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REVIEW

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# A systematic review on parental vaccine hesitancy for childhood immunizations in the European region: Can findings be generalized?

Toon Janssen [a,b,c], Julie Degraeve [b,c], Ilse De Coster [b,d], Ine Decuyper [b,e,f], Daan Van Brusselen [a,b,e], and Stijn Verhulst [a,b,c]

[a]Lab of Experimental Medicine and Pediatrics, University of Antwerp, Antwerp, Belgium; [b]Antwerp Pediatric Clinical Trial Network, University of Antwerp, Antwerp, Belgium; [c]Department of Pediatrics, Antwerp University Hospital, Edegem, Belgium; [d]Centre for Evaluation of Vaccination, University of Antwerp, Antwerp, Belgium; [e]Department of Pediatric Infectiology, ZAS Hospitals, Antwerp, Belgium; [f]Department of Clinical Sciences, Institute Tropical Medicine, Antwerp, Belgium

**ABSTRACT**

Vaccine hesitancy (VH) for childhood immunizations has been widely studied, but no review has synthesized evidence across Europe. This review addresses that gap using both qualitative and quantitative perspectives. A systematic search on February 5th, 2025, was conducted in MEDLINE/PubMed and Web of Science to assess the generalizability of findings regarding parental VH regarding childhood vaccinations (excluding HPV and Influenza) across the WHO European Regions. Forty-nine articles published between January 2015 and December 2024 in English, Dutch or French were included. Using WHO's 3C model (confidence, convenience, complacency), trust in healthcare professionals (HCPs) emerged as a key factor, while fear of side effects, logistical barriers and low perceived disease risk negatively influenced decisions. Demographic determinants were not generalizable across countries due to methodological and contextual (cultural, socioeconomic and healthcare system) differences, reinforcing the need for tailored approaches. VH remains multidimensional and context-dependent. WHO's 3C model is a useful tool for understanding VH. Tailored, country-specific strategies are needed, with strong HCP – caregiver relationships and policies addressing practical and socioeconomic barriers to ensure equitable access to childhood vaccination.

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## Introduction

Vaccine hesitancy (VH) is a spectrum ranging from 'acceptance despite doubts' to blatant vaccine refusal. The World Health Organization's Strategic Advisory Group of Experts (WHO SAGE) defines VH as *"A delay in acceptance or refusal of vaccines despite availability of vaccination services."* WHO SAGE states that VH is complex and context-specific, varying across time, place and vaccines.[1] Extensive research has been conducted on VH, and almost all studies draw the same conclusion: there is an increase in the number of unvaccinated or partially vaccinated children in recent years. According to the WHO, 2.7 million additional children were un- or undervaccinated in 2023 compared to pre-pandemic levels in 2019.[2] Geographic location, the economic status of a country, and the type of vaccination may explain the variation in VH.[3] The reasons for VH can be categorized into three groups according to the WHO's 3C model of hesitancy, a widely used but simplified framework for understanding VH. This broad and non-exhaustive model identifies complacency, convenience and confidence as the three main drivers of vaccine acceptance or refusal. Complacency refers to perceived disease risk; convenience relates to the accessibility of vaccination services; and confidence concerns the effectiveness and safety of vaccines, as well as trust in the healthcare system.[1]

To combat VH and to maximize uptake, countries apply different vaccination policies. Some focus on education about the benefits and leave the choice to the population, while others offer financial incentives or have obligatory immunization programs. Despite these different approaches, increased VH and refusal is seen all over the world.[4] Quantitative studies show that caregiver support for existing

**CONTACT** Toon Janssen toon.janssen@uantwerpen.be Antwerp Pediatric Clinical Trial Network, University of Antwerp, Drie Eikenstraat 655, Edegem 2650, Belgium.

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obligatory vaccination in National Immunization Programs (NIP) is high (73–88%). Obligatory immunization tends to increase vaccine uptake but can also generate resistance among parents. Some parents argue that they should not be penalized for opting out due to their personal safety concerns. Furthermore, financial incentives for vaccination were perceived as inappropriate and coercive by some parents.[5]

Although many studies have investigated VH, no systematic synthesis of evidence regarding European VH is available from both qualitative and quantitative lenses. Additionally, despite documented variation in vaccine confidence and attitudes, the link with and generalizability of demographic VH factors remains to be defined. This review aims to give an overview of the existing knowledge on parental VH in Europe from both a qualitative and quantitative point of view. Furthermore, the possibility of generalizing the results across European countries will be discussed.

## Methodology

A search was conducted on February 5th, 2025 in MEDLINE/PubMed and Web of Science, using following search string respectively: *("vaccin* hesitanc*" OR vaccination hesitancy[Mesh]) AND (Parent* OR child OR infant[tiab] OR Parents[Mesh] OR child[Mesh] OR "child, preschool"[Mesh] OR infant [Mesh]) NOT (COVID OR COVID-19[Mesh])* and *"vaccin* hesitanc*" AND (Parent* OR child OR infant) NOT COVID*. Articles published between January 1st, 2015, and December 31st, 2024, in English, Dutch, or French were considered. Screening was conducted in two stages: initial title and abstract screening, followed by full-text assessment, applying predefined inclusion and exclusion criteria. The population of interest comprised parents (mothers and fathers) and caregivers residing in Europe. Studies focusing only on adolescents, healthcare professionals (HCPs), policymakers, or undocumented migrants were excluded. Regarding outcomes, only original studies reporting quantitative and/or qualitative data on parental VH were eligible. For the type of vaccines, eligibility was restricted to childhood vaccines. Studies focusing only on the human papillomavirus (HPV) or influenza vaccines were therefore excluded. Editorials, short communications, letters to the editor, commentaries, protocols, reviews, meta-analyses, and abstracts were excluded. Finally, only studies conducted within the WHO European Region and with full-text availability were included. Screening of the eligible articles was done by T.J. and J.D. independently using Covidence (*www.covidence.org*). Any discrepancies were resolved during discussions with all authors. Data extraction took place by mutual agreement between all authors. A quality assessment took place using the Mixed-Methods Appraisal Tool (MMAT), version 2018, by two independent authors.[6] If discrepancies occurred, a discussion took place to reach agreement. The results of the assessment can be found in Supplementary Tables 1–3.

## Results

The search yielded 2.633 records, consisting of 1.610 unique articles and 1.023 duplicates. An initial screening based on title and abstract retained 78 articles. Following a more detailed evaluation of full texts, 49 records were selected with publication dates between 2017 and 2024, consisting of 10 qualitative studies, 33 quantitative studies and 9 studies with a mixed-methods design. An overview of the selection process can be found in Figure 1. This review discusses 26/44 European countries: France, The Netherlands, Switzerland, Italy, Spain, Greece, Cyprus, Croatia, Albania, United Kingdom, Ireland, Sweden, Norway, Poland, Romania, Ukraine, and Hungary. Furthermore, Belgium, Portugal, Austria, Germany, Lithuania, Malta, Republic of Moldova, Slovenia and Bulgaria were researched in the included multi-country studies. An overview of the included studies can be found in Table 1. Figure 2 shows the study distribution per country and study design.

This review summarizes the different studies by individual EU country, starting with two pan-European studies. An overview of qualitative findings can be found in Tables 2–4, showing respectively confidence-, convenience-, and complacency-related factors reported in qualitative studies. Quantitative data are summarized below and shown in Table 5.

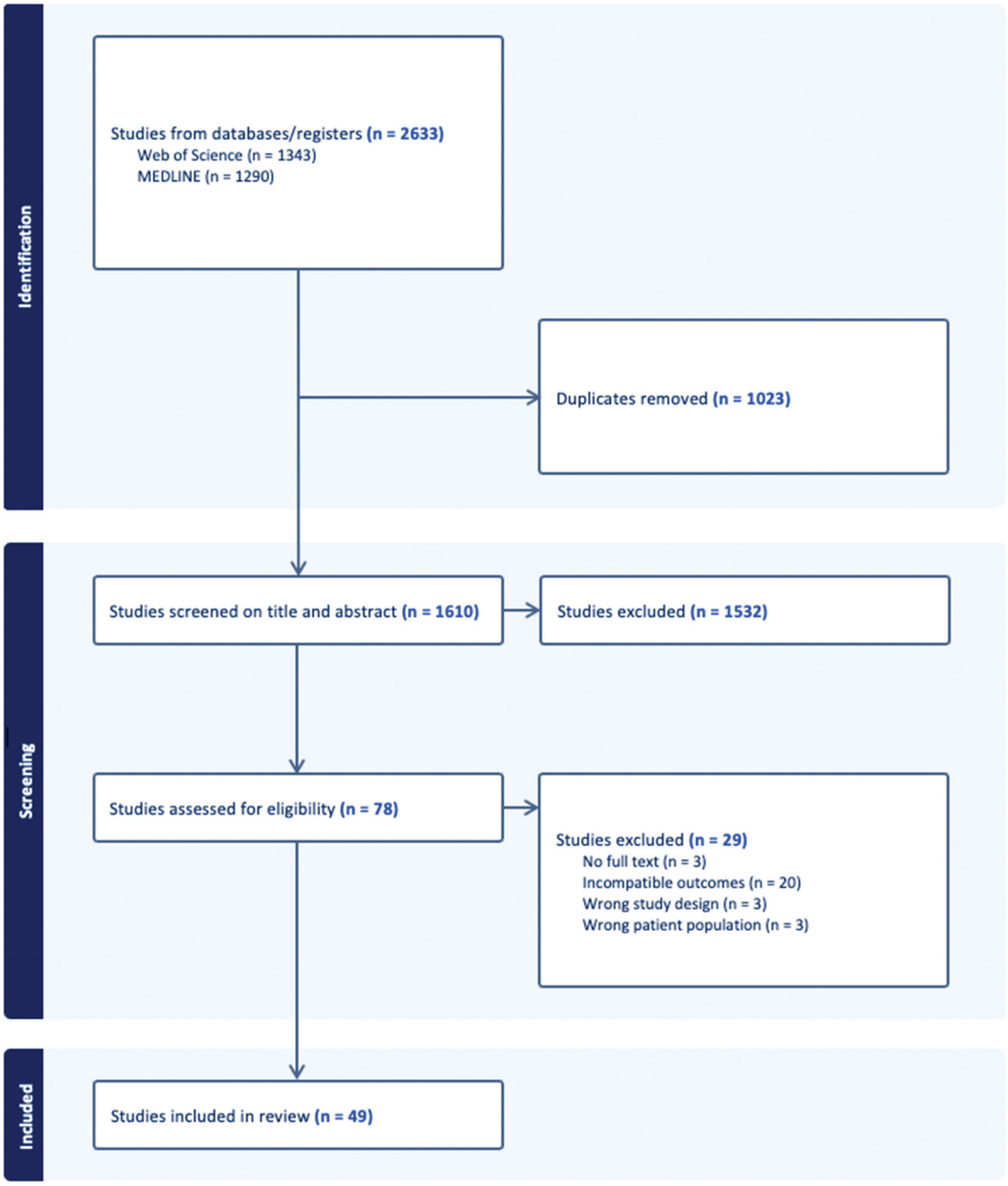


**Figure 1.** PRISMA flow diagram of study selection.

Hadjipanayis et al. investigated vaccine confidence among parents in 18 European countries. They have demonstrated that Portuguese parents were the most confident in vaccines (85%), while Bulgarian parents had the least trust (23%). This study showed no significant association between VH and parental gender, age, marital status or number of children per household. Education, however, was linked to VH, with parents who graduated from elementary or high school being more hesitant than those who graduated from university.[7]

A second multi-country study concerns a discrete choice experiment performed in Belgium, France, and the United Kingdom (UK). In this study, following factors were assessed: vaccine effectiveness, vaccine-preventable disease (VPD) burden, vaccine accessibility, vaccinator and administrative requirements, vaccine-related side effects, and vaccination coverage. All factors were statistically significant in the decision-making process of vaccine acceptance or refusal, with vaccine effectiveness and accessibility being the most influential. Mild vaccine-related side effects had the greatest impact on the vaccine acceptance process in France and Belgium, whereas vaccine effectiveness was most important in the UK. Overall, vaccines were perceived positively, but the UK showed the highest proportion of parents agreeing that vaccines included in the NIP are important.[8]

**Table 1.** Characteristics of the selected studies included in the systematic review.

| Author | Country | Vaccine | Population | Inclusion period | Inclusions | Type of research | Methodology | Instrument |
|---|---|---|---|---|---|---|---|---|
| Hadjipanayis et al.[7] | Europe | NIP | Parents of children 1–4 y old | ? | 5736 | Quantitative | Questionnaire | EAPRASnet$^{+}$ |
| Verelst et al.[8] | France, UK Belgium | ? | Parents of children <18 y old | Dec 2018 May 2019 | 1600 per country | Quantitative | Discrete Choice Experiment | / |
| Bocquier et al.[9] | France | NIP with focus on Measles, Hepatitis B, and HPV | Parents of children 1–15 y old | 2016 | 3927 | Quantitative | Questionnaire | Baromètre Santé |
| Rey et al.[10] | France | NIP with focus on Measles, Hepatitis B, HPV, and Influenza | Parents of children 1–15 y old | Jan–Jul 2016 | 3938 | Quantitative | Questionnaire | Self-made questionnaire |
| Peretti-Watel et al.[11] | France | NIP | Parents of children 3–5 y old | 2014 | 25 | Qualitative | Interviews | / |
| Romijnders et al.[12] | Netherlands | NIP | Parents (age child not specified) | Feb–Mar 2017 | 55 | Qualitative | FGD$^{=}$ | / |
| Ebi et al.[13] | Switzerland | NIP | Parents (age child not specified)<br>HCPs | Sep 2017–Feb 2018<br>Jan 2019–Apr 2020 | 30<br>1390 | Mixed-methods | Interviews<br>Questionnaire | PACV5° |
| Jafflin et al.[14] | Switzerland | NIP + HPV | Parents of children aged 0–11 y old<br>HCPs | Dec 2018–Feb 2020 | 2425 | Quantitative | Questionnaire | PACV5° |
| Facciola et al.[15] | Italy | NIP | Parents of children 13–14 y old | Jan–Jun 2017 | ? | Quantitative | Questionnaire | Self-made questionnaire |
| Gavaruzzi et al.[16] | Italy | NIP | Parents of vaccine-eligible children | Dec 2016–May 2017<br>Apr–May 2017 | 2778<br>593 | Mixed-methods | Questionnaire | Self-made questionnaire |
| Giambi et al.[17] | Italy | NIP | Parents of children 16–36 months old | Dec 2015–Jun 2016 | 3230 | Quantitative | Questionnaire | Self-made questionnaire |
| Napolitano et al.[18] | Italy | NIP | Parents of children 2–6 y old | Oct–Dec 2017 | 437 | Quantitative | Questionnaire | PACV° |
| Napolitano et al.[19] | Italy | NIP | Parents of children <17 y old with chronic condition | Jun–Dec 2021 | 444 | Quantitative | Questionnaire | PACV° |
| Lo Vecchio et al.[20] | Italy | Measles (included in NIP) | Parents of children aged >15 months | Nov 2016–Marc 2017 | 1141 | Mixed-methods | Questionnaire | Self-made questionnaire |
| Bianco et al.[21] | Italy | NIP | Parents of kindergartners | Apr–Jun 2017 | 575 | Quantitative | Questionnaire | PACV5° |
| Casigliani et al.[22] | Italy | NIP | Parents (age child not specified) | Nov 2020–Apr 2021 | 938 | Quantitative | Questionnaire | Self-made questionnaire |
| Gianfredi et al.[23] | Italy | Polio<br>Measles<br>(both included in NIP) | Children below 24 months old | 2015 – 2017 | ? | Quantitative | Database | / |
| Wiedermann et al. [24] | Italy | SARS-CoV-2<br>Compulsory vaccines in NIP | Parents of children up to 21 y old | Apr–Oct 2021 | 10 | Qualitative | Interviews | / |
| Bertoncello et al.[25] | Italy | NIP | Parents of children 3 months – 7 y old | Dec 2016–Apr 2017 | 3865 | Quantitative | Questionnaire | Self-made questionnaire |
| Caso et al.[26] | Italy | NIP | Parents of children 0–16 y old in antivax groups | 2018 | 447 | Quantitative | Questionnaire | Self-made questionnaire |
| Moschese et al.[27] | Italy | NIP | Parents of non-European origin children aged 0–17 y old | Feb–Jul 2023 | 310 | Quantitative | Questionnaire | Self-made questionnaire |
| Reverte et al.[28] | Spain | MMR (included in NIP) | Parents (age child not specified) | Oct 2023–Mar 2024 | 1919 | Quantitative | Questionnaire | Vaccine Confidence Index (VCI) |

(*Continued*)

**Table 1.** (Continued).

| Author | Country | Vaccine | Population | Inclusion period | Inclusions | Type of research | Methodology | Instrument |
|---|---|---|---|---|---|---|---|---|
| Kotsia et al.[29] | Greece | NIP | Parents of children <18 y old | 2014 – 2017 | 453 | Quantitative | Questionnaire | Greek Health Examination Survey EMENO |
| Gkentzi et al.[30] | Greece | NIP | Parents of children 4–12 y old | Sep 2019–Jun 2020 | 1227 | Quantitative | Questionnaire | Self-made questionnaire |
| Kyprianidou et al.[31] | Cyprus | NIP | Mothers of children <18 y old | Apr–Jun 2020 | 703 | Quantitative | Questionnaire | Self-made questionnaire |
| Tomljenovic et al.[32] | Croatia | Obligatory vaccines within NIP | Parents of children 3 months – 15 y old who refused at least one vaccine | Sep–Oct 2018 | 25 | Qualitative | Interviews | / |
| Mayerová et al.[33] | Albania | NIP | Parents of children 0–5 y old | Sep 2017–Feb 2018 | 2113 | Quantitative | Questionnaire | Albania Demographic and Health Survey |
| Gjini et al.[34] | Albania | NIP | Parents of children 6 months – 8 y old | Dec 2020–Feb 2021 | 475 | Quantitative | Questionnaire | PACV° |
| Campbell et al.[35] | UK | NIP | Parents of children 2 months – 5 y old | 2015 | 1792 | Mixed-methods | Interviews | / |
| Skirrow et al.[36] | UK | NIP | Parents of children aged 0–10 y old | Jun–Nov 2022 | 518 questionnaires 16 FGD | Mixed-methods | FGD= Questionnaire | Self-made questionnaire |
| Sherman et al.[37] | UK | Varicella (not included in NIP) | Parents of children 0–5 y old | Jul–Aug 2021 | 596 | Mixed-methods | Questionnaire | Self-made questionnaire |
| Marron et al.[38] | Ireland | NIP | Parents of children 0–48 months old | Jun–Aug 2021 | 855 | Quantitative | Questionnaire | PACV° + Vaccine Confidence Scale |
| Marshall et al.[39] | Ireland | NIP | Parents (age child not specified) | Nov 2018 | 105 | Quantitative | Questionnaire | PACV° |
| Whelan et al.[40] | Ireland | NIP | Parents of children 0–16 y old | Sep–dec 2018 | 436 | Quantitative | Questionnaire | PACV° |
| Nurmi et al.[41] | Finland | NIP | Parents who refused all vaccines | 2016 – 2019 | 38 | Qualitative | Interviews | / |
| Byström et al.[42] | Sweden | NIP | Parents of children 0–15 y old | 2014 | 825 | Mixed-methods | Questionnaire | Self-made questionnaire |
| Jama et al.[43] | Sweden (Somali) | MMR (included in NIP) | Lawful Somali parents in Sweden of children 18 months – 5 y old | Jun–Sep 2013 | 13 | Qualitative | Interviews | / |
| Jenness et al.[44] | Norway (Somali) | Measles (included in NIP) | Lawful Somali parents in Norway of children born in 2000–2016 | 2000 – 2016 | 11334 | Quantitative | Database | / |
| Bankiewicz et al.[45] | Poland | Obligatory vaccines in NIP | Parents of immunized children 1–5 y old | Feb–Mar 2016 | 53 | Qualitative | Interviews | / |
| Furman et al.[46] | Poland | Obligatory vaccines in NIP | Individuals aged >18 y old with at least one child | Mar 2019 | 1079 | Quantitative | Questionnaire | Self-made questionnaire |
| Lewandowska et al.[47] | Poland | NIP | Parents of child aged 10–14 y old | 2018 – 2019 | 2300 | Quantitative | Questionnaire | Self-made questionnaire |
| Krasnicka et al.[48] | Poland | NIP | Parents (age child not specified) | Jul 2015–Jun 2016 | 300 | Quantitative | Questionnaire | Self-made questionnaire |
| Gleditsch et al.[49] | Norway (Poland) | NIP | Polish lawful migrants in Norway | Sep–Nov 2022 | 15 | Qualitative | Interviews | / |
| Gorman et al.[50] | UK (Poland) | NIP | Polish migrants in Scotland | March 2018 | 13 | Qualitative | FGD= | / |
| Miron et al.[51] | Romania | Optional vaccines (not included in NIP) | Parents (age child not specified) | Aug 2021 | 2550 | Mixed-methods | Questionnaire | Self-made questionnaire |

(*Continued*)

**Table 1.** (Continued).

| Author | Country | Vaccine | Population | Inclusion period | Inclusions | Type of research | Methodology | Instrument |
|---|---|---|---|---|---|---|---|---|
| Iova et al.[52] | Romania | NIP | Postpartum mothers | ?–Jul 2023 | 404 | Quantitative | Questionnaire | PACV5° + WHO SAGE of immunization |
| Grechuka et al.[53] | Ukraine | NIP | Parents (age child not specified) | 2019 – 2020 | 797 | Quantitative | Questionnaire | EAPRASnet[+] |
| Osborne et al.[54] | Ukraine | NIP | Parents of children <6 y old and HCPs | May–Jul 2021 | 25 | Qualitative | Interviews | / |
| Huber et al.[55] | Hungary | Varicella (Included in NIP since September 1st, 2019) | Parents (age child not specified) and HCPs | Oct 2018–Feb 2019 | 1042 | Mixed-methods | Questionnaire | Self-made questionnaire |

° PACV5: Parental Attitude toward Childhood Vaccination; [+]EAPRASnet: European Academy of Pediatrics Research in Ambulatory Settings network; [=]FGD: Focus group discussions.

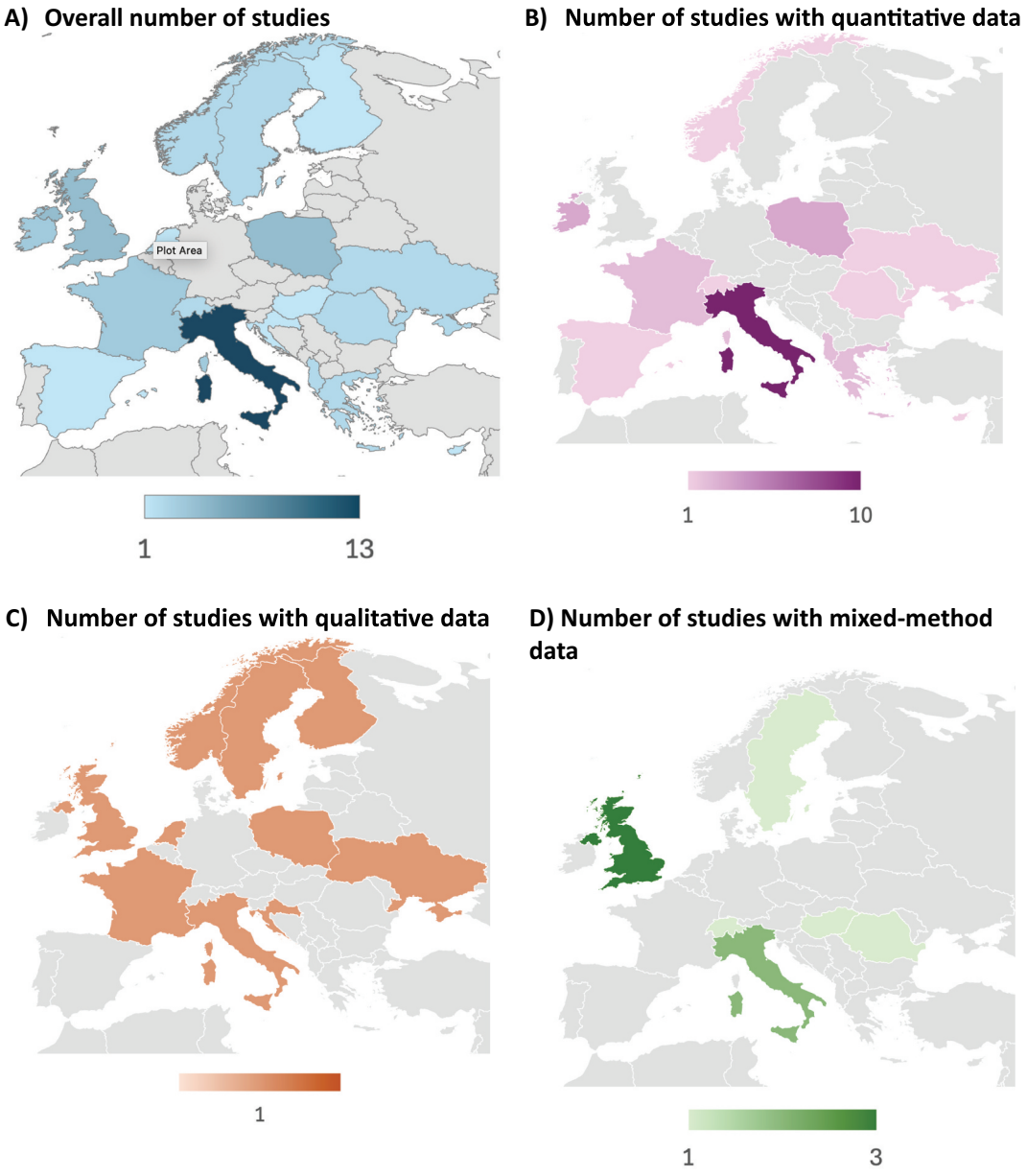


**Figure 2.** Overview of number of included studies per EU country.

## *Western-Europe*

### *France*

Three studies investigated VH in France, where most vaccines are nowadays obligatory and offered free of charge. The obligation came into effect in 2018, after completion of all included studies in this review. Vaccine refusal was more prevalent among parents with higher education profiles and among mothers compared to fathers. No association between VH and household income or presence of older siblings was found.[9,10]

Fear of side effects, along with personal or others' experiences, was identified by Peretti-Watel et al. as significant factor contributing to VH. Perceiving the disease as unlikely to occur or benign, led parents to consider vaccines as useless. Doubts were often expressed by parents, even among parents who vaccinated their children. VH-parents often immunized their child due to social pressure from HCPs, resulting in a pattern of 'doubtful acceptance,' as refusal was a difficult decision. All participants reported trusting their own physician, but only after identifying one they considered trustworthy. Physicians and the internet were key information sources. While some parents preferred 'official' websites, others relied on newsgroups, as official information was considered by some to be biased.[10,11]

**Table 2.** Summary of factors associated with VH by country related to 'confidence.' 'X' indicates that the topic was discussed in a study, while blank boxes indicate it was not discussed.

| | Fear of side effects | Previous experiences | Concerns about vaccine's effectiveness | Concerns about vaccine safety (and ingredients) | Lack of confidence in HCPs | Lack of confidence in official data and vaccine-related administration | Lack of confidence in health services | Lack of confidence in pharmaceutical industry | Lack of information | Negative HCP's advice |
|---|---|---|---|---|---|---|---|---|---|---|
| Percentages of countries investigating and mentioning the topic: | 94% | 38% | 31% | 44% | 69% | 13% | 38% | 25% | 50% | 56% |
| **France**[9–11] | X | X | X | X | X | | | | | |
| **The Netherlands**[12] | X | | | | X | | | | X | |
| **Switzerland**[13] | | | | | X | | X | | | X |
| **Italy**[15,17,18,20,21] | X | X | X | X | X | | | X | X | X |
| **Greece**[29] | X | | | | X | | | X | | |
| **Cyprus**[31] | X | | | | | | | | | X |
| **Croatia**[32] | X | X | | | X | X | X | | | X |
| **Albania**[33,34] | X | | | X | X | | | | | |
| **United Kingdom**[35–37] | X | X[%] | | X | X | | X | X | X | |
| **Ireland**[38–40] | X | | X | X | X | | | | | |
| **Finland**[41] | X | X | | | X | X | X | | | |
| **Sweden**[42] | X | | | | | | | | X | X |
| **Poland**[45–48] | X | X | X | X | X | | X | X | X | X |
| **Romania**[51] | X | | | X | | | | | X[£] | X |
| **Ukraine**[§,53,54] | X | | | | | | X | | X | X |
| **Hungary**[%,55] | X | | X | | | | | | X | X |

[£]Optional vaccines, not offered free of charge; [§]Specific groups, such as Roma Community or low-income households; [%]Varicella vaccine.

### *The Netherlands*

The Dutch NIP offers vaccines free of charge and on a voluntary basis. Negative aspects of the NIP were discussed among vaccine-refusers and included the perceived too early start of vaccinations, the inability to discuss alternatives and concerns with peers or HCPs, the inflexibility of a standardized schedule, the lack of transparency in the NIP, the use of combination vaccines, and the impression that immunization is obligatory. Influences in the decision-making process encompassed both perceived severity and susceptibility of VPDs and concerns about vaccine-related side effects. Additionally, vaccine-acceptors highlighted a strong social norm confirming their decision, while partial acceptors and refusers felt criticized by it.[12]

Most VH-parents lacked confidence in HCPs knowledge and their ability to address concerns regarding childhood vaccinations. The demeanor of HCP's was often perceived as patronizing, making parents feel

**Table 3.** Summary of VH factors related to 'convenience.' 'X' indicates that the topic was discussed in a study, while blank boxes indicate it was not discussed.

| | Contraindications or underlying medical condition | Sickness at time of vaccination | Allergies | Having to show identifying documents | Geographic distance | Financial difficulties | Difficulties to make appointments | Difficulties to access vaccination centers | Lack of time | Forgetfulness | Use of combination vaccines | Lack of transparency in NIP | Inability to discuss alternatives |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentages of countries investigating and mentioning the topic: | 18% | 36% | 9% | 9% | 9% | 36% | 9% | 18% | 27% | 9% | 9% | 9% | 9% |
| **The Netherlands**[12] | | | | | | | | | | | X | X | X |
| **Italy**[17,19,20] | X | | | | | | | | | X | | | |
| **Spain**[$,28] | | | | | | | X | X | | | | | |
| **Cyprus**[31] | | | | | | X | | | | | | | |
| **Albania**[33] | X | X | X | | | | | | X | | | | |
| **United Kingdom**[35] | | X | | | | | | X | X | | | | |
| **Ireland**[38] | | X | | | | | | | | | | | |
| **Poland**[47] | | X | | | | X | | | X | | | | |
| **Romania**[£,48] | | | | | | X | | | | | | | |
| **Ukraine**[§,54] | | | | X | X | | | | | | | | |
| **Hungary**[%,55] | | | | | | X | | | | | | | |

[$]MMR-vaccine; [£]Optional vaccines, not offered free of charge; [§]Specific groups, such as Roma Community or low-income households; [%]Varicella vaccine.

"stupid and bad." Moreover, several questions remained unanswered, and navigating through contradictory information was considered difficult.[12]

### *Switzerland*

Two Swiss studies investigated VH, in a context where vaccines are not obligatory and offered free of charge. Often mentioned influencing factors in parents' decision-making process included the child's doctor, other HCPs, family, friends, acquaintances, official public health recommendations, print media, the internet, and social media. The child's doctor was the most cited, but not always the most trusted one. VH-parents tended to rely more on social networks, other HCPs (e.g. nurses), and their personal gut feelings or previous experiences when making decisions. They often sought certainty by comparing and weighing information from different resources. Nevertheless, this process often generated ambiguity, as some information could solidify their opinion while other information led to further doubts and uncertainties.[13] Moreover, the type of HCP was correlated with VH. Parents attending moderately or highly hesitant complementary medicine providers were more likely to be moderately or highly VH themselves. Income also played a role, as higher household income was associated with lower odds of being VH.[14]

**Table 4.** Summary of factors related to VH by country, related to 'complacency.' 'X' indicates that the topic was discussed in a study, while blank boxes indicate it was not discussed.

| | Low perceived susceptibility to VPD | Low perceived severity of VPD | Low perceived severity of VPDs potential complications | The belief that vaccines are unnecessary | The belief that vaccines are bad | Preferring natural immunity | Already having had the disease |
|---|---|---|---|---|---|---|---|
| Percentage of countries investigating and mentioning the topic: | 20% | 60% | 10% | 50% | 10% | 30% | 10% |
| **France**[9–11] | X | X | | X | | X | |
| **The Netherlands**[12] | X | X | | | | | |
| **Italy**[17–19] | | | | X | X | | |
| **Greece**[29] | | | | | | X | |
| **United Kingdom**[%,35–37] | | X | X | X | | | X |
| **Finland**[41] | | | | | | X | |
| **Sweden**[42] | | X | | | | | |
| **Poland**[45,48] | | | | X | | | |
| **Romania**[51,52] | | X | | | | | |
| **Hungary**[%,55] | | X | | X | | | |

[%]Varicella vaccine.

## *Southern-Europe*

### *Italy*

One quarter of the included European studies were conducted in Italy, where vaccines are obligatory and offered free of charge. Many studies discussed the reasons for delaying or refusing a vaccine within the NIP. These reasons included notably fear of side effects, disbelief in the vaccine efficacy, the presence of contraindications (e.g. fever, underlying medical condition), prior negative experiences, lack of trust in and poor information from pediatricians, forgetfulness, and informed refusal.[15–23] Furthermore, Wiedermann et al. found that some circumstances in life were crucial in shaping parents' attitude toward vaccination, such as previous experiences with the healthcare system, previous allergic reactions to vaccines, perceived health issues related to vaccination, or the compulsion to vaccinate.[24] This skepticism was further fueled by distrust in the pharmaceutical industry and government and perceived inconsistencies in vaccination policies.[24]

Looking into the determinants associated with VH or refusal, numerous factors have been identified across different studies. These included the use of complementary medicine, rising levels of economic hardship, past experiences of adverse events following vaccination, low knowledge of the disease or vaccine,

**Table 5.** Overview of crude odds ratios (cOR,^), adjusted odds ratios (aOR,°), and univariate *p*-values (*) of parental sociodemographic factors associated with childhood vaccine hesitancy in European region.

| | Parental gender | Parental age | Marital status | Number of children | Educational level | Ethnicity | Financial status | Employment status |
|---|---|---|---|---|---|---|---|---|
| **France**[9,10] | **1.3 (1.2–1.5)°** | 0.9 (0.9–1.1)° | ***p* = .001*** | ***p* < .001*** 1.0 (0.8–1.2)° | **1.56 (1.19–2.04)°** | | 0.96 (0.73–1.25)° | |
| **Switzerland**[13,14] | *p* = ,095* | | 1.31 (0.79–2.17)° | | ***p* < .001*** 0.91 (0.58–1.41) | 1.10 (0.79–1.52)° | ***p* < .001*** 0.54 (0.34–0.86)° | |
| **Italy**[15,17,18,22,25,27] | ***p* = .009** 1.97 (0.63–6.18)° | ***p* = ,009*** 0.71 (0.35–1.45)° | 1.07 (0.58–1.97)° | *p* = .49* | **1.35 (1.10–1.66)^** (Higher = reference) 1.77 (0.77–4.11)° (Lower = reference) | **0.43 (0.22–0.59)°** (Italian = reference) **0.26 (0.11–0.67)°** (Migrants = reference) 1.14 (0.63–2.04)° (Not foreign = reference) | **1.59 (1.00–2.53)** | **0.65 (0.43–0.99)^** |
| **Spain**[28] | | | ***p* = ,014*** | | **0.14 (0.06–0.35)°** | ***p* < .001*** | | |
| **Greece**[29,30] | 0.95 (0.66–1.35)^ | 1.46 (1.05–2.02)° | 1.86 (1.25–2.76)° | 0.98 (0.75–1.20)^ | **1.47 (1.16–1.86)°** | **2.86 (1.36–5.98)°** (Non-Greek = reference) **1.25 (1.10–1.43)°** (Greek = reference) | ***p*=0.03*** 0.98 (0.80–1.21)^ | 1.35 (0.96–1.91)^ |
| **Albania**[33] | | | **0.08 (0.01–0.65)°** | | 0.64 (0.38–1.05)° | 1.01 (0.39–2.64) | | **0.65 (0.47–0.91)°** |
| **United Kingdom**[36,37] | 0.84 (0.55–1.28)° | 0.98 (0.95–1.02)° | | | | ***p* =.03*** | *p* =.471* | |
| **Ireland**[38,39] | 1.42 (0.71–2.79)° | **0.37 (0.15–0.92)°** | ***p* =.002*** 3.82 (1.54–9.43)° | **2.77 (1.14–6.73)°** | 0.45 (0.2–1.04)° | | 0.40 (0.17–0.92)° | **6.54 (2.02–20.59)°** |
| **Poland**[46,47] | 1.20 (0.91–1.60)° | ***p* < .001*** 0.96 (0.54–1.72)° | 0.83 (0.59–1.15)° | | ***p* < .001*** 1.10 (0.82–1.48)° | | *p* = .448* | 1.24 (0.90–1.72)° |
| **Hungary**[55] | 1.00 (0.44–2.46) | 0.91 (0.76–1.10)° | | **0.65 (0.45–0.95)°** | **0.50 (0.38–0.66)°** | | 0.77 (0.54–1.09)° | |

Bold = statistically significant results (p < .05 or 95% CI excluding 1.0); Green shading = significant positive association; coral shading = significant negative association; blue shading = significant association; Yellow shading = significant association in univariate analysis, but not in regression analysis; Pink shading = inconsistent significant associations among different studies; Grey shading = no data available.

and low trust in pediatricians.[15,17,18,22,25] Discrepancies were observed for country of origin and parental education level. While Giambi et al. showed that Italian citizenship was associated with higher VH, Bertoncello et al. did not find any association with ethnicity, but Moschese et al. reported that migrants were more likely to delay or refuse vaccines.[17,25,27] A similar heterogeneity was seen in parental education level: while lower educational level appeared to be associated with higher VH, Bertoncello et al. again did not find an association between educational level and VH.[15,18,19,22,25,27]

In most studies, HCPs, particularly pediatricians, were the most frequently consulted sources of information, followed by the internet, mass media, and family/friends.[17–19,21,27] The presence of a trustworthy physician was positively correlated with the number of fully vaccinated children. Furthermore, trust in science and healthcare institutions has shown to be protective against vaccination delays or refusal.[26] Yet, in some studies, physicians often provided contradictory information regarding vaccination.[15] VH-parents were more likely to report that childhood vaccinations were a profitable business for pharmaceutical companies and reported that pediatricians did not provide sufficient information on childhood vaccinations.[21]

In a study on obligatory vaccination, VH-parents often relied on a wide range of information sources, which made it difficult for them to access consistent and reliable information and to form a clear opinion. Parental knowledge was frequently shaped by skepticism, including doubts about vaccine effectiveness and safety.[24]

### Spain

One study investigated parental attitudes toward the MMR vaccine in Spain and the reasons for delaying vaccination. The MMR vaccine is free and recommended within the NIP, but not obligatory. For the first dose, significant delays were more common among children born outside of Spain, from single-parent households, or whose parents had lower levels of education. Similar reasons were identified for delays in the second dose, which was particularly prolonged in single-parent families and among children of parents not born in Spain. In the latter, barriers included difficulties to access vaccination centers and logistical challenges in scheduling appointments. Generally, not being the first-born child increased the likelihood of timely vaccination, as did receiving positive feedback from relatives, friends, or Public Health authorities. Regarding vaccine confidence, parents with higher confidence were more likely to timely immunize their child with the first MMR dose, but no differences were observed between high- and low-confidence parents regarding the second MMR dose at 4 years old.[28]

### Greece

In Greece, two studies addressed VH toward the NIP, which is offered free of charge and obligatory for children attending kindergarten and elementary school.[29] Overall, a positive attitude toward vaccines and the NIP was seen.[30] Despite only 7% of parents reporting a negative attitude toward vaccinations, more than 40% expressed skepticism toward at least some NIP vaccines. Potential side effects concerned parents the most, followed by the idea that it is better for the child to get natural immunity through illness rather than by vaccination. Most parents identified as skeptical were of non-Greek origin and single.[29] However, Gkentzi et al. found that most parents with a positive tendency toward vaccines were predominantly of Greek origin.[30] Other determinants that were associated with a negative attitude included higher education and living in semi-urban areas.[29] Like in other countries, the main source of parental information was a physician, being their primary care pediatrician.[29,30]

### Cyprus

Most vaccines in Cyprus are voluntary and provided free of charge. Overall, there was a positive perception of, and good knowledge about vaccines, with only 3% of mothers being VH. This indicates that mothers were aware of the importance, benefits, and preventive role of vaccination. Higher education levels were associated with higher adherence to the vaccination schedule. Furthermore, being employed and having access to a monthly income was related to higher knowledge about vaccines and positive vaccination practices. Reasons for VH are discussed in Tables 2–4.[31]

### Croatia

Tomljenovic et al. interviewed 25 parents who had refused at least one obligatory vaccine. These obligatory vaccines include the BCG-vaccine against tuberculosis, the 13-valent pneumococcal vaccine, the MMR vaccine, and a hexavalent vaccine. Participants described the vaccine decision-making process as complex and time-consuming, largely influenced by emotional responses, including fear of side effects, intuitive feelings, and social pressure. The most common way participants reflected on their decisions was through justifications related to their broader worldview, as well as moral and religious convictions. Over half of the respondents also expressed belief in some form of conspiracy theory. Additionally, concerns were raised about mistrust in vaccine administration and skepticism toward official data.[32]

### Albania

Two studies investigated VH in Albania, where immunization is obligatory with vaccines being offered free of charge. Childhood immunization coverage has been declining in Albania, despite growth in economy, health service expenditure, universal health insurance, and free childhood immunization is seen. The main and most trusted sources of health-related information were HCPs, followed by the internet, television, friends, and schools. Mothers who relied on the internet as their primary source of health-related information had lower odds of timely childhood immunization than those who relied on other sources.[33] Additionally, Gjini et al. found that low confidence in HCP's information was a predictor of VH.[34] Other determinants of timely immunization were occupational status, higher educational status, being married, ethnicity, and parental attitude toward childhood immunization.[33,34]

Working mothers and mothers without formal education had lower odds of timely immunization compared to non-working mothers and mothers with higher education. Single mothers had lower odds of vaccine confidence compared to married women or those living with a partner, while mothers from other ethnicities had lower odds compared to those of Albanian ethnicity.[33] A more negative parental attitude toward childhood immunization was an important driver of VH, along with low confidence in HCPs.[34] Reasons for delaying vaccinations included fear of side effects, doubts about vaccine safety, contraindications (e.g. acute illness, allergies), and lack of time.[33,34] Both the concerns about vaccine safety and concerns about side effects were the most frequently reported reasons for vaccine refusal.[33]

## Northern-Europe

### United Kingdom

In the UK, three studies have investigated VH. All childhood vaccines in UK's NIP are voluntary and provided free of charge.[35] In 2015, nine out of ten parents reported having all their children immunized on time, with the MMR vaccine being the most commonly delayed or refused vaccine.[35,36] Parents who delayed vaccination mentioned child illness as the main reason, followed by concerns about side effects or consequences.[35] In contrast, parents who refused vaccines reported ordinary objections to the vaccine, concerns about side effects and possible illness following immunization, worries about safety and ingredients of the vaccine, and issues related to their child's health.[35] Regarding varicella vaccination, which is included in the NIP, reasons for VH included the need for more information, prior disease experience, and the perception that varicella and its potential complications are mild.[37]

In England, HCPs were the most common and trusted source of information and advice on immunization. Nevertheless, around one in four parents sought additional information on side effects, the purpose of immunization, vaccine ingredients, and vaccine appointment logistics.[35–37] Furthermore, mistrust of the health service and pharmaceutical industry was reported. Vaccines routinely offered in the NIP were perceived as more established and consequently more trustworthy.[36]

When looking at the demographic factors that may interfere with vaccine acceptance, being from an ethnic minority group and being a mother showed significant association with VH. Mothers were more likely than fathers to refuse or delay vaccination, and parents from ethnic minority groups showed higher likelihoods of vaccine delay or refusal.[35,36] However, Sherman et al. found no significant association between parental gender or age and VH.[37]

In Scotland, mothers with Polish background perceived the differences in the Polish and Scottish NIPs not as problematic and noted the benefits of vaccines being offered free of charge. Furthermore, it was

assumed that Polish state-funded vaccines were inferior to those available in the UK since they were perceived to cause more side effects. However, some dissatisfactions were mentioned about the inflexibility, together with the desire to supplement the NIP with vaccines which are included in Poland's NIP. Additionally, the organization of childhood immunization was criticized since it differs between both countries. In Scotland, no physician's physical examination precedes the immunization, unlike in Poland where a physician makes sure it is safe to vaccinate.[50]

### Ireland

Vaccines are not obligatory in Ireland and are freely available. Three Irish studies found that the predominant drivers of VH were concerns about vaccine safety and efficacy, as well as the large number of vaccines included in the NIP.[38–40] Yet, parents generally chose to vaccinate despite these concerns. Most parents reported that vaccines are important and safe and express high trust in information provided by HCPs, such as general practitioners, nurse practitioners, as well as the government. Regarding determinants of VH, lower vaccine acceptance was associated with being single, unemployed, or having four or more children. No effect of age, education level, gender, geographic location, household income, or religion was observed.[38,39]

### Finland

Nordic countries reported a positive attitude toward vaccination, although a decrease in perceived vaccine safety was seen between 2015 and 2018. In Finland, vaccines are offered free of charge and the NIP is recommended but not obligatory. Witnessing, experiencing or hearing about side effects was the most important reason for vaccine refusal among parents. Convictions were often so strong that HCP's assurance could not change VH-parents' reasoning. Despite high trust in the state, scientific institutions, and science itself, some reasons for vaccine refusal were linked to a lack of trust in health authorities, vaccination research, or HCPs. Other reasons were associated with health-related practices and perceptions toward vaccines. Some parents hoped their child would get a VPD during childhood when the symptoms are expected to be milder, in order to achieve a more 'natural, longer-lasting immunity.'[41]

### Sweden

One study showed Swedish parents had high confidence in the NIP, in which all included vaccinations are offered voluntarily and free of charge with a coverage that is both high and stable. However, one in five parents reported concerns about or refused at least one vaccination in the NIP. The main reasons for questioning or refusing vaccines included concerns about adverse events, exposure to negative recommendations, or a lack of reliable information. Convenience did not appear to be a major barrier to childhood immunization, as most concerns were rather related to both confidence and complacency.[42]

Jama et al. investigated how Somali-born mothers living in Sweden perceive the MMR vaccine. Barriers to timely immunization included peer pressure from other parents, concerns about side effects and uncertainty about vaccine safety, as well as negative previous experiences with HCPs. Conversely, positive peer pressure, trust in HCPs, and faith in God were seen as facilitating factors for timely vaccination.[43]

### Norway

Lawful Polish migrants in Norway, the largest migrant group in Norway, reported a smooth transition from one NIP to the other, feeling less pressured to vaccinate in Norway compared to Poland since Norway has no obligatory vaccines. In Norway, a high level of trust in the offered vaccines and few questions about them or potential side effects were observed. This trust together with trust in official recommendations were important in the decision-making process. Nevertheless, some parents reported VH toward some vaccines in Norway's NIP, but not toward the program altogether. This VH was linked to unfamiliarity with specific vaccines, particularly those being recently implemented in the NIP, or when the likelihood of their child getting sick from the disease was considered low.[49] In Norway, children of Somali migrants had lower MMR vaccine coverage compared to children of native Norwegians, and the mother's length of residency was negatively associated with vaccine coverage.[44]

## Eastern-Europe

### Poland

Six studies investigated the view of Polish parents on immunizations within the NIP. Among Polish children, the number of unvaccinated children has increased since 2019 although the high and stable immunization coverage still ensures herd immunity.[45] NIP vaccinations remain obligatory until the age of 19, and vaccines within the program are free of charge. These obligatory vaccines include the BCG vaccine, 10-valent pneumococcal vaccine, the MMR vaccine, and a hexavalent vaccine. Three quarters of the Polish population supported the safety of these obligatory vaccines. Around 10% of parents reported they would stop vaccinating their child if the state were to end the vaccination obligation.[46] At the same time, over half of the respondents found that pediatric vaccinations should not be compulsory.[47] Notably, older parents were more inclined to support toward mandatory vaccination.[48]

Influencing factors for parental immunization decisions are shown in Tables 2–4. In summary,: enrollment in a nursery or preschool, fear for the disease or complications, doctor's recommendations, and trust in HCP's or other authority figures were seen as facilitators for vaccination.[45,49,50] Vaccination was delayed due to child illness at the time of immunization or exposure to negative information about immunization, while non-immunization was mainly driven by fear of side effects and discouragement of vaccination by a physician.[45,47,48]

Most parents believed that vaccinating their child was a prudent choice, as immunization prevents the occurrence of infectious diseases, decreases the VPD's severity, is safe, and aligns with their personal experiences. However, some parents questioned the necessity of immunization, citing that vaccines were ineffective, may cause the VPD, and mainly benefited the pharmaceutical companies.[45]

Above all, HCPs were the most important factor shaping parents' positive attitudes toward vaccinations together with authority figures and a medical exam preceding the immunization.[45] Trust in doctors, and parental scientific knowledge have a positive influence on vaccine confidence.[46,47] Furthermore, media broadcasts on the consequences of non-immunization increased positive parental attitudes.[45]

Despite some studies not finding a correlation between vaccine confidence and factors such as gender, marital status, educational level, occupational status, financial status, and place of residence, others found that vaccination confidence was associated with educational level, and with certain vaccination assumptions and influences.[46–48] Higher education was correlated with a perception of lower vaccine safety compared to lower education.[47,48] Furthermore, higher confidence was associated with a negative assessment of the occurrence of vaccination complications or with a positive assessment of vaccination by professionals.[47]

### Romania

VH toward vaccines within and outside of the NIP was the topic of two studies in Romania. In 2021, 11 VPDs were included in Romania's NIP. Although the NIP is free of charge and immunization is not obligatory, a decline in vaccination coverage has been observed over the past years with a decreased perception in vaccines' importance, safety, or effectiveness.[51,52] Fear of adverse reactions, parents' own decision, and HCP's recommendations to avoid specific vaccine(s) were mentioned as main reasons for not or only partially vaccinating children.[51] Moreover, VH-mothers were more concerned about the safety of new vaccines and had a lower perceived risk of the disease.[52]

VH was seen more often in mothers who lived in an urban environment, those with university or post-secondary education, and those who were married.[52] A higher level of parental knowledge about vaccination and VPD was positively correlated with vaccine uptake, compared to parents who chose not to vaccinate.[51,52]

Several vaccines are not routinely recommended and therefore not free of charge. Around three-quarters of parents reported having administered at least one optional vaccine to at least one of their children. Fear of side effects was cited as the main reason for refusing optional vaccines, along with high costs and insufficient information.[51]

Although pediatricians and general practitioners were the most frequently cited as the main sources of vaccination information, many parents additionally relied on online sources or advice from peer-parents.[51,52]

### Ukraine

Two Ukrainian studies investigated VH. The country offers vaccines free of charge and on voluntary basis. In Kyiv, 4.5% of parents with a university degree stated that the only reason for immunizing their child was to allow them to enter daycare or school, compared to 15% of parents with a high school degree. In both studies, approximately half of the parents fully trusted the NIP and agreed that questioning child vaccination is part of their parental role.[53]

Specific groups in Ukraine, such as the Roma community and low-income households, face structural barriers to accessing healthcare, including geographic distance, the requirement to present identification documents, and limited access to reliable information. Other factors contributing to incomplete immunization were partial or unemployment and a lack of a stable income. However, fear of side effects seemed to be one of the main drivers of VH, consistent with observations in many countries. These perceived side effects were believed to vary depending on the country of vaccine production, with European vaccines considered safer than those produced in Asian countries.[54]

### Hungary

One study investigated VH related to the varicella vaccination in Hungary, which was not free of charge at the time. Determinants of higher varicella vaccination acceptance included having only one child, living in the Capital, and receiving a recommendation from HCPs. The latter was the strongest determinant of positive varicella vaccination practices. Financial status, gender, and a parental history of a varicella infection were not significantly associated with vaccination acceptance. The most cited reason for not vaccinating children with the varicella vaccine was the belief that it was unnecessary, as the infection was not perceived as "being serious enough." Additional reasons included concerns regarding the perceived side effects, doubts regarding vaccine effectiveness, limited knowledge about vaccination, negative vaccination advice from HCPs, and financial difficulties.[55]

## Discussion

To our knowledge, this is the first review to explore parental VH differences and generalizability across Europe from both quantitative and qualitative perspectives, using WHO's 3C model. Parental VH appears to be a heterogeneous concept, varying across countries and within populations and requiring a tailored approach.[56,57] Quantitative data are not generalizable across Europe, as study populations, contextual factors, and research methodologies differ between countries. At the same time, determinants of VH should not be investigated separately, as multiple factors simultaneously influence parents' vaccination decision-making. This highlights the complexity and multidimensionality of the decision-making process. Qualitative data revealed the importance of confidence-related reasons for postponing or refusing vaccines across regions. Most of this data can be categorized as part of the 'Confidence' domain of the WHO's 3C model. Across all European regions, fear of side effects was the most frequently cited reason for VH, followed by other confidence-related topics. Practical barriers to immunization were most frequently reported in Southern- and Eastern-Europe, although they may also exist in other European regions. Regarding complacency, low perceived severity to a VPD was commonly mentioned across all regions, whereas low perceived susceptibility to a VPD was reported only in Western-Europe. Finally, in more than half of the countries mentioned, parents stressed the importance of the HCPs as a source of information and trusted figure to help guide their decision-making process.

Although the qualitative evidence demonstrates a notable degree of convergence across European settings as it is based on parents' self-reports through interviews or questionnaires, the interpretation of the quantitative findings is substantially more complex due to the differences in study methodology and study population. Shared themes mentioned as important factors in qualitative research are not systematically reflected in the quantitative data. Consequently, a tension emerges between the two types of evidence: whereas the qualitative literature suggests a coherent and cross-nationally stable set of reasons for VH, the quantitative results yield often incongruent results or conclusions but reflect very diverse methodologies and populations making comparison impossible. The latter underscores the need for

methodological alignment and the development of standardized approaches (e.g. harmonized survey instruments) to improve comparability.

## 3C model of vaccine hesitancy

### Confidence

Confidence-related concerns encompass factors related to the effectiveness and safety of vaccines as well as trust in the healthcare system and accounted for the majority of reasons for VH. Fear of side effects was among the most frequently cited reasons among parents across all European regions, regardless of educational level, occupational status or income. Consequently, both policymakers and HCPs should be aware of these concerns and actively address them through targeted communication, counseling, and trust-building strategies. In addition, general doubts about vaccine safety and skepticism regarding vaccine efficacy were also commonly reported. Other reasons for VH included doubts about vaccine ingredients and suspicions regarding commercial motives. Unfamiliarity with a vaccine can also contribute to distrust toward a specific immunization. When a vaccine has only recently been implemented, parents may perceive their child as a guinea pig.[58]

HCPs were the most trusted and frequently consulted sources of information. A trustworthy HCP was the key factor in shaping positive attitudes toward vaccination and could serve as a critical facilitator of childhood immunization, as parents rely on them to provide accurate information and tackle misinformation. As such, a high level of trust in HCPs and their recommendations was positively correlated with vaccine uptake while, conversely insufficient information or a HCP's negative recommendation was positively associated with VH.[59] The manner in which HCPs interact and communicate with parents may influence decisions to immunize children, although each communication strategy has its own advantages and limitations.[57,59,60] Simultaneously, other sources of information (e.g. the internet, family, or friends) played an important role.[11,13,33,36]

### Convenience

Convenience relates to the accessibility of vaccination services. Related factors included lack of time, financial constraints, and geographic distance. Financial considerations appeared particularly relevant in Eastern-Europe, where some vaccines are not offered free of charge, such as the varicella vaccine in Hungary and other optional vaccines in Romania.[51,55] Structural barriers are suggested to be as important as parental VH in limiting access of immunization services.[61]

In Spain, parents with lower education levels reported difficulties in making appointments and accessing vaccination centers.[28] Considering that these parents are more likely to work in less flexible jobs, such barriers may be more pronounced. Similar challenges may also affect parents from minority groups, who reported geographic distance as a barrier to immunization in Ukraine.[54] Additionally, Spain's national NIP includes seven recommended vaccines, which can make it challenging for parents to attend all vaccination visits. Albanian parents also cited lack of time as a reason for missed vaccinations. Although Albania's NIP contains only four different vaccines in the first year of life, it requires almost as many immunization appointments as Spain during this period (six vs. seven, respectively). When addressing VH, both the number of vaccines and the number of required immunization appointments should be considered.

In the Netherlands, the use of combination vaccines (e.g., the hexavalent vaccine) was considered a confidence-related barrier, likely due to perceived safety concerns associated with these vaccines. Consequently, the potential reduction in appointments or injections cannot be regarded as a significant advantage without targeted communication to inform parents about the efficacy and safety of combination vaccines, addressing both confidence-related and convenience-related factors. Further research should investigate the impact of convenience-related factors on VH.

### Complacency

Complacency encompasses factors associated with perceived disease risk. In the included studies, parents frequently mentioned the perceived severity and susceptibility of the VPDs, potential complications of the diseases, and their knowledge and awareness of the VPDs. Nevertheless, some parents preferred that their child contract certain VPDs in childhood, believing that the disease course would be mild. For example, in the UK – where the varicella vaccine was not recommended nor obligatory at the time of Sherman et al.'s study –

parents mentioned a low perceived severity of the VPD and its potential complications.[37] This may suggest that VPDs for which vaccines are not recommended, and thus not obligatory, are perceived as less severe, potentially influencing parents' attitudes toward immunization. On the other hand, it may indicate that HCPs communication on real-world risks of certain VPDs should be better targeted and adapted to the audience, as they are the most trusted form of information according to confidence-related factors. However, in Italy and Poland, two countries with obligatory vaccinations, some parents still expressed the belief that vaccines are unnecessary.[13,14,47,48] Although approximately 65% of UK parents would accept the varicella vaccine, vaccine coverage in Italy (where vaccination is obligatory) reaches up to 83%, varying by study and region.[37,62]

### *Demographic determinants of VH*

Quantitative data revealed considerable inconsistencies regarding the demographic determinants of VH, due to variations in study populations, as well as differences in research methodologies across countries, making direct comparison between studies challenging.

VH varied significantly across a range of socio-demographic factors, including parental education, occupational status, income, living area, marital status, and country of origin. While some studies reported a negative association between higher educational status and VH, others found the inverse or no correlation. Country-specific findings further illustrate these variations: in France, Poland and Romania, parents with a higher level of education were more likely to be VH, whereas in Spain, Cyprus and Albania, lower educational levels were associated with VH.[9,10,28,31,33,34,47,48,52] In Italy and Greece, the association between educational level and VH was inconsistent, with some studies reporting higher VH among highly educated parents,[29] and others reporting higher VH among parents with lower educational levels, suggesting the need for standardized research methodologies.[25,27] These inconsistencies may reflect selection bias or, alternatively, differences in parental understanding of vaccine-related information, the availability of alternative information sources, and regional context. Parents with lower educational levels may have a reduced understanding of the quality of vaccine-related information and can benefit from additional education and advice. In contrast, VH-parents with higher educational degrees more often perceive vaccines as less safe.[47,48] These inconsistencies within a single country underline the need for further research on demographic factors, using study designs tailored to a country's healthcare system and policies.

Some studies in Italy and Greece reported lower vaccine acceptance among native parents, whereas studies in Albania and the UK found higher VH among non-native parents.[17,29,33,36] In Albania, the observed higher VH among non-native parents may be influenced by the country's obligatory immunization policy. Parents coming from countries without such requirements may perceive it as restrictive, potentially inducing resistance. Conversely, parents from countries with obligatory vaccination may question why vaccines are optional, fostering mistrust.

Occupational status has also been linked to VH, with both working and unemployed parents showing higher VH in different studies.[31,33,38,54] For example, working parents may face challenges in attending vaccination appointments.[33] Financial situation similarly influenced VH: in Ukraine and Italy, rising levels of economic hardship or the absence of a stable income were associated with increased VH, whereas in France, no such association was observed.[9,25,54] Living area and marital status were additionally relevant: in Greece and Poland, parents living in (semi-)urban areas were more likely to be VH, while in Hungary, residents of the capital exhibited lower VH.[33,38,52] Being single was associated with higher VH in Albania and Ireland, whereas in Romania, single parents were less likely to be VH.[34,39,52]

Other determinants appeared to be more consistent across populations. More extensive parental knowledge about vaccinations and having multiple children were positively correlated with vaccine uptake,[38,55] which may reflect increased experience with the immunization process and resolution of first-child concerns. Religion was rarely studied in Europe, with only one study in Ireland reporting no association with VH, underscoring its potential as a topic for further research.[38]

Overall, these results underline that VH is a multidimensional, complex, and context-dependent phenomenon. Results cannot be generalized across or even within countries. Policymakers must consider vaccine-, person-, and context-related factors unique to their populations to effectively address and combat

VH through targeted interventions. Nonetheless, trusting and supportive relationships between HCPs and caregivers, along with investments to increase parental understanding, remain crucial for promoting childhood vaccination uptake across Europe.

### *Limitations*

This systematic review has several limitations that should be acknowledged. First, heterogeneity in study designs and populations makes direct comparison and synthesis of findings challenging. Many of the included studies used different, often self-developed, questionnaires to assess VH, which hampers comparison and may affect the validity and reliability of the reported outcomes. Additionally, while many reasons for VH have been identified across countries, direct cross-country comparison remains difficult due to differences in population characteristics and research methodologies. Consequently, no definitive conclusions can be drawn regarding the relative contribution of these reasons to VH across countries.

Secondly, most studies relied on self-reported data gathered via surveys or interviews. This methodology is inherently vulnerable to several forms of bias, particularly social desirability bias, where participants may underreport VH or concerns to align with perceived societal expectations. Furthermore, the quality assessment of quantitative articles indicates low reporting of their sample's representativeness of the population of interest, thereby introducing sampling bias. In addition, a high risk of non-response bias may further exacerbate this issue. Third, the included studies cover both pre- and post-COVID-19 pandemic periods, introducing an additional layer of variability. The pandemic significantly reshaped public attitudes toward vaccination. As a result, findings from studies conducted pre-pandemic may not accurately reflect current perspectives. Additionally, pre-2015 studies were excluded, which may have omitted earlier foundational work. This temporal inconsistency limits the generalizability of the overall results and should be considered when interpreting the findings. Fourth, omitting studies that were not written in English, Dutch or French may have introduced language bias. Lastly, all COVID-related articles were excluded through to the search string, as the focus of this review was not on COVID-19 VH. However, excluding studies in this way may have introduced selection bias, potentially omitting relevant research within the broader context of the pandemic.

## Implications of this study

WHO's 3C model provides a valuable framework for HCPs to guide discussions with VH-parents. Given that confidence is the most frequently cited source of VH and low confidence in HCPs contributes significantly to VH, HCPs should prioritize building trusting and supportive relationships with parents by attentive listening and respectful addressing parental concerns. By leading the conversations with VH-parents without being directive or confrontational, HCPs could build the crucial trust. This approach should include a willingness to listen without immediately offering solutions.[63–66] Furthermore, trying to understand the parents' perspective, actively exploring their ideas, concerns, and expectations regarding vaccination, and refraining from engaging in disputes is important.[63–66] Understanding parents' viewpoints and allowing space for reflection are essential components of effective communication. To maintain a balanced dialogue and avoid overwhelming parents, no more than three consecutive questions should be asked.[63–66] Trust should be built gradually and it is important that parents feel heard and understood, while they maintain confidence in the healthcare system. Additionally, tools such as comic strips or games (e.g. Immune Patrol, https://www.who.int/europe/tools-and-toolkits/immune-patrol) for vaccine-hesitant parents, designed to debunk common vaccination myths, are established evidence-based solutions for parental VH.[67,68]

Factors related to convenience are mentioned by parents as well, especially regarding optional vaccines that are not provided free of charge. Policymakers should consider equity when issuing vaccine recommendations. Recommended vaccines requiring out-of-pocket payment might therefore be considered for availability at low cost. Furthermore, HPCs and policymakers must keep in mind parents' busy schedules to minimize inconvenience as a reason for missed vaccinations. While illness may justify postponing a vaccination, it should not result in skipping a specific vaccine. In such cases, proper counseling and proactive follow-up are essential.[57]

Our study highlights that demographic determinants of VH cannot be generalized across all European countries, as attitudes and perceptions toward vaccines vary between them. VH is a multidimensional and complex topic and has evolved over time and across settings. Therefore, policymakers should consider the characteristics of their own population and consider the transformation of VH when implementing new vaccines or campaigns to combat VH. Future research should investigate the determinants of VH across Europe using standardized approaches to identify relevant confounders and potential solutions.

## Author contributions

CRediT: **Toon Janssen:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing; **Julie Degraeve:** Methodology, Writing – review & editing; **Ilse De Coster:** Supervision, Writing – review & editing; **Ine Decuyper:** Supervision, Writing – review & editing; **Daan Van Brusselen:** Supervision, Writing – review & editing; **Stijn Verhulst:** Supervision, Writing – review & editing.

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## Notes on contributor

*Toon Janssen*, MD, obtained his Master of Medicine degree from the University of Antwerp (Belgium) in June 2024. Shortly afterward, he started a PhD at the same institution, focusing on vaccine hesitancy and vaccine trial hesitancy. In parallel with his doctoral research, Dr Janssen is a pediatric resident at Antwerp University Hospital and acts as sub-investigator in multiple ongoing clinical (vaccine) trials. His research interests include infectious diseases, vaccinology, vaccine trials, vaccine trial conduct, and factors influencing vaccine acceptance.

## ORCID

Toon Janssen http://orcid.org/0009-0006-6570-4625
Julie Degraeve http://orcid.org/0000-0002-9971-4622
Ilse De Coster http://orcid.org/0000-0002-4847-2328
Ine Decuyper http://orcid.org/0000-0001-8127-5791
Daan Van Brusselen http://orcid.org/0009-0007-1280-5980
Stijn Verhulst http://orcid.org/0000-0002-1922-9716

## Registration of protocol

This protocol was registered on https://osf.io with registration number 7 × 85z. Registration can be found using following link: https://doi.org/10.17605/OSF.IO/7X85Z.

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