REVIEW ARTICLE

Childhood Vaccine Hesitancy in selected Islamic and Muslim-majority Countries: Result Synthesis from a Scoping Review

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ABSTRACT

Vaccine hesitancy and refusal were linked to various religious beliefs, including Islam. Regardless, there were limited studies which offer insights into the role of religious affiliations and related misconceptions in childhood vaccination refusal and hesitancy in Islamic and Muslim Majority countries (MMC). Therefore, this review identifies the prevalence of childhood vaccine hesitancy and its contributory factors while determining the role of religious beliefs in childhood vaccine hesitancy in Islamic states and MMC. We examined four electronic databases for published studies related to childhood vaccine hesitancy and refusal in Islamic countries or MMC from 2011 to 2021. Results revealed that the prevalence of vaccine hesitancy and vaccine refusal range from 8.0% to 21.0% and 1.0% to 58%, respectively, which was comparable to other countries. Parental reasons contributing towards vaccine hesitancy and refusal include concerns related to vaccine safety, side effects and effectiveness, preference for alternative measure to prevent disease, prior bad experiences, and healthcare system distrust. Religious reasons instigating vaccine hesitancy include concerns that vaccine consists of haram ingredients, beliefs that vaccine is against God's will, perceptions of vaccine being harmful, influences from religious leaders, and distrust towards religious authorities supporting vaccination. In brief, various factors induce vaccine hesitancy and refusal in Islamic states and MMC. Further studies could provide better insights into the role of religious factors in childhood vaccine hesitancy within local contexts in order to formulate effective interventions to address this issue.

Keywords
vaccine hesitancy, vaccine refusal, child, Muslim-majority countries, Islamic countries

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INTRODUCTION

Childhood vaccines improve health through diseases and disability prevention[1], precluding 3 million deaths globally.[1] Nonetheless, the World Health Organization (WHO) declared vaccine hesitancy as a threat to global health.[2] Vaccine hesitancy refers to the delay in vaccine acceptance or vaccine refusal despite its availability[3] and is complex and context-specific while varying across times, geography, and type of vaccine.[3] Vaccine-hesitant individuals belong within the vaccine acceptance-refusal continuum[3] which include parents who reluctantly vaccinate their children despite having doubts, delay vaccination for their children, accept only certain vaccines, or reject them altogether.

Religion is one of the determinants of vaccine hesitancy[4] with studies linking vaccine hesitancy to the Orthodox Church, Catholic Christian, Protestant Christian, and Islam.[5] Within the context of childhood vaccine, religious affiliations prevent effective childhood immunization[3] and are usually associated with vaccine refusal.[6] The Islamic philosophy determines that vaccination correlates with the concept of maqasid al-shariah whereby it is considered an act to reform (islah) the wellbeing of the population (ummah).[7] In principle, Islamic understanding supports vaccination in lieu that it prevents disease and deaths to preserve human life (hifz an-nas) and religion (hifz ad-din) where health allows a person's religious

obligations.[7] Unfortunately, the childhood vaccination coverage of Muslim-majority countries (MMC) was found to be lower than the global average.[8] Despite various studies investigating childhood vaccine hesitancy, there is little research into understanding the factors that influence childhood vaccine hesitancy in Islamic countries and MMC. Considering the importance of religion, there is a paucity of evidence to help determine whether religious misconceptions possess any fundamental influence on childhood vaccine hesitancy. It is imperative to understand these factors as the population in Islamic countries and MMC may face distinct contextual factors contributing towards childhood vaccine hesitancy. More importantly, since parents may be vaccine-hesitant owing to such religious concerns, addressing these issues is fundamental to foster vaccine acceptance. Therefore, this review aims to identify the prevalence and contributing factors of childhood vaccine hesitancy in Islamic countries and MMC. Additionally, this review aims to determine the role of religious factors related to childhood vaccine hesitancy in the respective countries.

MATERIALS AND METHODS

This review follows the Arksey and O'Malley framework, the Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping review (PRIMA-ScR) checklist[9] and the Joanna Briggs Institute (JBI) Framework for Scoping Reviews[10] methodology. The search criteria based on the PCC question were as of the following;

Table I : The PCC criteria for this study

Population	Islamic countries and Muslim-majority countries (MMC)
Concept	Vaccine hesitancy or refusal
Context	Childhood vaccination

The countries investigated in this study were; (i) countries considered as Islamic states (countries practicing Sharia Law as the basis of government law) including Iran, Pakistan, Afghanistan, Mauritania, and Yemen[11], (ii) countries pronouncing Islam as the state religion (namely Egypt, Jordan, Kuwait, Algeria, Malaysia, Maldives, Morocco, Libya, Tunisia, United Arab Emirates, Somalia, and Brunei)[11]; and (iii) countries with Muslim-majority population (eg; Niger, Indonesia, Sudan, Bosnia and Herzegovina, Sierra Leonne, and Djibouti).[11] Literature works published between 2011 and 2021 were collected from four databases: Scopus, Ebscohost/Medline, Science Direct, and Google Scholar. A key term search strategy was employed using the combination of the following words: ("vaccine hesitancy" OR "vaccination hesitancy" OR "vaccine refusal") AND (child OR children OR paediatric) OR ("Islamic countries" OR "Muslim countries" OR "country name" ("specific Islamic countries and MMC as listed above")).

Articles were evaluated using the following inclusion criteria: (i) describe vaccine hesitancy or refusal or parental intention to delay or refuse childhood vaccination, OR; (ii) describe reasons for vaccine hesitancy or refusal with or without exploring the religious factors, AND (iii) available in the English language. The exclusion criteria for this review are: i) studies that only describe parental perception, belief, or knowledge related to childhood vaccination and ii) review articles.

Articles were screened, duplicates were removed, and titles and abstracts were scanned for the relevancy of the research questions and objectives. Articles not meeting the inclusion criteria were removed, and reasons for exclusion were noted. For selected articles, key information was collected using a data extraction table. The following characteristics from each of the selected articles were included in the data extraction table: study country, author, sample size and population, vaccine under study, the proportion of vaccine hesitancy (if available) and factors contributing to vaccine hesitancy.

RESULTS

A total of twenty articles were selected for review. The study selection process is described in Figure 1.

The articles are from Malaysia (n=8), Pakistan (n=4), Saudi Arabia (n=3), Indonesia (n=2), and a study each from the United Arab Emirates, Afghanistan, and Iraq. The studies are mainly quantitative studies (n=16) with some qualitative (n=2) and mixed-method studies (n=2) focusing on childhood immunization (n=15), polio (n=4), and Zika vaccine (n=1). In most articles (n=18), the authors explicitly used the terms 'vaccine hesitancy' and

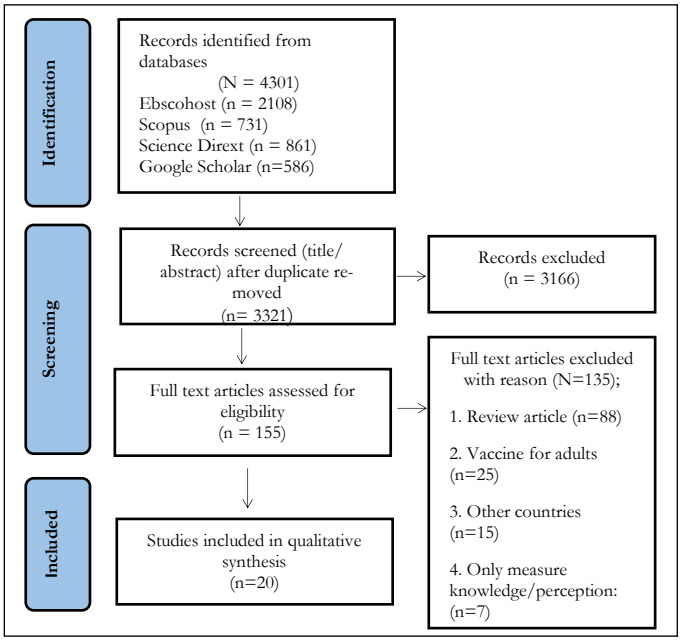

Figure 1. PRISMA flowchart for the selection of studies.

'vaccine refusal'. Meanwhile, despite no explicit use of the terms 'vaccine hesitancy or 'vaccine refusal', two studies were included in this review as a study described parents who were 'uncommitted' to polio vaccination[12] while another study described the parental 'non-participation' in polio vaccination activities.[13] Table II summarized the studies included in this review.

DISCUSSION

Our review highlights the prevalence of childhood vaccine hesitancy and refusal in Islamic states and MMC, its common contributing factors, as well as the religious factors related to childhood vaccine hesitancy and refusal.

Prevalence of vaccine hesitancy and refusal in Islamic and Muslim-majority countries

Several findings were highlighted. Primarily, we found that the prevalence of vaccine hesitancy and refusal in Islamic and MMC were comparable to other countries globally. For example, among the studies (N=7) with vaccine hesitancy measured using the Parental Attitude about Childhood Vaccine (PACV) tool, the vaccine hesitancy ranged between 8.0% in Malaysia[14] and 15.9% in Indonesia.[15] For comparison, the vaccine hesitancy measurement using the PACV score in other countries like Italy (34.7%)[16], Croatia (31.1%)[17], and the United States of America (28.2%)[18] also showed a different range of results. Meanwhile, self-reported vaccine hesitancy from three studies included in this review ranged from 14.8%[19] to 21.0%.[12] Similarly, self-reported vaccine hesitancy in other countries ranges from 14% (Cyprus), 36% (Italy) to 42% (Israel)[20], and Canada (40%).[21] Secondly, we also found that studies within a country yield diverse results, emphasizing the fact that vaccine hesitancy is context and population-specific. Studies from Saudi Arabia revealed that vaccine hesitancy is at 11% in Dammam City[22], while in Riyadh City, it was at 14.8%[19] and 20.0%.[23] Similarly, studies from Malaysia showed the prevalence of vaccine refusal between 1.0%[24] and 58.0%.[25] Additionally, another study demonstrated different prevalence of polio vaccine refusal between three Pakistani districts.[26] These findings supported the fact that vaccine hesitancy varies between vaccines, places, and times.[3]

Interestingly, this review found unusually high proportion of childhood vaccine refusal reported by several studies. In Pakistan, a study observed 27.9% parental vaccine refusal[27], which was higher than studies conducted in other regions within the country. The factors for such high vaccine refusal in the study findings remain unclear though vaccine refusal is significantly linked to illiteracy and the lack of education.[27] Another study revealed 58% vaccine refusal among urban Malaysian Malay parents.[25] Nonetheless, it was conducted online using convenient sampling method, implying possible bias and a small sample size which limits the study generalizability.[25]

Reasons for childhood vaccine hesitancy and refusal

In general, we found that parental concerns related to childhood vaccines were mostly due to two reasons-concerns about vaccine safety and doubting the vaccine effectiveness. Parental vaccine hesitancy was fueled by concerns that the vaccine may be unsafe for use, especially for children. Indeed, vaccine hesitancy was significantly associated with more concerns related to vaccine safety.[23, 28] Some parents were worried about the side effects of vaccines on their children, therefore giving rise to both parental vaccine hesitancy[23, 29] and vaccine refusal.[27, 30, 31] Others believed that vaccine contains heavy metal that

Table II : Summary of articles included in the review

Country	Author	Vaccine type	Study details	Vaccine hesitancy (VH) / refusal (VR)
Afghanistan	(SteelFisher et al., 2017)	Polio	Quantitative study Sample : 1980 caregivers of children from several districts randomly selected using stratified multi-stage cluster design Vaccine hesitancy was measured using self-reporting of parents uncommitted to accept oral polio vaccine (OPV) for their children Reasons for vaccine hesitancy was investigated using self-designed questionnaire	21% (VH)
Indonesia	(Syiroj et al., 2019)	CI	Qualitative study Sample : 20 Muslim parents with unimmunized or partially immunized children using purposive sampling Reasons for vaccine refusal were explored using semi-structured interviews	NA
Indonesia	(Yufika et al., 2020)	Zika	Quantitative study Sample : 956 parents who visited outpatient clinics or hospitals selected using convenient sampling Vaccine hesitancy was identified if parental PACV score was >50 Parental reasons for vaccine hesitancy was investigated using PACV questionnaire	15.9% (VH)
Iraq	(Raouf., 2018)	CI	Quantitative study Sample : 564 parents attending a health clinic selected using convenient sampling Vaccine hesitancy was identified if PACV score was > 25 Parental reasons for vaccine hesitancy were investigated using PACV questionnaire	14.2% (VH)
Malaysia	(Chan et al., 2018)	CI	Quantitative study Sample : 803 parents with vaccine refusal selected using convenient sampling Vaccine hesitancy identified using clinic records Reason for vaccine hesitancy investigated using self-designed questionnaire interview by telephone	NA
Malaysia	(Kalok et al., 2020)	CI	Quantitative study Sample : 1081 pregnant mothers at a teaching hospital selected using convenient sampling Vaccine hesitancy was identified if PACV score was >50 Parental reasons for vaccine hesitancy were investigated using PACV questionnaire	8.0% (VH)
Malaysia	(Lim et al., 2016)	CI	Quantitative study Sample : 39 parents who defaulted immunization Vaccine refusal was measured using self-reporting Reason for vaccine hesitancy was investigated using self-designed questionnaire	18.2% (VR)
Malaysia	(Mohd Azizi et al., 2017)	CI	Quantitative study Sample : 545 parents attending paediatric and antenatal clinic selected using convenient sampling Vaccine hesitancy was identified if PACV score was >50 Parental reasons for vaccine hesitancy were investigated using PACV questionnaire	11.6% (VH)
Malaysia	(Mohd Diah et al., 2019)	CI	Quantitative study Sample : 80 urban Malay parents selected using convenient sampling Vaccine refusal was measured using self-reporting Reasons for vaccine hesitancy were investigated using self-designed questionnaire	58.0% (VR)
Malaysia	(Paramasivam et al., 2019)	CI	Quantitative study Sample : 384 parents in clinical & community setting selected using convenient sampling Vaccine hesitancy was measured using self-reported vaccine refusal Reasons for vaccine hesitancy were investigated using self-designed questionnaire	6.8% (VR)
Malaysia	(Rumetta et al., 2020)	CI	Qualitative study Sample : 14 parents with vaccine refusal using purposive sampling Reasons of vaccine refusal was explored using face-to-face and online in-depth interview	NA
Malaysia	(Sohail et al., 2020)	CI	Quantitative study : 396 parents from community selected using convenient sampling Vaccine refusal measured using self-reporting Reason for vaccine hesitancy was investigated using self-designed questionnaire	0.8% (VR)
Pakistan	(Chaudhry et al., 2020)	Polio	Quantitative study Sample : 110 cases of vaccine refusal selected from record Vaccine refusal and the contributing reasons were investigated using data collection from records	-
Pakistan	(Khattak et al., 2021)	CI	Quantitative study Sample : 610 parents from a district selected using multistage cluster sampling Vaccine refusal was measured using self-reporting Reasons for vaccine hesitancy were investigated using WHO SAGE Working Group on Vaccine Hesitancy Survey Tool	27.9% (VR)
Pakistan	(Khowaja et al., 2012)	Polio	Mixed-method study Sample : 1017 parents from community selected using cluster sampling (for quantitative component) Vaccine refusal was measured using self-reporting Parental reasons for vaccine hesitancy were investigated using self-designed structured questionnaire (for quantitative part) and 30 parents who reported vaccine refusal were invited for in-depth interviews	11.4% (VH)

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Country	Author	Vaccine type	Study details	Vaccine hesitancy (VH) / refusal (VR)
Pakistan	(Murakami et al., 2014)	Polio	Mixed-method study Sample : 210 mothers with children <1 year old from 3 districts selected using cluster sampling (for quantitative component) Vaccine refusal was measured using self-reporting Reason for vaccine hesitancy was investigated using six focus group discussion conducted among mothers with children aged < 1 year old from 3 districts	VR= 3.8%, (Swat district), 2.9% (Buner district) 9.0% (Shangla district)
Saudi Arabia	(Algoraini et al., 2020)	CI	Quantitative study Sample : 384 Parents with children admitted to ward selected using convenient sampling Vaccine hesitancy and refusal measured using self-reporting Reason for vaccine hesitancy was investigated using the WHO SAGE Vaccine Hesitancy Working Group Survey Tool	14.8% (VH) 1.6% (VR)
Saudi Arabia	(Al-Regaiey et al., 2021)	CI	Quantitative study Sample : 325 parents attending clinic selected using systematic random sampling Vaccine hesitancy identified if PACV score >50 Parental reasons for vaccine hesitancy investigated using PACV questionnaire	11.0 % (VH)
Saudi Arabia	(Alsubaie et al., 2019)	CI	Quantitative study Sample : 500 parents attending outpatient clinic selected using convenient sampling Vaccine refusal was measured using self-reporting Reason for vaccine hesitancy was investigated using SAGE Working Group on Vaccine Hesitancy Survey Tool	20.0% (VH)
United Arab Emirates	(Alsuwaidi et al., 2020)	CI	Quantitative study Sample : 300 parents attending healthcare service selected using convenient sampling Vaccine hesitancy identified if PACV score was >50 Parental reasons for vaccine hesitancy investigated using PACV questionnaire	12.0% (VH) 6% (VR)

*CI=Childhood immunization, PACV= Parent Assessment for Childhood Vaccination

could harm children.[32] Additionally, parents feared that childhood vaccines cause diseases like autism, seizure, and paralysis.[23]

Meanwhile, studies had consistently found that vaccine-hesitant parents were pointedly associated with concerns related to vaccine effectiveness.[23, 25, 28, 29, 33] Some parents perceived vaccines as not beneficial.[13, 27] Instead, they prefer alternative measures to prevent their children from catching diseases, for example using homeopathy treatment in Malaysia.[25, 31, 33, 34] Other contributing factors include parental concerns that the children received too many injections[23, 35], fear of injection pain[14, 35] and previous unpleasant experience related to vaccination or the healthcare personnel.[31, 34] Consequently, parents expressed distrust in the healthcare personnel or the medical industry.[12, 14, 28]

Interestingly, we found several unique reasons for vaccine hesitancy within the local community context. A study in Rahim Yar Khan district in Pakistan suggested that polio vaccine refusal was contributed by repeated vaccination campaigns by the government.[30] As Pakistan is a country with endemic polio, frequent vaccination campaigns conducted subsequently raised community resistance towards vaccination.[30] In addition, as males are the primary decision-makers in Pakistani households, as they were absent during the daytime when vaccinators visit their homes, mothers refrained from making any decision, thus refusing polio vaccine for their children.[13,26] Additionally, vaccine refusal were also caused by the misconception that the oral polio vaccine was a birth control method that prevents their children from giving birth later in life.[26]

In essence, this review found that as described by the World Health Organization (WHO), the determinants of vaccine hesitancy in Islamic countries and MMC are complex and vary with place.[3] Consistent with global findings, vaccine safety and effectiveness are significant vaccine concerns in different regions[36] including the Islamic countries and MMC.

The role of religious factors in vaccine hesitancy and refusal in Islamic and MMC

Our review shows that religious factors affecting parental decisions on childhood immunization remain significant among the communities in Islamic countries and MMC, however the magnitude of religious influences differ

across studies. Some studies highlighted that the religious concerns among parents with vaccine refusal were pronounced.[25, 27, 30, 37] In Pakistan, polio vaccine refusal was significantly associated with the perception that some ethnic-religious groups play a role in vaccination difficulties.[27] Similarly, studies in Pakistan found that 50% of vaccine-hesitant parents quoted religious reasons[12,30], with parental religious misconceptions associated with being 'uncommitted' for polio vaccination.[12] Interestingly, the proportion of parents that described religious reasons for vaccine hesitancy or refusal also differs across studies within the same country. In Malaysia, while a study found that 76% of parents with vaccine refusal were linked to religious misconceptions, namely doubts related to the vaccine 'halal' status[34], other studies discovered that the religious reasons were only quoted by 6.8%[31] and 25% of those refusing vaccines.[24] However, Malaysian studies found that Muslim parents were less likely to be vaccine-hesitant.[14, 29] Concurrent with this finding, the defaulters of childhood immunization were shown to be associated with non-Muslim Malaysian parents.[38]

Religious misconceptions among parents with vaccine hesitancy and refusal

In this review, we identified several misconceptions about the Islamic religion contributing to vaccine hesitancy. Firstly, the parental concerns on vaccine composition considered haram (not allowed in Islam) influence their decision to refuse childhood vaccinations.[12, 25, 34, 37] In Pakistan, the parental belief of vaccines being not halal (allowed in Islam) was significantly linked to their disinterest in oral polio vaccine[12]. Other studies showed that parental hesitancy was connected to concerns that childhood vaccines could contain pork (a substance forbidden in Islam) [26, 30], aborted foetus cells, or monkey blood.[32]

Secondly, vaccine hesitancy was also instigated by the beliefs that vaccine is irrelevant and against God's will. Some parents believed that the vaccine was discordant with the Holy Hadith and an artificial alteration of the fate determined by God [26] or 'unnatural' way of achieving immunity[32], reckoned as a denial of God's will[32], especially since vaccines were not available during the time of Prophet Muhammad.[37]

Third, some parents perceived vaccines as bringing harm (mudharat) to children, which contradicts the Islamic approach to ensure the wellness of the population (ummah). For example, Pakistani parents believed that the polio vaccine contained a birth control substance to harm the children.[13] Similarly, some parents perceived that there were presence of unsafe substances in vaccines which can be harmful to children.[37] In addition, it was also believed that vaccines were created by Western countries partly as a conspiracy against Muslim nations.[13]

As the local religious leaders were influential towards their Muslim community, any misconception or lack of support regarding vaccination correspondingly influenced vaccine hesitancy and refusal.[27, 37] In Pakistan, 20% of caregivers expressing disinterest in the polio vaccine had quoted their religious leaders' belief that childhood polio vaccine was "not a very good idea".[30] Similarly, there were reports of religious leaders opposing vaccination programmes.[26] Additionally, the religious institutions (madrasah) heavily influenced parents' opinions.[13] Despite the effort of religious authorities to exhibit scholars' support towards vaccination, distrust of these organizations remain a challenge among the Muslim community.[37] From our review, various religious-related vaccine misconceptions had resulted in vaccine hesitancy and refusal in Islamic countries and MMC. As individuals living in the community, the religious leaders and institutions could suggestively shape parental perception on childhood vaccines.

Barriers towards determining religious influences towards vaccine hesitancy

While determining the role of Islamic beliefs in vaccine hesitancy, we found several challenges. Mainly, not all studies explored religious misconceptions among parents with vaccine hesitancy or refusal. A total of six studies investigating vaccine hesitancy included in this review did not explicitly investigate religion in the questionnaire. [14, 15, 22, 28, 29, 35] It is noted that these studies applied the Parent Assessment for Childhood Vaccination (PACV) assessment which did not explicitly investigate the

religious barriers for childhood immunization. Regardless, the PACV tool included the question 'How concerned are you that the vaccination shot for your child may not be safe?'[39] which could be perceived as a concern related to vaccines composition or its 'halal' status. The PACV questionnaire was constructed based on an analysis of previous vaccine hesitancy surveys at the time, which were mostly done in high-income countries.[39] Despite being validated and used worldwide, the questionnaire did not include specific religious reasons for vaccine hesitancy.

Secondly, making a distinct separation between religious, cultural, and political factors is often difficult. For example, in a study, the respondents were asked, 'do you think some ethnic-religious groups play a role in vaccination difficulties?' and 'do religious and political leaders support vaccination?'.[27] Although these questions implied that religion-based concerns possibly contribute towards vaccine hesitancy, they also proved that making a distinct separation between factors related to culture, ethnicity, politics, and the actual religious influences for vaccine hesitancy was an intricate task. In support of this finding, vaccine hesitancy and obstruction of childhood examination programmes in certain Islamic countries (like Afghanistan, Pakistan and Nigeria) traditionally linked to the backward, anti-Western ideology of Islamic militants, in reality was argued to be closely related to the country political and cultural situations.[40] Within one religious group itself, varying views suggested that political, cultural, and historical contexts influence vaccine opinion[36] and modify the effects of religion in vaccine hesitancy.[36]

CONCLUSIONS

In conclusion, we found that the prevalence of vaccine hesitancy in Islamic countries and MMC ranges from 8.0 - 21.0%, which was comparable to other countries. Various parental reasons contributed to vaccine hesitancy and refusal, particularly concerns about vaccine safety, side effects, and effectiveness. Religious misconceptions significantly influence childhood vaccine hesitancy and refusal in Islamic and MMC; however, the magnitude of impacts and interplay of factors related to the religion-based misconceptions towards parental vaccine hesitancy differs between countries and requires an insight into the local context.

There are several limitations of this review. Firstly, heterogeneity in sample population and methodology must be taken into consideration when comparing the vaccine hesitancy prevalence between studies. Additionally, some studies applied convenient sampling with resultant bias results that may not represent the overall population. Secondly, as it is difficult to significantly distinguish between political, cultural, and religious factors related to vaccine hesitancy, the role of religious misconceptions described in this review may also comprise other influences. Third, since the selected studies were limited to those in the English language, studies reported in other languages were excluded for review. Finally, as studies included in this review were conducted in a limited number of Islamic and MMC countries, the evidence does not allow for a conclusive and comprehensive understanding towards the childhood vaccine hesitancy in the Islamic world.

Notwithstanding these limitations, this review provides important insights into the childhood vaccine hesitancy in the Islamic world. Firstly, we recommend opting for contextual-based and comprehensive qualitative research to gain better understanding of childhood vaccine hesitancy within local context to successfully formulate a pragmatic strategy to overcome vaccine hesitancy, as a one-size-fits-all approach is inadequate. Secondly, comprehensive evaluation of vaccine hesitancy allows identification of pockets of vaccine-hesitant parents and formulate effective interventions to address them. Addressing this issue requires collaboration of the actors in the healthcare system and religious organizations, religious leaders, and community alike. Finally, in the era of information technology, we proposes opportunities for utilization of the role of religious organizations and social media to promote childhood vaccination and combat vaccine misconceptions. These interventions may enable the policy-makers to construct and improve programmes and policies to address childhood vaccine hesitancy.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

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