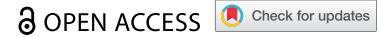




REVIEW



# Factors affecting childhood immunization: Thematic analysis of parents and healthcare workers' perceptions

Preeti Balgovind<sup>a</sup> and Masoud Mohammadnezhad<sup>b</sup>

<sup>a</sup>School of Public Health and Primary Care, Fiji National University, Suva, Fiji Islands; <sup>b</sup>School of Nursing and Healthcare Leadership, University of Bradford, Bradford, UK

## ABSTRACT

Immunization against common childhood diseases is an important strategy as it is critical for reducing the global child morbidity and mortality. This review explores the perceptions of parents and HCWs toward childhood immunization. The PRISMA guideline was used to search and include the studies. Relevant electronic databases were systemically searched for the years ranging from 2000 to 2021 to identify studies reported in English. Themes were then identified using thematic analysis. A total of 44 studies met the review criteria and were summarized and categorized into 4 themes: barriers to immunization, parental knowledge, attitude and behavior (KAB), health system factors and HCWs' KAB. This review found that immunization decision-making is a complex process. Parental KAB leads to immunization decisions. HCWs were also noted to be the trusted sources of immunization information. Further research can be conducted on how to improve parents' perceptions of immunization and immunization practices.

## ARTICLE HISTORY

Received 16 April 2022  
Revised 29 September 2022  
Accepted 14 October 2022

## KEYWORDS

Perceptions; childhood immunization; healthcare workers; parents; systemic review

## Introduction

With the support of the World Health Organization (WHO), the Expanded Program on Immunization (EPI) was officially established in 1974 with the goal of immunizing every child to counter vaccine-preventable diseases (VPDs).<sup>1</sup> WHO has described immunization as the single most effective public health intervention in preventing childhood VPDs.<sup>1–3</sup> However, EPI has set the priority for developing countries since high prevalence of VPD and inadequate service delivery for immunization has been observed in these countries.<sup>4</sup> Immunization is defined as the process of giving a vaccine to incur immunity against a disease in an individual.<sup>5</sup> It has been estimated that immunization has prevented approximately 10 million deaths globally between 2010 and 2015.<sup>6</sup> The implementation of routine and mass immunization programs has led to the eradication of smallpox and elimination of poliomyelitis in many regions of the world, together with the control of once life-threatening diseases like diphtheria and tetanus.<sup>7</sup> Immunization programs help reduce the global burden of VPDs and decrease healthcare costs.<sup>8</sup>

Immunization against common childhood diseases is an important strategy as it is critical for reducing global child morbidity and mortality.<sup>8–12</sup> However, some studies have shown that even with the importance of immunization known to parents, there still exists parents who are vaccine hesitant. Vaccine hesitancy is also influenced by factors such as complacency, convenience and confidence.<sup>13</sup> Parental forgetfulness can have a substantial impact on a child being fully immunized with all the recommended vaccines.<sup>14</sup> Parental attitudes, experiences and social grade are influential in determining whether a child receives a vaccine.<sup>14,15</sup> Healthcare

workers (HCWs) have an important role in immunization of children as they are the main trusted source of information. However, given the important role of HCWs, their attitudes toward immunization can impact parental perceptions. By understanding the barriers and attitudes to immunization, policymakers and HCWs can effectively address parental concerns and develop strategies to increase the immunization rates.<sup>15</sup> The objective of this review was to explore the perceptions of parents and HCWs toward childhood immunizations.

## Methods

### Search strategy

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline was used as a search strategy for this review. A literature search was conducted through electronic databases and included all methods of studies. These databases included ClinicalKey<sup>®</sup>, EBSCO<sup>®</sup>, Embase<sup>®</sup>, GoogleScholar<sup>®</sup>, ProQuest<sup>®</sup>, PubMed<sup>®</sup>, ScienceDirect<sup>®</sup> and Scopus<sup>®</sup> from years 2000–2021. The Mendeley<sup>®</sup> software was used for reference management. Papers were chosen based on the key terms used in previous studies. The reference lists of the chosen articles were screened and then searched to find additional articles relevant to the subject of this review. Studies that reported on immunization, barriers, attitudes and perceptions on parents, caregivers and health workers that were involved in the immunization process and primary healthcare nurses and family and general practice physician were chosen.

The search strategy used “Boolean” terms such as (AND, OR) with key terms such as: “Immunisation,” “Immunization,” “Vaccination,” “Parents,” “Belief,” “Default\*,” “Hesitant\*,”

“Healthcare workers,” (“barriers” OR “challenges”) AND (“attitudes” OR “perception”) AND (“vaccine\*” AND “immun\*”) AND (“practice” AND “knowledge”) OR (“awareness” AND “Role\*”) OR (“health workers” or “health care professional” OR “healthcare provider” OR “maternal child health nurs\*”) OR (“Parents” OR “caregivers” OR “mother\*” OR “father\*”).

### Selection criteria

All types of studies (qualitative, quantitative and mixed method) published globally were considered in this review to extract relevant studies on childhood immunization and perceptions of parents and HCWs. The studies published from 1 January 2000 to 31 December 2021 and published in English language were examined and included from peer-reviewed journals, published books and WHO reports with full texts available.

Systemic review studies, studies with full text not available and the studies that reported on immunization pertaining to adolescents, adults, other HCWs (such as dieticians and med-

ical students) that were not involved with immunization in their practice; studies conducted on immunization on children more than 5 y of age and school immunizations; studies that were done before 2000; reports, reviews and studies in other languages were excluded.

### Selection process

The selection process began by cross-checking all the titles and abstracts of the studies to identify relevant studies. After the abstracts, the full texts on the remaining studies were checked to see if they were applicable to the current research study. The studies were also checked for duplication and only the studies that suited the inclusion and exclusion criteria were retrieved from the search engines. The quality of studies was assessed using different critical appraisal tools that were developed for a variety of study designs. The studies that failed to meet the criteria focused on reporting results as well as the methodology were considered as low-quality studies. Once the studies were

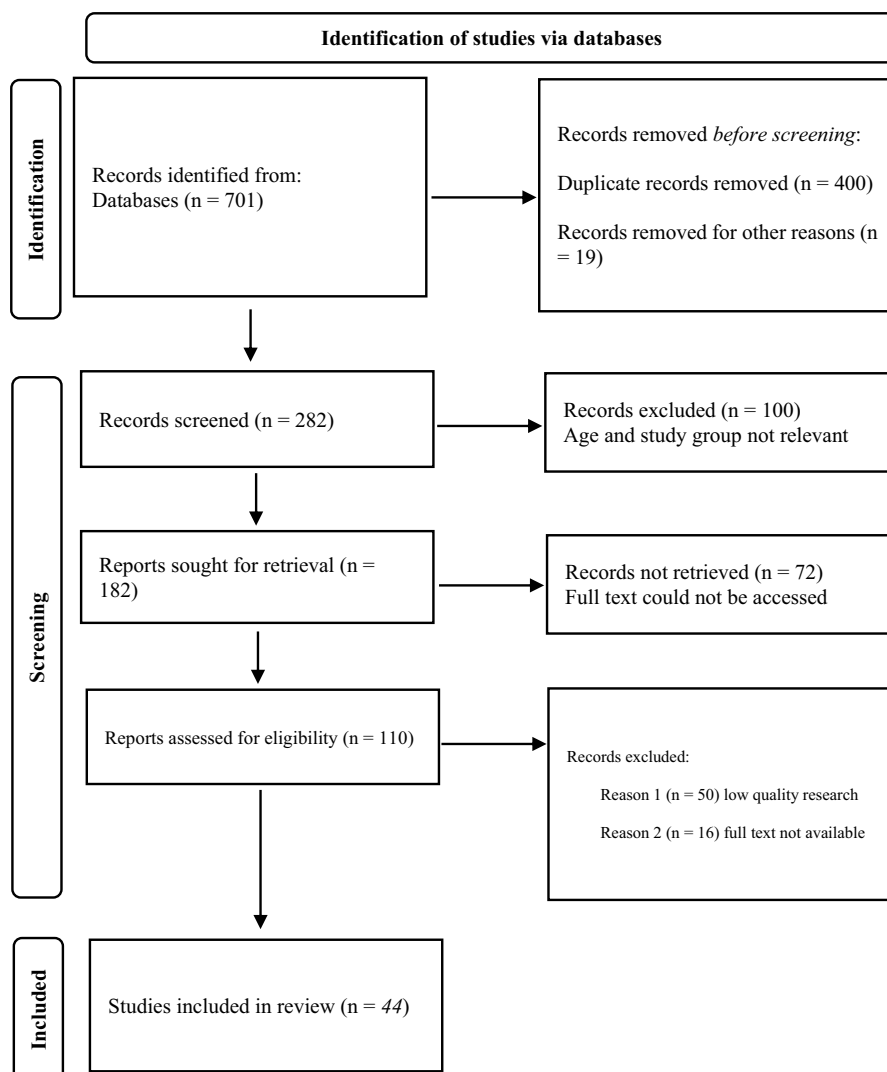


Figure 1. Article search and selection process.

retrieved, the references of the studies were perused to find additional studies that could be used in this review. The selection process is shown in [Figure 1](#).

### Data extraction and analysis

For each included study, data was extracted into a data extraction sheet on Microsoft Excel® on the characteristics of the study design; characteristics under study; the group under study (parents, caregivers, HCWs); and the outcomes of the study. Thematic analysis was used to analyze the data. Themes were identified by reading the articles and identifying similar concepts seen in them. A data extraction table was developed to extract the relevant information needed for further analysis and to create themes for the study ([Table 1](#)).

## Results

### Characteristics of studies

The 44 studies were conducted across the globe in Europe, the United States of America (USA), Canada, Asia, Africa, Australia and New Zealand and show that most of the studies were quantitative ([Table 2](#)).

### Thematic analysis

From the 44 studies, factors were identified related to the perceptions of parents and HCWs toward childhood immunization. They were subsequently summarized and categorized into four themes: Perceived barriers; Parental KAB; Health system factors and HCWs' KAB.

#### Theme 1: Perceived barriers

Factors such as work schedules; distance to the health facility; adverse weather on the appointment day; being young mothers; economically deprived households; being a patriarchal system; and a greater number of children in the family posed high risk at not being up to date with the schedule.<sup>9,17,33,34,42,46</sup> A single study highlights that movement to another place; HCWs not opening vials unless a certain number of children are present; poor interaction between HCWs and mothers during sessions; perceived adverse reactions; and a lack of proper information<sup>19</sup> are some of the factors that may affect immunization services and coverage. Negative perception and negative publicity can create fear and doubts about the vaccines.<sup>29</sup>

#### Theme 2: Parental KAB

Most of the articles reported that some of the parental factors were parental education, religious beliefs, limited knowledge about vaccines and socioeconomic factors. Ten articles identified the factors such as low maternal education,<sup>28,35</sup> fathers' involvement and a patriarchal system<sup>9,17,33,46</sup> and religious beliefs such as vaccines that were perceived to be dangerous or 'haram'<sup>14,25,41</sup> being some of the factors affecting immunization services. Four articles stated that personal experience or an acquaintance's experience influenced immunization decision-making.<sup>14,18,23,39</sup> Five articles mentioned the importance of

fathers' involvement and role in immunization.<sup>17,20,22,33,46</sup> Two papers noted that immunization coverage was high among parents who had adequate knowledge regarding immunization and quoted HCWs as important sources of immunization information.<sup>23,49</sup> Two papers noted that parental religious belief system and the community the parents live in play an important role in the immunization coverage.<sup>25,28</sup>

#### Theme 3: Health system factors

One paper highlighted that supply and health system barriers and demand-related barriers can act to impede immunization coverage.<sup>52</sup> Furthermore, it was found in two papers that the distance to the health facility was an important obstacle to adequate coverage.<sup>23,24</sup> Health system factors such as language barrier, HCW information not being clear enough for the parents, low quality of service, and having a poor or uniform recall or reminder system impede adequate immunization coverage.<sup>34,51</sup> A paper suggested that one-size-fits-all approach to immunization information and intervention is not appropriate.<sup>31</sup> Two papers highlighted how HCWs shared parental concerns and sentiments regarding the number of injections at single visits and for there to be the introduction of a new vaccine to an existing immunization schedule.<sup>47,52</sup>

#### Theme 4: HCWs' KAB

There were eight articles which emphasized how trust in HCWs was integral as they were important sources of information.<sup>27,29,32,34,36,38,40,45</sup> Three articles highlighted the importance of proper and correct communication and imparting of vaccine information.<sup>23,47,51</sup> Two articles stressed how HCWs' own beliefs and attitudes toward vaccines and immunizations can impact services and coverage.<sup>48,54</sup> Two other articles found that rudeness, poor attitude, insensitivity and unpleasant immunization operating procedures including long waiting hours, extended time of exposure of the child, accessibility of the services, poor respect of client rights, cleanliness of the facility can deter parents from coming in for their next appointment.<sup>49,55</sup>

## Discussion

The international studies and some Pacific Island studies (New Zealand and Australia) have shown that even with the importance of immunization known to parents, there is still vaccine hesitancy among the parental group. Perceptions of parents and HCWs regarding childhood immunization need to be addressed effectively. As children fall under the vulnerable group, immunization is an effective way of preventing VPDs.<sup>8,9</sup>

Inadequate knowledge; maternal factors such as maternal education, work schedule, social network, lack of social support, transportation; the subordinate role of women in society, socioeconomic factors; the number of other siblings in the family; transportation are some of the factors that may influence the parental decision-making process.

This review found that HCWs are the primary source of vaccine information. Parents need reassurance and information about the addition of any new vaccines to the schedule, the likelihood of developing post-immunization fever and post-immunization management.<sup>36</sup> Furthermore, this research showed that better parent-HCW communication is associated with higher

Table 1. Data extraction sheet.

Study information Parents/Caregivers	Objective	Participants	Study design	Findings	Barriers	Drivers/Facilitators
Low-income countries Adhikary, et al., (2013) Bangladesh <sup>3</sup>	To evaluate immunization status of children aged 12 to 23 months and to investigate reasons for non-immunization and partial immunization, if any, under national EPI.	Mothers (n = 249)	Cross-sectional study	<ul style="list-style-type: none"> <li>Main source of information about the VPDs and vaccinations reported to be HCWs.</li> </ul>	<ul style="list-style-type: none"> <li>Physical proximity, parental attitudes, illness, need for reminders, maternal lack of information about the place, schedule, eligible age of immunization and maternal workplace and schedule.</li> </ul>	<ul style="list-style-type: none"> <li>Children of older mothers were more likely to have correct vaccinations.</li> <li>Vaccination rates were higher with increasing age of children and education level of mothers.</li> </ul>
Grossman, et al., (2019) Israel <sup>16</sup>	To monitor vaccine confidence and to examine trends over time in attitudes and vaccine decisions among parents.	Parents (n = 360)	Survey done in 2008 and 2016 (Computer assisted telephone interview)	<ul style="list-style-type: none"> <li>Carrying out repeated surveys to track parental attitudes on the vaccination of their children is important to monitor barriers.</li> </ul>	<ul style="list-style-type: none"> <li>Less confidence in sources for vaccine information.</li> <li>Exposure to antivaccination information.</li> </ul>	<ul style="list-style-type: none"> <li>Changes in vaccination policy.</li> </ul>
Abdullahi, et al., (2020) Somalia <sup>17</sup>	To find out the factors associated with childhood immunization uptake from the viewpoint of the communities and HCWs.	Parents (FGDs; n = 48) and HCWs (IDs; n = 15)	Qualitative study	<ul style="list-style-type: none"> <li>Both HCWs and parents stated that current awareness raising activities were not sufficiently resourced to convince individuals in the community about the importance of vaccines.</li> </ul>	<ul style="list-style-type: none"> <li>Parents felt that HCWs were poorly informed and unable to convince parents concerning the benefits of vaccination.</li> <li>Patriarchal culture of the community was found to be one of the barriers.</li> <li>Poor infrastructure and misinterpretation of religious beliefs.</li> <li>Low vaccine coverage is attributed to prolonged conflict in the country and underfunded health system.</li> </ul>	<ul style="list-style-type: none"> <li>Social mobilizers, health centers and hospitals reported as main source of information.</li> </ul>
Jani, et al., (2008) Mozambique <sup>18</sup>	To examine the reasons for non-immunization and the magnitude of missed opportunities for immunization of children less than 2 y of age	Mothers (n = 668)	Cross-sectional study (interview)	<ul style="list-style-type: none"> <li>Utilization of the health services by the community was noted to be adequate.</li> <li>Mothers were found to be in favor of immunizing their children.</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete immunizations are associated with accessibility to health facilities, poor quality of services, low maternal education and children being born at home or outside of Mozambique.</li> </ul>	<ul style="list-style-type: none"> <li>HCWs were found to be a potential source for disseminating immunization program information.</li> </ul>
Kagoné, et al., (2018) Burkina Faso, Africa <sup>19</sup>	To collect data on the knowledge and perception regarding the childhood immunization from the community.	Mothers, community health workers and traditional healers (n = 33)	Qualitative study (IDs = 29; FGDs = 4)	<ul style="list-style-type: none"> <li>HCWs have important role in the implementation of immunization strategies: responsible for informing and mobilizing people.</li> </ul>	<ul style="list-style-type: none"> <li>Migration/moving to another place, work schedule, HCWs not opening vials unless a certain number of children were present, poor interactions between HCWs and mothers during sessions, perceived adverse reactions, inaccessibility during adverse weather conditions and lack of information.</li> </ul>	<ul style="list-style-type: none"> <li>HCWs' attitude and behavior is appreciated by mothers.</li> </ul>

(Continued)

Table 1. (Continued).

Study information	Objective	Participants	Study design	Findings	Barriers	Drivers/Facilitators
Mapatano, et al., (2008) Democratic Republic of Congo <sup>20</sup>	To determine the reasons for low coverage of routine immunization by examining the socio-demographic characteristics of the mothers and the health system. To assess maternal knowledge, attitudes and practices associated with routine immunization.	Mothers of children from ages 0 to 4 y of age in June 1999 (n = 1024)	Cross-sectional survey	<ul style="list-style-type: none"> <li>Most were aware of immunization and its protective role against disease, but most could not differentiate between diseases but had positive attitudes toward immunization.</li> <li>HCWs were important sources of immunization information.</li> <li>Vaccination-related knowledge is a significant determinant.</li> <li>Coverage was dependent on which zone the child lived in.</li> <li>Number of antenatal clinics attended, immunization plans and financial status were important individual factors.</li> <li>Some mothers reported no immunization card or missing cards or had children whose immunization was incomplete.</li> </ul>	<ul style="list-style-type: none"> <li>University education of fathers.</li> <li>Patriarchal culture in the community.</li> </ul>	<ul style="list-style-type: none"> <li>Mothers with better social support.</li> <li>Mothers' experiences of a disease.</li> </ul>
Ntenda, et al., (2017) Malawi <sup>9</sup>	To explore the individual- and community-level socioeconomic factors and a child being immunized	Children aged 12–23 months (n = 2042 in 2004 and n = 3496 in 2010)	Data from demographic health survey	<ul style="list-style-type: none"> <li>Higher incomes associated with greater likelihood to obtain better health knowledge and perform health-seeking practices.</li> </ul>	<ul style="list-style-type: none"> <li>Infants born to mothers with no formal education.</li> <li>Patriarchal beliefs.</li> <li>Infants born in low or middle-income households.</li> <li>Access to health facilities.</li> </ul>	
<b>Middle-income countries</b>						
Lopez, et al., (2018) Philippines <sup>21</sup>	To explore the acceptability, perceptions and experiences of parents and HCWs of the pre- and post-IPV and introduction of new vaccines into the schedule;	HCWs (n = 89) and caregivers (n = 286) [Pre-introduction phase]; HCWs (n = 137) and caregivers (n = 455) [post-introduction phase]	2-phased Survey (Pre-introduction [October to December 2015] and post-introduction [January to October 2016]) Cross-sectional study	<ul style="list-style-type: none"> <li>Caregivers were comfortable with the introduction-citing trust in HCWs or immunization programs and better protection against diseases.</li> <li>Caregivers cited some fear from adverse effects of but had belief and trust in the health system.</li> <li>Parents, especially fathers, should be educated on the schedule and need to ensure children receive all vaccines and when due.</li> </ul>	<ul style="list-style-type: none"> <li>Miscommunication and HCWs perceived beliefs about parents not wanting three vaccines to be administered.</li> </ul>	<ul style="list-style-type: none"> <li>Positive attitude toward administration of more than 3 vaccines at one time.</li> </ul>
Raji, et al., (2019) Northwest Nigeria <sup>22</sup>	To assess the knowledge of fathers on the uptake of immunization.	Fathers (n = 286)	Cross-sectional study	<ul style="list-style-type: none"> <li>Fathers having no formal education.</li> <li>Poor knowledge about routine immunizations.</li> </ul>	<ul style="list-style-type: none"> <li>Fathers having no formal education.</li> <li>Poor knowledge about routine immunizations.</li> </ul>	<ul style="list-style-type: none"> <li>Education level of parents.</li> <li>Perception that children be allowed to receive the vaccine.</li> <li>Fathers' involvement.</li> <li>Parents' existing knowledge and positive attitude.</li> </ul>
Topuzoğlu, et al., (2007) Istanbul <sup>23</sup>	To explore the behaviors, decision-making processes, barriers and motivating factors of mothers	Mothers (n = 70)	Qualitative design using FGDs (n = 8) and IDIs (n = 2)	<ul style="list-style-type: none"> <li>Mothers' dependent on social network for accessing immunization information and services.</li> </ul>	<ul style="list-style-type: none"> <li>Negative and judging attitude of HCWs toward mother delayed the session.</li> <li>Misinformation about the vaccines.</li> <li>Lack of awareness concerning benefits about vaccines.</li> <li>Lack of effective communication and information transfer.</li> <li>Socially subordinate role of mothers.</li> </ul>	<ul style="list-style-type: none"> <li>Attitudes of HCWs toward mothers.</li> <li>Effective counseling tailored to immunization sessions.</li> <li>Social support from neighbors and/or relatives.</li> </ul>

(Continued)





Table 1. (Continued).

Study information	Objective	Participants	Study design	Findings	Barriers	Drivers/Facilitators
Tuma, et al., (2002) Cameroon <sup>24</sup>	To analyze the factors associated with caregiver compliance and childhood immunization schedule.	Caregivers (n = 550)	Survey	<ul style="list-style-type: none"> <li>Health belief model developed as a conceptual framework to provide an understanding of limited success of public health programs implemented in the 1950s.</li> <li>Parental beliefs and attitudes contributed to compliance to immunization schedule.</li> <li>Parents rely on recommendations and information from HCWs.</li> <li>Engagement of local religious leaders is pivotal.</li> </ul>	<ul style="list-style-type: none"> <li>Living in rural location.</li> <li>Lower maternal education level.</li> </ul>	<ul style="list-style-type: none"> <li>Higher education level.</li> <li>Living in urban locations.</li> <li>High levels of confidence.</li> </ul>
Syroj, et al., (2019) Indonesia <sup>25</sup>	To explore the underlying factors contributing to incomplete immunization	Caregivers (n = 16)	Qualitative (interview)	<ul style="list-style-type: none"> <li>Religious beliefs – Islamic beliefs and that vaccines were 'haram.'</li> <li>Concerns about vaccine safety.</li> <li>Immunization misinformation.</li> <li>Limited knowledge about vaccines.</li> <li>Parents' belief of natural immunity.</li> </ul>	<ul style="list-style-type: none"> <li>Increasing and improving national and regional health promotion campaigns.</li> <li>Expansion of out-of-clinic times and mobile clinics.</li> </ul>	
Pugliese-García, et al., (2018) Zambia <sup>26</sup>	To investigate the perceptions on vaccine acceptability, hesitancy and accessibility.	Community HCWs (n = 18) and residents (n = 30)	Qualitative study (48 FGDs)	<ul style="list-style-type: none"> <li>Elders and community leaders influence decisions of younger family and community members.</li> <li>Personal experiences with vaccination.</li> <li>Alternative belief systems.</li> <li>Limited knowledge about how vaccines work.</li> <li>Access to facilities.</li> <li>Competing traditional and religious beliefs and distrust of modern medicine.</li> </ul>	<ul style="list-style-type: none"> <li>Improved health literacy and access to vaccines.</li> <li>Increased time and place of vaccine availability increase convenience.</li> </ul>	
<b>High-income countries</b>						
Alstyne, et al., (2018) USA <sup>27</sup>	To understand vaccine hesitancy in mothers; to explore factors that influence their confidence and beliefs; and assess whether educational materials affect parental confidence.	Mothers (n = 61) in USA from April to May 2016	Qualitative study using FGDs	<ul style="list-style-type: none"> <li>Some had delayed or declined at least one recommended vaccination.</li> <li>Vaccine-related information plays a significant role in parents' confidence.</li> <li>One bad experience is not deterring parents from pursuing further vaccinations.</li> <li>Waiting time did not pose problems according to the parents in this study.</li> </ul>	<ul style="list-style-type: none"> <li>Parental belief that vaccines cause harm.</li> <li>Fear of adverse reactions.</li> </ul>	<ul style="list-style-type: none"> <li>Trust in the healthcare system and vaccination programs.</li> <li>Parental knowledge and attitude.</li> <li>Parental sense of control</li> <li>Pregnant mothers attending at least four ANC.</li> <li>Higher maternal education.</li> <li>Greater household wealth.</li> </ul>
Bondy, et al., (2009) Philippines <sup>28</sup>	To identify determinants of childhood immunization.	Secondary data (Mothers; n = 1324)	National Democratic Health Survey			

(Continued)

**Table 1.** (Continued).

Study information	Objective	Participants	Study design	Findings	Barriers	Drivers/Facilitators
Biezen, et al., (2018) Australia <sup>29</sup>	To explore the views, attitudes and practices of parents and primary care providers on their knowledge and acceptance of influenza immunization of children under 5 y of age.	Parents (FGDs; n = 50) and primary care providers (ID); n = 30) (from June 2014 to July 2015)	Qualitative study	<ul style="list-style-type: none"> <li>• HCWs trusted sources of health-related information, and they play a key role in the uptake of the influenza immunization.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of knowledge and awareness of the disease and severity.</li> <li>• Uncertainty about the vaccine's efficacy and safety.</li> <li>• Negative publicity about the vaccination.</li> <li>• Costs incurred.</li> <li>• Reluctance to increase the number of vaccinations for young children.</li> </ul>	<ul style="list-style-type: none"> <li>• Advice from HCWs.</li> <li>• Increased public health campaigns to educate parents on the disease and severity of diseases and the differences between the common cold.</li> <li>• Targeted continuous education development for HCWs about the benefits of vaccines.</li> <li>• Provision of up-to-date and easy to access surveillance reports.</li> <li>• Structural and policy changes to incorporate the vaccine into routine immunization schedules.</li> </ul>
Bond and Nolan (2011) Australia <sup>30</sup>	To examine the parental perception and decision-making processes in immunizing their children to better understand the differences between the health beliefs of the immunizers and the non-immunizers.	Parents (n = 45) (Semi-structured IDIs)	Qualitative study	<ul style="list-style-type: none"> <li>• Perceptions of severity of disease are influenced by unfamiliarity of the disease.</li> </ul>	<ul style="list-style-type: none"> <li>• Non-immunizers dreaded the uncertain outcomes of the vaccines.</li> <li>• Being familiar with a disease contributed to delays in immunization or not immunizing as these diseases were not considered to be severe.</li> </ul>	<ul style="list-style-type: none"> <li>• Fear motivating parents to vaccinate.</li> <li>• Proper communication by HCWs.</li> <li>• Good client-HCW relationship.</li> </ul>
Brunson, (2013) USA <sup>31</sup>	To examine the process of how parents make decisions about children's immunization.	Mothers (n = 15) and couples (n = 3)	Qualitative study	<ul style="list-style-type: none"> <li>• Vaccine decision-making is a complex process.</li> <li>• One-size-fits-all approach is inappropriate.</li> <li>• Understanding how parents make their vaccination decisions is an important component.</li> <li>• Three general assessment groups exist: acceptors, reliers and searchers.</li> </ul>	<ul style="list-style-type: none"> <li>• Negative/previous experience.</li> </ul>	<ul style="list-style-type: none"> <li>• Exposure to general social norms.</li> <li>• Continued parental acceptance.</li> </ul>
Campbell, et al., (2017) England <sup>32</sup>	To explore the parental attitudes to childhood immunizations and compared to results from a previous 10-y survey	Parents (n = 1792)	Survey (January to April 2015)	<ul style="list-style-type: none"> <li>• HCWs key factor influencing parental decision.</li> <li>• Main consideration for parents was the danger/risk of side effects.</li> </ul>	<ul style="list-style-type: none"> <li>• Misinformation and distrusting parents can lead to doubt getting their children immunized.</li> <li>• Parents seeing misleading information on social media or chat rooms.</li> </ul>	<ul style="list-style-type: none"> <li>• Parents trust advice given by HCWs.</li> </ul>

(Continued)





Table 1. (Continued).

Study information	Objective	Participants	Study design	Findings	Barriers	Drivers/Facilitators
Danis, et al., (2010) Greece <sup>33</sup>	To identify predictive factors of complete and age-appropriate vaccination status	Children (n = 3878) and their parents/guardians	Stratified cluster sampling	<ul style="list-style-type: none"> <li>Socioeconomics play an important role rather than parental perceptions.</li> </ul>	<ul style="list-style-type: none"> <li>The presence of three or more children.</li> <li>Health system factors: inconvenient opening hours, HCWs' behavior.</li> <li>Parental belief that natural childhood disease is better.</li> <li>Cost of visit to facility and of the vaccine.</li> <li>Low paternal education</li> <li>Language, distance to facility, bad weather and access to transport.</li> <li>Limited consultation time.</li> <li>Traditional beliefs that imported vaccines were safer.</li> </ul>	<ul style="list-style-type: none"> <li>HCWs advice.</li> <li>Parental education.</li> </ul>
Harmsen, et al., (2015) Netherlands <sup>34</sup>	To explore the factors that influence the decision-making among parents with different ethnic backgrounds.	Mothers (n = 33)	Qualitative study using FGDs (n = 6)	<ul style="list-style-type: none"> <li>Mostly positive attitude toward vaccination.</li> </ul>	<ul style="list-style-type: none"> <li>Advice of HCWs.</li> <li>HCWs' attitude and demeanor toward the mothers.</li> </ul>	<ul style="list-style-type: none"> <li>Greater trust in doctors related to belief that imported vaccines were safer.</li> </ul>
Huang, et al., (2018) China <sup>35</sup>	To describe the parents' and caregivers' beliefs about the safety and effectiveness of domestic and imported vaccines.	Caregivers in May 2014 (n = 618)	Survey	<ul style="list-style-type: none"> <li>Parents thought that the effectiveness of domestic and foreign vaccines was comparable.</li> <li>Education is a strong factor related to differential beliefs in effectiveness and safety of domestic versus imported vaccines.</li> </ul>	<ul style="list-style-type: none"> <li>Role of doctors as trusted sources of information.</li> <li>Individuals with positive beliefs about vaccine safety and effectiveness are more likely to get vaccinated.</li> </ul>	<ul style="list-style-type: none"> <li>Trusting NHS and HCWs is a key influence on acceptance of vaccines.</li> <li>Advising parents of likely adverse events after administration of the vaccine is an important part.</li> </ul>
Jackson, et al., (2017) United Kingdom <sup>36</sup>	To examine the knowledge, attitude and parental views regarding the Group B meningococcal disease and serogroup B meningococcal vaccine prior to introduction into the immunization schedule.	Parents with children less than 2 y of age (n = 60)	Qualitative study	<ul style="list-style-type: none"> <li>Successful implementation of any vaccination program depends on its acceptance by parents.</li> <li>Need for additional injections, the likelihood of post-immunization fever and its management issues that parents need more information on and reassurance from HCWs.</li> </ul>	<ul style="list-style-type: none"> <li>Poor knowledge about the group B Meningococcal disease and Meningococcal B vaccine.</li> </ul>	<ul style="list-style-type: none"> <li>High education level is associated with better understanding of vaccine-related matters.</li> </ul>
Kyprianidou, M., et al., (2021) Cyprus <sup>37</sup>	To assess the level of mother's knowledge on aspects of immunization of their children and examine the association between the vaccination coverage and delay in and compliance with the schedules.	Mothers (n = 703)	Online Cross-sectional study	<ul style="list-style-type: none"> <li>Open communication between HCWs and mothers will serve to improve awareness about vaccine safety and importance of vaccinations.</li> <li>HCWs to discuss with mothers and convince them about the benefits of vaccines, especially those with high levels of health literacy.</li> </ul>	<ul style="list-style-type: none"> <li>Financial status, low maternal education,</li> </ul>	<ul style="list-style-type: none"> <li>Mothers' knowledge dependent on expertise of HCWs advising upon vaccine administration.</li> </ul>
Limaye, et al., (2020) USA <sup>38</sup>	To explore the role of power in the maternal vaccine decision-making; to elicit how power plays a role in a mothers' decision-making process in childhood vaccines.	Mothers (n = 40)	Qualitative study (IDJ)	<ul style="list-style-type: none"> <li>Designated and distributive power is important in patient-provider vaccine relationship.</li> <li>Medical knowledge related to vaccine safety and experience of provider, coupled with beneficent intentions, increased trust with a provider.</li> </ul>	<ul style="list-style-type: none"> <li>Distrust on the vaccine information provided by the HCW.</li> <li>Perceived dismissive attitude of the HCWs by the parents.</li> </ul>	<ul style="list-style-type: none"> <li>Distributive power gained by provider showing concern and empathy, while designated power through medical experience leads to increased trust.</li> </ul>

(Continued)

Table 1. (Continued).

Study information	Objective	Participants	Study design	Findings	Barriers	Drivers/Facilitators
McNeil, et al., (2019) Canada <sup>39</sup>	To understand the maternal immunization decision making for children	Mothers (n = 1560)	Longitudinal community-based survey	<ul style="list-style-type: none"> <li>Decision-making is influenced by personal, family or others' experience or external sources.</li> <li>Some experienced pressure from external sources such as health institutions.</li> <li>Social networks being sources of influence in decision-making and an avenue for interventions.</li> <li>Perception of vulnerability to disease and having no other child were positively associated with higher intention to vaccinate.</li> <li>Support should be provided to HCWs as they play a key role in public acceptance of the introduction of new vaccines.</li> </ul>	<ul style="list-style-type: none"> <li>Negative experience with vaccinations.</li> <li>Perceived beliefs that risks outweighed the benefits.</li> </ul>	<ul style="list-style-type: none"> <li>Personal experiences or experiences of their family.</li> </ul>
Morin, et al., (2012) Canada <sup>40</sup>	To evaluate the knowledge, attitude and behavior of pregnant regarding rotavirus gastroenteritis (RVGE) and its prevention by immunization. To determine intention to immunize and to identify the factors associated with this intention.	Pregnant mothers (n = 343) (from February 10–18, 2011)	Cross-sectional survey	<ul style="list-style-type: none"> <li>Incompletely immunized child did not have a parent that disagreed with the immunization but had other social issues (other children at home, lone parent, moved places), socioeconomically disadvantaged parents likely, perceived medical contraindications and lack of social support.</li> <li>Delaying vaccination will increase vulnerability period of infants against VPDs.</li> <li>Vaccine hesitancy influenced by complacency, confidence and convenience.</li> <li>Younger mothers at high risk of not being up-to-date.</li> <li>Mothers that stayed home after birth and left the workforce are likely to follow the recommended immunization schedule.</li> <li>HCWs were frequently consulted information sources on immunization, followed by social media, then friends or family.</li> <li>Educational campaign should cover beliefs and behavior associated with acceptance of vaccination.</li> </ul>	<ul style="list-style-type: none"> <li>Having already heard about GE in the media.</li> <li>Perceived medical contraindications.</li> <li>Lack of social support.</li> <li>Lack of access to facilities.</li> <li>Psychological wellbeing.</li> <li>Childcare and competing obligations.</li> </ul>	<ul style="list-style-type: none"> <li>Being from another ethnic origin than Caucasian associated with higher intention of vaccination.</li> <li>Cues such as reimbursement of vaccines, its integration into the vaccination programs and recommendations.</li> <li>Concomitant administration with other vaccines and oral administration.</li> <li>High maternal education.</li> <li>Easily able to access facilities.</li> <li>Fathers' involvement.</li> </ul>
Pearce, et al., (2015) Australia <sup>41</sup>	To examine potential barriers experienced by parents who did not disagree with immunization of their child.	Selection of parents of children (n = 5107) registered on the Medicare database	Longitudinal study method by interview	<ul style="list-style-type: none"> <li>Children aged 2 y old (n = 3604)</li> </ul>	<ul style="list-style-type: none"> <li>Being of the female gender.</li> <li>Being born out of Canada.</li> <li>From a single-parent family.</li> <li>Remote places and reduced accessibility to facilities.</li> <li>Difficulty in conciliating family and work responsibilities.</li> <li>Maternal work schedule.</li> <li>Lower education level and socioeconomically disadvantage.</li> <li>Lack of knowledge and experiences.</li> </ul>	<ul style="list-style-type: none"> <li>Belief in vaccine effectiveness.</li> <li>Education level of the parent.</li> </ul>
Périnet, et al., (2018) Canada <sup>14</sup>	To find the factors associated with delays in the uptake of the first dose of the measles vaccine and to examine the socioeconomic factors and knowledge, attitudes and beliefs (KAB) towards immunization.	Population – based data from 2010–2011 (n = 1 727)	Secondary data of the 2013 Childhood National Immunization Coverage survey	<ul style="list-style-type: none"> <li>Belief in vaccine effectiveness.</li> <li>Education level of the parent.</li> </ul>	<ul style="list-style-type: none"> <li>Belief in vaccine effectiveness.</li> <li>Education level of the parent.</li> </ul>	<ul style="list-style-type: none"> <li>Belief in vaccine effectiveness.</li> <li>Education level of the parent.</li> </ul>
Ueda, et al., (2014) Japan <sup>42</sup>	To examine the maternal work-related factors (availability of paid maternal leave) affecting immunization status	Population – based data from 2010–2011 (n = 1 727)	Survey	<ul style="list-style-type: none"> <li>Belief in vaccine effectiveness.</li> <li>Education level of the parent.</li> </ul>	<ul style="list-style-type: none"> <li>Belief in vaccine effectiveness.</li> <li>Education level of the parent.</li> </ul>	<ul style="list-style-type: none"> <li>Belief in vaccine effectiveness.</li> <li>Education level of the parent.</li> </ul>
Vezzosi, et al., (2017) Italy <sup>43</sup>	To examine parents' knowledge, attitude and behavior regarding varicella infection and its vaccine.	Parents (n = 414)	Cross-sectional survey	<ul style="list-style-type: none"> <li>Belief in vaccine effectiveness.</li> <li>Education level of the parent.</li> </ul>	<ul style="list-style-type: none"> <li>Belief in vaccine effectiveness.</li> <li>Education level of the parent.</li> </ul>	<ul style="list-style-type: none"> <li>Belief in vaccine effectiveness.</li> <li>Education level of the parent.</li> </ul>

(Continued)



Table 1. (Continued).

Study information	Objective	Participants	Study design	Findings	Barriers	Drivers/Facilitators
Wagner, et al., (2017) China <sup>44</sup>	To compare the perceptions of measles, pneumonia and meningitis vaccines among the caregivers.	Caregivers (n = 619) (May–June 2014)	Survey	<ul style="list-style-type: none"> <li>Necessary to develop better understanding of relationship between parental perceptions of a disease and its vaccine.</li> </ul>	<ul style="list-style-type: none"> <li>Parents preferring one vaccine over the other.</li> <li>Not having enough knowledge about the diseases.</li> </ul>	<ul style="list-style-type: none"> <li>Perceived safety about the vaccine.</li> <li>Due to one-child policy, threat of disease viewed in a difference and heightened focus</li> </ul>
Yanwood, et al., (2005) England <sup>15</sup>	To obtain information on mothers' knowledge of and attitudes towards immunization, attitudes, mothers' experience of immunization services. To monitor the recall and interpretation of NHS Immunization Information (NHS II) advertising and immunization information materials.	Mothers interviewed from October 1991 to March 2001 (n = 15000)	20 Survey	<ul style="list-style-type: none"> <li>Mothers understood and had knowledge about the vaccines and the diseases they protect against</li> <li>Mothers more strongly influenced by the perceived risk that a vaccine carries.</li> </ul>	<ul style="list-style-type: none"> <li>Not enough time available for discussion.</li> <li>Misinformation or negative attitude of HCWs.</li> </ul>	<ul style="list-style-type: none"> <li>Advertising and publicity can play an important role in reaching a wide audience, in reinforcing long-term messages and informing people of important changes in the program.</li> <li>Health education or advice from friends, family or health professionals.</li> <li>Great awareness of a specific vaccination.</li> <li>Popular media can be used as a tool for dissemination of key messages about vaccines.</li> <li>HCWs as primary sources of information.</li> </ul>
Handy, et al., (2017) Botswana, the Dominican Republic and Greece <sup>45</sup>	To explore the knowledge and attitudes regarding vaccines and VPDs among caregivers and immunization providers in the three-study countries. To examine how access to information impacts reported vaccine acceptance	Providers (n = 96) and caregivers (n = 153)	Qualitative design using FGDs (n = 37) and 14 semi-structured interviews (n = 14)	<ul style="list-style-type: none"> <li>HCWs or medical literature are primary sources of information.</li> </ul>	<ul style="list-style-type: none"> <li>Insufficient information or communication about vaccines available.</li> </ul>	<ul style="list-style-type: none"> <li>Receiving vaccination increased with increasing levels of paternal education.</li> </ul>
Rammohan, et al., (2012) Indonesia, India, Pakistan, Nigeria, Democratic Republic of Congo and Ethiopia <sup>46</sup>	To demonstrate the independent influence of paternal education status on measles immunization.	Secondary data (n = 106831)	Survey	<ul style="list-style-type: none"> <li>Paternal education status is an independent correlate of measles immunization coverage.</li> </ul>	<ul style="list-style-type: none"> <li>Non-vaccination associated with lower secondary paternal education.</li> </ul>	<ul style="list-style-type: none"> <li>Receiving vaccination increased with increasing levels of paternal education.</li> </ul>
Charania, et al., (2018) New Zealand <sup>47</sup>	To explore caregiver and healthcare provider perceptions regarding the proposed introduction of the universal varicella vaccination.	20 participants (n = 20) caregivers (n = 10) and vaccinating nurses (n = 10)	Qualitative study	<ul style="list-style-type: none"> <li>Participants displayed a high level of trust in the immunization schedule and adherence to receiving routine vaccines.</li> </ul>	<ul style="list-style-type: none"> <li>Increasing number of injections in a single visit.</li> <li>Perception that the vaccine was an interference.</li> <li>Lack of knowledge about the vaccine.</li> </ul>	<ul style="list-style-type: none"> <li>Mandating vaccinations for entry into daycare or school.</li> <li>Advice from HCWs.</li> </ul>
<b>Healthcare workers</b>						
Filla, et al., (2019) Italy <sup>48</sup>	To examine the vaccination knowledge, attitudes and practices among pediatricians and identify factors associated with their feelings of being sufficiently knowledgeable about immunizations and VPDs to be able to address parental concerns and questions.	Pediatricians (n = 903)	Survey	<ul style="list-style-type: none"> <li>Some gaps were found between overall positive attitudes toward vaccinations and knowledge, beliefs and practices.</li> </ul>	<ul style="list-style-type: none"> <li>Holding false beliefs about vaccines.</li> <li>Having concerns about safety of usefulness of vaccines.</li> </ul>	<ul style="list-style-type: none"> <li>Favorable attitude and behavior of HCWs.</li> <li>Proper communication and correct information imparted to the public.</li> </ul>

(Continued)

Table 1. (Continued).

Study information	Objective	Participants	Study design	Findings	Barriers	Drivers/Facilitators
Khan, et al., (2015) Pakistan <sup>49</sup>	To assess the knowledge and attitudes towards the polio vaccination among the HCWs providing immunization and immunization education.	HCWs (n = 468) (August to December 2015)	Descriptive cross-sectional study	<ul style="list-style-type: none"> <li>• HCWs had knowledge and positive attitudes toward immunization, although there were some hesitations displayed.</li> <li>• HCWs are the main source of information for the public about immunization.</li> </ul>	<ul style="list-style-type: none"> <li>• Negative attitudes and behavior.</li> </ul>	<ul style="list-style-type: none"> <li>• Inadequate knowledge of issues such as administration of vaccines may lead to transfer of false information.</li> </ul>
Matta, et al., (2020) Lebanon <sup>50</sup>	To determine the factors, especially the parent-physician communication, associated with parental knowledge, attitudes and practices of their children's vaccinations.	Parents (n = 2 785) (February–April 2019)	Qualitative study (Interviews)	<ul style="list-style-type: none"> <li>• Important to identify new strategies to highlight the need to vaccination and to educate parents about the importance of vaccines at an individual and public health level.</li> </ul>	<ul style="list-style-type: none"> <li>• Improper communication about the importance of vaccines.</li> </ul>	<ul style="list-style-type: none"> <li>• Better parent-physician communication.</li> <li>• Better knowledge and better practice.</li> <li>• Higher level of education.</li> </ul>
Musa, et al., (2020) Federation of Bosnia and Herzegovina <sup>51</sup>	To investigate the views of HCWs on the barriers and drivers to childhood immunization practices.	HCWs (n = 38)	Qualitative study (interviews)	<ul style="list-style-type: none"> <li>• Most had awareness of the risks of low vaccine coverage, knowledge of advising parents on the side effects, good communication methods, timeliness and availability of vaccines, belief in the value and safety of immunization and acknowledgment of their role.</li> </ul>	<ul style="list-style-type: none"> <li>• Not knowing the law regarding parents refusing vaccines.</li> <li>• Authoritative behavior toward parents.</li> <li>• Misconceptions about certain conditions as valid contraindications to vaccinations.</li> <li>• Poor communication skills with parents.</li> <li>• Shortage of staff.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge and skills in managing contraindications.</li> <li>• Good communication skills.</li> </ul>
Nkwenkeu, et al., (2020) Burkina Faso, Africa <sup>52</sup>	To examine HCWs perceptions of the Meningococcal serogroup. A Conjugate Vaccine introduction; to identify the barriers to the uptake and to explore the opportunities to improve the coverage.	HCWs (n = 12)	Qualitative study (IDIs)	<ul style="list-style-type: none"> <li>• HCWs viewed the introduction as a source of motivation for caregivers to bring their children for immunization visits.</li> <li>• A need for adequate operational and programmatic planning, HCW training and clear policy communication regarding opening of multi-dose vials.</li> <li>• Passive refusal stems from mistrust of authorities, personal beliefs and influence of traditional healers.</li> </ul>	<ul style="list-style-type: none"> <li>• Cultural practices and beliefs.</li> <li>• Misconceptions about vaccines and religious beliefs.</li> <li>• Insufficient supplies and financial resources to conduct vaccination outreach activities.</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation of community outreach activities.</li> <li>• The importance of interactions between caregivers and HCWs during vaccination sessions.</li> </ul>
Owino, et al., (2009) Kenya <sup>53</sup>	To determine the factors that influence immunization coverage.	parents (n = 712)	Mixed (qualitative and quantitative study)	<ul style="list-style-type: none"> <li>• Specific behavior from HCWs can deter parents from returning to complete the schedule.</li> </ul>	<ul style="list-style-type: none"> <li>• Rudeness and insensitivity.</li> <li>• Unpleasant vaccination operating procedures, long waiting queues, lateness and absenteeism of HCWs.</li> <li>• Vaccine stockouts.</li> <li>• Fear of adverse effects following immunization.</li> </ul>	<ul style="list-style-type: none"> <li>• Polite behavior and attitude.</li> <li>• Good knowledge of vaccines.</li> <li>• Good communication skills.</li> </ul>
Picchio, et al., (2019) Barcelona <sup>54</sup>	To describe the knowledge, attitudes and beliefs of primary HCWs involved in the administration about childhood vaccines and immunizations.	HCWs (n = 277)	Cross-sectional study using structured survey	<ul style="list-style-type: none"> <li>• The majority believed that children benefited from the administration of vaccines.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of knowledge about vaccine components.</li> <li>• Being vaccine-hesitant.</li> </ul>	<ul style="list-style-type: none"> <li>• Delivering accurate information.</li> <li>• HCWs' recommendations being sufficient.</li> </ul>

(Continued)

Table 1. (Continued).

Study information	Objective	Participants	Study design	Findings	Barriers	Drivers/Facilitators
Udonwa, et al., (2010) <sup>55</sup> Nigeria	To determine the degree of client satisfaction with childhood immunization services.	Caregivers (n = 402)	Cross-sectional descriptive study	<ul style="list-style-type: none"> <li>Determination of degree of client satisfaction provided evidence as to whether or not the right immunizations services were being provided at the right time, in the right place, in the right way and by the right personnel.</li> <li>Provides baseline data for assessment of quality improvement strategies, which culminates in an increase in immunization coverage in the country.</li> </ul>	<ul style="list-style-type: none"> <li>Parents not treated with dignity by HCWs.</li> <li>Poor comfort measures at the facilities.</li> <li>Inadequate seats at the facility.</li> <li>Poor interpersonal relationships.</li> </ul>	<ul style="list-style-type: none"> <li>Improvement in health facilities.</li> <li>Attitudinal change.</li> <li>Traditional rulers consulted and brought in for consulted.</li> <li>Training and retraining of HCWs.</li> </ul>

**Table 2.** General characteristics of the studies.

Variable	Number	Percentage
<b>Types of studies</b>		
Qualitative	20	45
Mixed	1	3
Quantitative	23	52
<b>Region study was conducted</b>		
Asia	8	18.2
The United States of America	3	6.8
Europe	10	22.7
Africa	11	25
Pacific	4	9.1
Multi-country	2	4.5
Middle East	3	6.8
Canada	3	6.8

knowledge, a better attitude and practice in immunization<sup>50</sup> and also that perceived safety is associated with uptake.<sup>40</sup>

The condition of the health facility; poor HCW attitudes and behavior; rudeness and unpleasant operating methods; poor communication skills affect; inconvenient facility opening hours; perceived bad organization of services; and a recall or reminder system not being uniform can deter parents to come in for the next appointment.<sup>51–53–55</sup>

Furthermore, HCWs' beliefs and perceptions about immunization can have an influence on parents. The research found that while having great trust and a positive attitude toward vaccines and immunizations, there can be some doubts and hesitancy by parents and HCWs when new vaccines are being added to an existing schedule.<sup>48,49,52,54</sup>

## Conclusion

The review systemically explored the findings of 44 studies. It is important that vaccine providers are aware of specific barriers to immunization in their parts of the world. Health ministries must address the practical and communicative challenges the world is facing in order to increase vaccine uptake. Parental education and family socio-economic background have a significant influence on immunization decision-making and, hence, immunization uptake. Mothers mostly rely on networking for accessing immunization information and services, and fathers need to be more involved in the immunization process and decision-making. Better parent–HCW communication is associated with higher vaccine uptake and coverage. Poor attitudes of HCWs, long waiting hours and unpleasant immunization operating procedures such as long periods of exposure of the child can deter parents and caregivers from returning for the next appointment.

HCWs need to be more vigilant in identifying and addressing the factors which affect immunization adversely, and this could be done by proper communication and surveys. HCWs need to have more in-service training and workshops to improve their skills and attitudes. Health ministries should work in partnership with media to impart correct information to the public about. The health ministry should include other stakeholders such as community leaders and groups to spread awareness and correct information about immunization.

## Abbreviations

ANC Antenatal Clinics

EPI	Expanded Program on Immunization
FGD	Focus Group Discussion
HCWs	Healthcare Workers
IDI	In-Depth Interviews
IPV	Inactivated Polio Vaccine
KAB	Knowledge, Attitude and Behavior
NHS II	National Health Service Immunization Information
PRISMA	Preferred Reporting Items for Systemic Reviews and Meta-Analyses
RVGE	Rotavirus Gastroenteritis
SAGE	Strategic Advisory Group of Experts
VPD	Vaccine Preventable Diseases
WHO	World Health Organization

## Acknowledgments

We would like to thank Mrs Julie Sutherland for editing this paper.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

The author(s) reported that there is no funding associated with the work featured in this article.

## ORCID

Masoud Mohammadnezhad  <http://orcid.org/0000-0002-5048-9719>

## Contributions

The design of the study was undertaken by both authors. Data were collected, analyzed and interpreted by PB. The study was guided by MM. Both authors contributed toward the manuscript preparation and approved the final manuscript for publication.

## Limitations

Only full-text studies were included in this review. About 72 studies could not be retrieved as they could not be accessed.

## References

- Keja K, Chan C, Hayden G, Henderson RH. Expanded programme on immunization. *World Health Stat Q.* 1998;41:59–63.
- Paterson P, Meurice F, Stanberry LL, Glismann S, Rosenthal SL, Larson HJ. Vaccine hesitancy and healthcare providers. *Vaccine.* 2016;34(52):6700–06. doi:10.1016/j.vaccine.2016.10.042.
- Adhikary M, Haque R, Tanira S. Determinants of child immunization under expanded programme on immunization (EPI) in a rural setting of Bangladesh. *J Dhaka Med Coll.* 2015;22(2):201–06. doi:10.3329/jdmc.v22i2.21543.
- Rainey JJ, Watkins M, Ryman TK, Sandhu P, Bo A, Banerjee K. Reasons related to non-vaccination and under-vaccination of children in low and middle income countries: findings from a systematic review of the published literature, 1999–2009. *Vaccine.* 2011;29(46):8215–21. doi:10.1016/j.vaccine.2011.08.096.
- World Health Organization. The power of vaccines: still not fully utilized. [Online]. 2019 [accessed 2021 Jan 20]. <https://www.who.int/publications/10-year-review/chapter-vaccines.pdf>.
- World Health Organization. WHO mission vision 2030. [Online]. 2020 [accessed 2020 Aug 9]. <https://www.who.int/immunisation/>



- documents/general/WHO\_Mission\_Vision\_Immunisation\_Vaccines\_2015\_2030.pdf?ua=1.
7. Bonanni P, Sacco C, Donato R, Capei R. Lifelong vaccination as a key disease-prevention strategy. *Clin Microbiol Infect.* 2014;20 (Suppl. 5):32–36. doi:10.1111/1469-0691.12537.
  8. Martino GD, Giovanni PD, Girolamo AD, Scampoli P, Cedrone F, D'Addezio M, Meo F, Romano F, Sciascio MBD, Staniscia T. Knowledge and attitude towards vaccination among healthcare workers: a multicenter cross-sectional study in a Southern Italian region. *Vaccines.* 2020;8(2):248–58. doi:10.3390/vaccines8020248.
  9. Ntenda PAM, Chuang K, Tiruneh FN, Chuang Y. Analysis of the effects of individual and community level factors on childhood immunisation in Malawi. *Vaccine.* 2017;35(15):1907–17. doi:10.1016/j.vaccine.2017.02.036.
  10. Esposito S, Principi N, Cornaglia G. Barriers to the vaccination of children and adolescents and possible solutions. *Clin Microbiol Infect.* 2014;20(Suppl. 5):25–31. doi:10.1111/1469-0691.12447.
  11. Dessie DB, Negeri MA. Determining factors of full immunisation of children among 12–23 months old in rural Ethiopia. *Am J Public Health Res.* 2018;6:160–65.
  12. MacDonald NE. Vaccine hesitancy: definition, scope and determinants. *Vaccine.* 2015;33(34):4161–64. doi:10.1016/j.vaccine.2015.04.036.
  13. Jong KM, Sikora CA, MacDonald ME. Childhood immunization appointment reminders and recalls: strengths, weaknesses and opportunities to increase vaccine coverage. *Vaccine.* 2021;194:170–75. doi:10.1016/j.puhe.2021.02.034.
  14. Pearce A, Marshall H, Bedford H, Lynch J. Barriers to childhood immunisation: findings from the longitudinal study of Australian children. *Vaccine.* 2015;33(29):3377–83. doi:10.1016/j.vaccine.2015.04.089.
  15. Yarwood J, Noakes K, Kennedy D, Campbell H, Salisbury D. Tracking mothers' attitudes to childhood immunisation 1991–2001. *Vaccine.* 2005;23:5670–87. doi:10.1016/j.vaccine.2004.11.081.
  16. Grossman Z, Hadjipanayis A, Degani A, Somekh E. Tracking changes in vaccine attitudes and decisions: results from 2008 and 2016 parental surveys. *Pediatr Infect Dis J.* 2019;38(4):e75–76. doi:10.1097/INF.0000000000002147.
  17. Abdullahi MF, Williams JS, Sahlén K, Bile K, Kinsman J. Factors contributing to the uptake of childhood vaccination in Galkayo District, Puntland, Somalia. *Glob Health Action.* 2020;13(1):1803543. [accessed 2020 Sep 1] doi:10.1080/16549716.2020.1803543.
  18. Jani JV, De Schacht C, Jani IV, Bjune G. Risk factors for incomplete vaccination and missed opportunity for immunization in rural Mozambique. *BMC Public Health.* 2008;8(1):161. doi:10.1186/1471-2458-8-161.
  19. Kagoné M, Yé M, Nebié E, Sié A, Müller O, Beiersmann C. Community perception regarding childhood vaccinations and its implications for effectiveness: a qualitative study in rural Burkina Faso. *BMC Public Health.* 2018;18(1):324. doi:10.1186/s12889-018-5244-9.
  20. Mapatano MA, Kayembe K, Piripiri L, Nyandwe K. Immunisation-related knowledge, attitudes and practices of mothers in Kinshasa, Democratic Republic of the Congo. *S Afr Family Pract.* 2008;50(2):61–61e. doi:10.1080/20786204.2008.10873699.
  21. Lopez AL, Harris JB, Raguindin PF, Aldaba J, Morales M, Sylim P, Wannemuehler K, Wallace A, Ehlman DC, Hyde TB, et al. Introduction of inactivated poliovirus vaccine in Philippines: effect on health care provider and infant caregiver attitudes and practices. *Vaccine.* 2018;36(48):7399–407. doi:10.1016/j.vaccine.2018.09.028.
  22. Raji MO, Sani AA, Ibrahim LS, Muhammad H, Oladigbolu RA, Kaoje AU. Assessment of the knowledge of fathers, uptake of routine immunization, and its associated factors in a rural community of Northwest Nigeria. *Ann Afr Med.* 2019;18(2):97–102. doi:10.4103/aam.aam\_41\_18.
  23. Topuzoğlu A, Ay P, Hidiroglu S, Gurbuz Y. The barriers against childhood immunizations: a qualitative research among socio-economically disadvantaged mothers. *Eur J Public Health.* 2007;17(4):348–52. doi:10.1093/eurpub/ckl250.
  24. Tuma JN, Smith SM, Kirk RH, Hagmann CE, Zemel PC. Beliefs and attitudes of caregivers toward compliance with childhood immunisations in Cameroon. *Public Health.* 2002;116(1):55–61. doi:10.1016/S0033-3506(02)90061-2.
  25. Syiroj ATR, Pardosi JF, Heywood AE. Exploring parents' reasons for incomplete childhood immunisation in Indonesia. *Vaccine.* 2019;37(43):6486–93. doi:10.1016/j.vaccine.2019.08.081.
  26. Pugliese-Garcia M, Heyerdahl LW, Mwamba C, Nkwemu S, Chilengi R, Demolis R, Guillemet E, Sharma A. Factors influencing vaccine acceptance and hesitancy in three informal settlements in Lusaka, Zambia. *Vaccine.* 2018;36(37):5617–24. doi:10.1016/j.vaccine.2018.07.042.
  27. Alstynne JAM, Nowak GJ, Aikin AL. What is 'confidence' and what could affect it?: a qualitative study of mothers who are hesitant about vaccines. *Vaccine.* 2018;36(44):6464–72. doi:10.1016/j.vaccine.2017.09.007.
  28. Bondy JN, Thind A, Koval JJ, Speechley KN. Identifying the determinants of childhood immunization in the Philippines. *Vaccine.* 2009;27(1):169–75. doi:10.1016/j.vaccine.2008.08.042.
  29. Biezen R, Grando D, Mazza D, Brijnath B. Why do we not want to recommend influenza vaccination to young children? A qualitative study of Australian parents and primary care providers. *Vaccine.* 2018;36(6):859–65. doi:10.1016/j.vaccine.2017.12.066.
  30. Bond L, Nolan T. Making sense of perceptions of risk of disease and vaccinations: a qualitative study combining models of health beliefs, decision-making and risk perception. *BMC Public Health.* 2011;11(1):943–57. doi:10.1186/1471-2458-11-943.
  31. Brunson EK. How parents make decisions about their children's vaccinations. *Vaccine.* 2013;31(46):5466–70. doi:10.1016/j.vaccine.2013.08.104.
  32. Campbell H, Edwards A, Letley L, Bedford H, Ramsay M, Yarwood J. Changing attitudes to childhood immunisation in English parents. *Vaccine.* 2017;35(22):2979–85. doi:10.1016/j.vaccine.2017.03.089.
  33. Danis K, Georgakopoulou T, Stavrou T, Laggas D, Panagiotopoulos T. Socioeconomic factors play a more important role in childhood vaccination coverage than parental perceptions: a cross-sectional study in Greece. *Vaccine.* 2010;28(7):1861–69. doi:10.1016/j.vaccine.2009.11.078.
  34. Harmsen IA, Bos H, Ruiters RAC, Paulussen TGW, Kok G, de Melker HA, Mollema L. Vaccination decision-making of immigrant parents in the Netherlands; a focus group study. *BMC Public Health.* 2015;15(1):1229–37. doi:10.1186/s12889-015-2572-x.
  35. Huang X, Sun X, Wagner AL, Ren J, Boulton ML, Prosser LA, Zikmund-fisher BJ. Parent and caregiver perceptions about the safety and effectiveness of foreign and domestic vaccines in Shanghai, China. *PLoS ONE.* 2018;13(5):e0197437. doi:10.1371/journal.pone.0197437.
  36. Jackson C, Yarwood J, Saliba V, Bedford H. UK parents' attitudes towards Meningococcal group B (MenB) vaccination: a qualitative analysis. *BMJ Open.* 2017;7(4):e012851. doi:10.1136/bmjopen-2016-012851.
  37. Kyprianidou M, Tzira E, Galanis P, Giannakou K. Knowledge of mothers regarding children's vaccinations in Cyprus: a cross-sectional study. *PLoS ONE.* 2021;16(9):e0257590. doi:10.1371/journal.pone.0257590.
  38. Limaye RJ, Malik F, Frew PM, Randall LA, Ellingson MK, O'Leary ST, Bednarczyk RA, Oloko O, Salmon DA, Omer SB. Patient decision making related to maternal and childhood vaccines: exploring the role of trust in providers through a relational theory of power approach. *Health Educ Behav.* 2020;47(3):449–56. doi:10.1177/1090198120915432.
  39. McNeil DA, Mueller M, MacDonald S, McDonald S, Saini V, Kellner JD, Tough S. Maternal perceptions of childhood vaccination: explanations of reasons for and against vaccination.

- BMC Public Health. 2019;19(1):49–60. doi:10.1186/s12889-018-6338-0.
40. Morin A, Lemaître T, Farrands A, Carrier N, Gagneur A. Maternal knowledge, attitudes and beliefs regarding gastroenteritis and rotavirus vaccine before implementing vaccination program: which key messages in light of a new immunization program? *Vaccine*. 2012;30:5921–27. doi:10.1016/j.vaccine.2012.07.050.
  41. Périnet S, Kiely M, de Serres G, Gilbert NL. Delayed Measles vaccination of toddlers in Canada: associated socio-demographic factors and parental knowledge, attitudes and beliefs. *Human Vaccines Immunotherapu*. 2018;14(4):868–74. doi:10.1080/21645515.2017.1412899.
  42. Ueda M, Kondo N, Takada M, Hashimoto H. Maternal work conditions, socioeconomic and educational status and vaccination of children: a community-based household survey in Japan. *Prev Med*. 2014;66:17–21. doi:10.1016/j.ypmed.2014.05.018.
  43. Vezzosi L, Santagati G, Angelillo F. Knowledge, attitudes and behaviors of parents towards varicella and its vaccination. *BMC Infect Dis*. 2017;17(1):172–80. doi:10.1186/s12879-017-2247-6.
  44. Wagner AL, Boulton ML, Sun X, Mukherjee B, Huang Z, Harmsen IA, Ren J, Zikmund-fisher BJ. Perceptions of Measles, Pneumonia, and Meningitis vaccines among caregivers in Shanghai, China, and the health belief model: a cross-sectional study. *BMC Pediatr*. 2017;17(1):143–52. doi:10.1186/s12887-017-0900-2.
  45. Handy LK, Maroudi S, Powell M, Nfila B, Moser C, Japa I, Monyatsi N, Tzortzi E, Kouzeli I, Luberti A, et al. The impact of access to immunization information on vaccine acceptance in three countries. *PLoS ONE*. 2017;12(8):e0180759. doi:10.1371/journal.pone.0180759.
  46. Rammohan A, Awofeso N, Fernandez RC. Paternal education status significantly influences infants' measles vaccination uptake, independent of maternal education status. *BMC Public Health*. 2012;12(1):336–312. doi:10.1186/1471-2458-12-336.
  47. Charania NA, Watson DG, Turner NM. Perceptions of caregivers and providers regarding the potential introduction of the varicella vaccine to the childhood immunisation schedule in New Zealand: a qualitative exploratory study. *J Paediatr Child Health*. 2018;54(1):28–35. doi:10.1111/jpc.13661.
  48. Filia A, Bella A, D'Ancona F, Fabiani M, Giambi C, Rizzo C, Ferrara L, Pascucci MG, Rota MC. Childhood vaccinations: knowledge, attitudes and practices of paediatricians and factors associated with their confidence in addressing parental concerns, Italy, 2016. *Eurosurveillance*. 2019;26(6):1800275. doi:10.2807/1560-7917.ES.2019.24.6.1800275.
  49. Khan MU, Ahmad A, Aqeel T, Akbar N, Salman S, Idress J. A cross-sectional survey of healthcare workers on the knowledge and attitudes towards polio vaccination in Pakistan. *PLoS ONE*. 2015;10(11):e0142485. doi:10.1371/journal.pone.0142485.
  50. Matta P, El Mouallem R, Akel M, Hallit S, Khalife MF. Parents' knowledge, attitude and practice towards children's vaccination in Lebanon: role of the parent-physician communication. *BMC Public Health*. 2020;20(1):1439–48. doi:10.1186/s12889-020-09526-3.
  51. Musa S, Skrijelj V, Kulo A, Habersaat KB, Smjecanin M, Primorac E, Becirovic D, Jackson C. Identifying barriers and drivers to vaccination: a qualitative interview study with health workers in the Federation of Bosnia and Herzegovina. *Vaccine*. 2020;38(8):1906–14. doi:10.1016/j.vaccine.2020.01.025.
  52. Nkwenkeu SF, Jalloh MF, Walldorf JA, Zoma RL, Tarbangdo F, Fall S, Hien S, Combassere R, Ky C, Kambou L, et al. Health workers' perceptions and challenges in implementing Meningococcal serogroup a conjugate vaccine in the routine childhood immunization schedule in Burkina Faso. *BMC Public Health*. 2020;20(1):254. doi:10.1186/s12889-020-8347-z.
  53. Owino LO, Irimu G, Olenja J, Meme JS. Factors influencing immunization coverage in Mathare Valley, Nairobi. *East Afr Med J*. 2009;86(7):323–29. doi:10.4314/eamj.v86i7.54146.
  54. Picchio CA, Carrasco MG, Sagué-vilavella M, Rius C. Knowledge, attitudes and beliefs about vaccination in primary healthcare workers involved in the administration of systematic childhood vaccines, Barcelona, 2016/17. *Euro Surveillance*. 2019;24(6):1800117. doi:10.2807/1560-7917.ES.2019.24.6.1800117.
  55. Udonwa NE, Gyuse AN, Etokidem AJ, Ogaji DST. Client views, perception and satisfaction with immunisation services at primary health care facilities in Calabar, South-South Nigeria. *Asian Pac J Trop Med*. 2010;3(4):298–301. doi:10.1016/S1995-7645(10)60073-9.