3):

- Are different terms and definitions used?
- Is there, for example, a difference between the official and the public or popular discourse relatedto the topic?
- If you have more than one official language in your country, is there a difference between howvaccine hesitancy is described in these languages? If you answered yes, does it affect your work in connection to vaccine confidence and uptake in your country/region?
- In the case the terminology related to vaccine hesitancy is not established or if it is multifacetedor incoherent, how does it affect your work in connection to vaccine uptake and confidence?

5. According to the WHO, "Vaccine hesitancy refers to delay in acceptance or refusal of vaccines despiteavailability of vaccination services. Vaccine hesitancy is complex and context specific varying across time, place and vaccines. It includes factors such as complacency, convenience and confidence" (WHO SAGE Vaccine Hesitancy Working Group report). *

| | Not at all | Only to a limited extent | To some extent | To a great extent | I do not know |
|---|---|---|---|---|---|
| How well do you think this definition corresponds to how you understand the meaning of the term 'vaccine hesitancy' in your country/region? | ○ | ○ | ○ | ○ | ○ |

6. Please list the three vaccines from the National Immunisation Programme with the lowest orwith decreasing coverage. Please indicate coverage (%) for each using most recent data (year). *

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7. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

8. As far as you are aware, is suboptimal vaccine uptake in your country *

| | No | Yes, but only to a limited extent | Yes, to some extent | Yes, to a great extent | I do not know |
|---|---|---|---|---|---|
| The result of poor access of vaccination services? (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| The result of a regional or national vaccine safety-related crisis? (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| The result of the lack of confidence in vaccine safety? (if relevant, please specify the concerns expressed and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Related to the lack of confidence in the effectiveness of vaccines? (if relevant, please specify the concerns expressed and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Related to the perceived risk of VPDs? (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| The result of inconvenience of vaccination services? (if relevant, please specify which vaccines and/or VPDs this concerns) | | | | | |
| The result of the lack of confidence in the institution responsible for organising the vaccination services? (if relevant, | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| please specify the concerns expressed and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |

| | No | Yes, but only to a limited extent | Yes, to some extent | Yes, to a great extent | I do not know |
|---|---|---|---|---|---|
| Related to specific groups within the population? (if relevant, please specifywhich groups and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Related to the lack of confidence amonghealth care workers? (if relevant, pleasespecify the concerns expressed and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Related to the public perception of specific vaccines? (if relevant, pleasespecify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Related to vaccine shortages? (if relevant, please specify which vaccinesand/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Related to religious reasons or groups?(if relevant, please specify which reasons/groups and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Related to ideological reasons promoted, for example, by a vocal anti-vaccine lobby? (if relevant, please specify which groups and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |

Other (please describe)?

9. Please elaborate and please provide one or more examples, and describe in detail the reasonsbehind and the groups with suboptimal vaccine uptake in your country/region.

10. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

11. Have you at your institution or organisation conducted studies (or surveys, reviews or otherexaminations) to understand barriers and drivers to vaccination and vaccine hesitancy in your country/region? * ◯ Yes

No

◯

12. If you answered yes, please describe briefly (in case more than one study has been conducted,please describe them all):

- Methods (study design, selection of participants (sampling methods), sample size, representativeness,timeframe/period)
- Results
- Relevance
- Information on whether study/studies addressed barriers and drivers of vaccination of a specificvaccine and/or VPD
- How often are these studies conducted
- Comment (your observations in general of the study)

13. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

14. If you have conducted studies, has the knowledge from these studies been implemented in policiesor actions and operations in your country/region? *

- ◯ Yes
- ◯ No
- ◯ I do not know

15.15.

- If yes, please elaborate how.
- In case you have conducted a baseline evaluation as well, did the policies or the actions andoperations help achieve the intended objective for which they were implemented or not?
- If no, please explain why.

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16. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

17. Have any of these studies to understand barriers and drivers to vaccination, including literaturereviews or sharing of data, been done as a collaboration with cross border partners? *

- ◯ Yes
- ◯ No
- ◯ I do not know

18. If yes, please explain your motivation for working across borders.Please provide a list of any cross border partners and studies.

19. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

20. As far as you are aware, have other parties conducted studies (or surveys, reviews or otherexaminations) to understand barriers and drivers to vaccination and/or vaccine confidence in your country/region? *

- ○ Yes
- ○ No
- ○ I do not know

21. If you answered yes, please describe briefly:

- Which type of organisation(s) (please provide contact information)
- Methods (study design, selection of participants (sampling methods), sample size, representativeness,timeframe/period)
- Results
- Relevance
- Information on whether study/studies addressed barriers and drivers of vaccination of a specificvaccine
- How often are these studies conducted
- Comment (your observations in general of the study)

22. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

23. Has the knowledge from these studies been implemented in policies or actions and operations inyour country/region? *

- ◯ Yes
- ◯ No
- ◯ I do not know

24.24.

- If you answered no to the previous question, please state why.
- If you answered yes, please elaborate.

25. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

26. What kind of experience does your organisation have from work related to maintaining orincreasing good vaccine uptake and/or strengthening confidence? Has the work been: *

| | No | Yes, but only to a limited extent | Yes, to some extent | Yes, to a great extent | I do not know |
|---|---|---|---|---|---|
| Vaccine or antigen-specific? (if relevant,please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Related to health care workers? (if relevant, please specify which vaccinesand/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Carried out through communication activities? (if relevant, please specifywhich vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Conducted in cooperation with government bodies? (if relevant, pleasespecify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Conducted in cooperation with other partners and stakeholders in your country or region? (if relevant, please specify which partners and/or stakeholders and which vaccines and/orVPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Related to specific population groups (if relevant, please specify which groups and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Related to the access of vaccination services? (if relevant, please specifywhich vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |

| | No | Yes, but only to a limited extent | Yes, to some extent | Yes, to a great extent | I do not know |
|---|---|---|---|---|---|
| Related to education (as a part of the school curriculum, for example, vaccinerelated education in primary and/or secondary schools)? (if relevant, please specify which vaccines and/or VPDsthis concerns) | ○ | ○ | ○ | ○ | ○ |
| Other? (please elaborate) | ○ | ○ | ○ | ○ | ○ |

27. Please elaborate on your answers above about your organisation's experiences from work relatedto maintaining or increasing good vaccination coverage and/or strengthening confidence.

28. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

29. Has this work (interventions, projects, campaigns, policies, practices, etc.) been based onresearch-based knowledge? *

- ◯ Yes
- ◯ No
- ◯ Both yes and no
- ◯ I do not know

30.30.

- If you answered yes, please describe how.
- If you answered no, please state why.

31. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

32. Have any of these interventions to address barriers and drivers to vaccination been done as acollaboration with cross border partners? *

- ◯ Yes
- ◯ No
- ◯ I do not know

33. If yes, please explain your motivation for working across borders.Please provide a list of any cross border partners and interventions.

34. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

35. Have you at your institution or organisation experience from work related specifically to maintainingor increasing the uptake of the second dose of measles mumps, and rubella vaccine (MMR2)? *

- ◯ Yes
- ◯ No

36. Please elaborate on your answer above and please give examples on your work related specificallyto to maintaining or increasing uptake for the second dose of measles mumps, and rubella vaccine (MMR2).

37. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

38. Have you at your institution or organisation experience from work that could also have maintained or increased the uptake of the second dose of measles mumps, andrubella vaccine (MMR2), but was not specifically designed for only that purpose? *

- ◯ Yes
- ◯ No

39. Please elaborate on your answer above and please give examples on your work that could alsohave maintained or increased the uptake of the second dose of measles mumps, and rubella vaccine (MMR2), but was not specifically designed for only that purpose.

40. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

41. How is vaccine information for vaccines included in the National Immunisation Programmecommunicated to the public in your country? *

| | No | Yes, but only to a limited extent | Yes, to some extent | Yes, to a great extent | I do not know |
|---|---|---|---|---|---|
| Informational brochures/pamphlets /leaflets. (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| School education (as a part of the school curriculum, for example, vaccine related education in primary and/or secondary schools). (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Official website(s) (please describe which). (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| News media, including print media (newspapers, newsmagazines), broadcast media (television and radio), and online newspapers. (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Social media. (if relevant, please specify which social media platform(s) and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Health care worker when meeting patient. (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Advertisements or campaigns. (if relevant, please specify which vaccines | | | | | |

and/or VPDs this concerns)

| | No | Yes, but only to a limited extent | Yes, to some extent | Yes, to a great extent | I do not know |
|---|---|---|---|---|---|
| E-health (electronic health services). (if relevant, please specify which vaccinesand/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Other. (please elaborate) | ○ | ○ | ○ | ○ | ○ |

42. Please elaborate on your answers above on how vaccine information is communicated to thepublic in your country.

43. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

44. How is vaccine safety information for vaccines included in the National Immunisation Programmecommunicated to the public in your country? *

| | No | Yes, but only to a limited extent | Yes, to some extent | Yes, to a great extent | I do not know |
|---|---|---|---|---|---|
| Informational brochures/pamphlets /leaflets. (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| School education (as a part of the school curriculum, for example, vaccine related education in primary and/or secondary schools). (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Official website(s). (if relevant, please specify which website(s) and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| News media, including print media (newspapers, newsmagazines), broadcast media (television and radio), and online newspapers. (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Social media. (if relevant, please specify which social media platform(s) and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Health care worker when meeting patient. (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| E-health (electronic health services). (if | | | | | |

relevant, please specify which vaccines and/or VPDs this concerns)

| | No | Yes, but only to a limited extent | Yes, to some extent | Yes, to a great extent | I do not know |
|---|---|---|---|---|---|
| Other. (please elaborate) | ○ | ○ | ○ | ○ | ○ |

45. Please elaborate on your answers above on how vaccine safety information is communicated tothe public in your country.

46. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

47. How is vaccine and vaccine safety information for vaccines included in the National ImmunisationProgramme communicated to health care workers responsible for vaccination in your country? *

| | No | Yes, but only to a limited extent | Yes, to some extent | Yes, to a great extent | I do not know |
|---|---|---|---|---|---|
| Informational brochures/pamphlets /leaflets. (if relevant, please specifywhich vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Meetings/lectures/training events. (if relevant, please specify which vaccinesand/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Official website (s) (please describe which). (if relevant, please specify whichvaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| News media, including print media (newspapers, newsmagazines), broadcast media (television and radio),and online newspapers. (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Social media. (if relevant, please specifywhich social media platform(s) and which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Telephone service/hotline to public health institute or other. (if relevant, please specify which vaccines and/orVPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| E-mail service. (if relevant, please specify which vaccines and/or VPDsthis concerns) | ○ | ○ | ○ | ○ | ○ |

| | | | | | |
|---|---|---|---|---|---|
| Official written communication. (if relevant, please specify which vaccinesand/or VPDs this concerns) | ◯ | ◯ | ◯ | ◯ | ◯ |

| | No | Yes, but only to a limited extent | Yes, to some extent | Yes, to a great extent | I do not know |
|---|---|---|---|---|---|
| E-health (electronic health services). (if relevant, please specify which vaccinesand/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Post diploma education and/or continuous/updating training. (if relevant, please specify which vaccines and/or VPDs this concerns) | ○ | ○ | ○ | ○ | ○ |
| Other. (please elaborate) | ○ | ○ | ○ | ○ | ○ |

48. Please elaborate on your answers above on how vaccine and vaccine safety information communicated to health care workers
responsible for vaccination in your country.

49. Concerning your answer to the previous question, please provide references and/or copy of thereport(s) (all languages are welcome).

50. Are there any examples of where you have collaborated with cross border partners on the development of vaccine information materials, including vaccine safety information and information tohealthcare workers? *

- ◯ Yes
- ◯ No
- ◯ I do not know

51. If yes, please explain your motivation for working across borders.

Please provide a list of any cross border partners and links to vaccine information materials.

52. Please describe any other collaboration (excluding the EU Joint Action on Vaccination) where youare working across borders on the development of plans or strategies relating to work on addressing barriers and drivers of vaccination.

- In your experience, what could be the benefits of teaming up with cross border partners?
- In your experience, what could be the difficulties of teaming up with cross border partners?
- In your experience, what could be done to encourage more cross border collaboration?

53. Concerning your answers to the previous questions on collaboration with cross border partners, please provide references and/or copy of the report(s) (all languages are welcome).

54. Are there any examples of where you have collaborated with cross border partners on the development of vaccine information materials, including vaccine safety information and information tohealthcare workers? *

- ◯ Yes
- ◯ No
- ◯ I do not know

55. If yes, please explain your motivation for working across borders.

Please provide a list of any cross border partners and links to vaccine information materials.

56. Please describe any other collaboration (excluding the EU Joint Action on Vaccination) where youare working across borders on the development of plans or strategies relating to work on addressing barriers and drivers of vaccination.

- In your experience, what could be the benefits of teaming up with cross border partners?
- In your experience, what could be the difficulties of teaming up with cross border partners?
- In your experience, what could be done to encourage more cross border collaboration?

57. Concerning your answers to the previous questions on collaboration with cross border partners, please provide references and/or copy of the report(s) (all languages are welcome).

58. Does your institution have one or more persons or advisors dedicated to working primarily on maintaining or increasing good vaccine uptake and/or strengthening vaccine confidence? *

- ◯ Yes
- ◯ No

59.59.

- If no, please state why and describe what team or which person is in charge of this matter.
- If yes, please describe in detail the roles and responsibilities of this/these person(s), their educationaland professional background, resources available etc.
- Please estimate the time efforts you use at your institution on vaccine hesitancy related work (100%=1person working full time).
- Please also give the contact information for the person in charge of this work.

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60. Are you, at your institution or organisation, able to work with vaccine hesitancy and uptakerelated issues in a way that meets your needs? *

- ◯ Yes
- ◯ No

61. What are the main barriers that prevent you from working with vaccine hesitancy and uptakerelated issues? *

| | Yes, but only to a limited extent | No | Yes, to some extent | Yes, to a great extent | I do not know |
|---|---|---|---|---|---|
| Lack of funding. | ◯ | ◯ | ◯ | ◯ | ◯ |
| Lack of competence/competent staff. | ◯ | ◯ | ◯ | ◯ | ◯ |
| Lack of mandate. | ◯ | ◯ | ◯ | ◯ | ◯ |
| Organisational limits/restrictions (such as workload and/or other responsibilities prioritisations). | ◯ | ◯ | ◯ | ◯ | ◯ and/or |
| Other, what? | ◯ | ◯ | ◯ | ◯ | ◯ |

62. Please elaborate on your answer above on main barriers that prevent you from working withvaccine hesitancy and uptake related issues in your country/region.

63. Do you, at your organisation, have long-term strategies or plans for strengthening vaccineconfidence and increasing vaccine uptake in your country/region? *

- ◯ Yes
- ◯ No
- ◯ I do not know

64.64.

- If no, please state why.
- If yes, please describe in detail.

65. Concerning your answer to the previous questions, please provide reference and/or copy of thestrategy/plan (all languages are welcome).

66. In the case you have conducted work (interventions, projects, campaigns, policies, practices) inrelation to increasing vaccination coverage or strengthening trust, has this work been successful orunsuccessful?

- If no, please state why.
- If yes, please describe these cases separately in detail.

67. Concerning your previous answer, how do you determine the success or failure?
Have you, for example, conducted studies evaluating the possible impact of the work (interventions, projects, campaigns, policies, practices)?

- If no, please state why.
- If yes, please describe in detail.

68. Concerning your answers to the two previous questions, please provide reference or copy ofreports, if possible(all
languages are welcome).

69. What is the latest programme/activity you have conducted at your institution aimed at increasingvaccine confidence and uptake?

70. Concerning your answer to the previous questions, please provide reference and/or copy of thestrategy (all languages are welcome).

71. Please describe any other policies, practices and projects that have affected (increased or decreased) vaccine uptake in your country/region, but that have not directly been related to or affectedby the work at your institution, for example, social media activities or influencers, legislation related to mandatory vaccinations or school curriculums/vaccine related education in primary or secondary schools.

72. Concerning your answer to the previous question, please provide reference or copy of reports, ifpossible(all languages are welcome).

73. Are there examples of vaccine hesitancy and/or uptake related work at your organisation or in your country/region that could be presented as constructive examples of either successful or unsuccessful actions, practices and decisions? *

- ◯ Yes. If yes, please explain what andwhy.
- ◯ No

74. Would you be willing to present this work, for example, in the form of an article, podcast or video lecture/webinar that could be published on an online platform specifically designed for providing guidance for developing practices and policies for maintaining good vaccine uptake and confidence? (Or,if the work has been conducted by another actor, would you be willing to organise a presentation of their work?) *

- ◯ Yes. Please explain how.No.
- ◯ Please explain why.

75. Are there stakeholders that have been active in vaccine hesitancy and uptake related work in your country/region that should be asked to take part in the mapping of best practices and lessons learned? *

- ◯ Yes
- ◯ No. If no, please state why not. [ ]

76. If you answered yes to the previous question, please describe who should be included and why (Please also provide contact information).

77. Is there anything else you would like to tell us?

## TABLE of FIGURES