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Review

Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: A systematic review of published literature, 2007–2012

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ABSTRACT

Vaccine "hesitancy" is an emerging term in the literature and discourse on vaccine decision-making and determinants of vaccine acceptance. It recognizes a continuum between the domains of vaccine acceptance and vaccine refusal and de-polarizes previous characterization of individuals and groups as either anti-vaccine or pro-vaccine.

The primary aims of this systematic review are to: 1) identify research on vaccine hesitancy; 2) identify determinants of vaccine hesitancy in different settings including its context-specific causes, its expression and its impact; and 3) inform the development of a model for assessing determinants of vaccine hesitancy in different settings as proposed by the Strategic Advisory Group of Experts Working Group (SAGE WG) for dealing with vaccine hesitancy.

A broad search strategy, built to capture multiple dimensions of public trust, confidence and hesitancy around vaccines, was applied across multiple databases. Peer-reviewed studies were selected for inclusion if they focused on childhood vaccines [≤7 years of age], used multivariate analyses, and were published between January 2007 and November 2012.

Our results show a variety of factors as being associated with vaccine hesitancy but they do not allow for a complete classification and confirmation of their independent and relative strength of influence. Determinants of vaccine hesitancy are complex and context-specific – varying across time, place and vaccines.

1. Introduction

Vaccination is often cited as one of the most important achievements of public health. However, this success has always been challenged by individuals and groups who question, and sometimes refuse, vaccines for a variety of reasons including religious, scientific and political [1–3]. Present day debates around vaccination are increasingly complex, as more vaccines and combinations of vaccines have become available and modes of global communication have become far more ubiquitous, fast and non-hierarchical. Rapid global sharing of public concerns and sometimes uncertainty around vaccines [4] are leading to an increase in the number of people questioning vaccines, seeking alternative vaccination schedules [5,6] and sometimes delaying or refusing vaccination [7].

In recent years, there has been growing attention to what has been termed "vaccine hesitancy" [8–10], de-polarizing earlier attention to "pro"- versus "anti"-vaccination individuals and groups. Vaccine-hesitant individuals have been defined as a heterogeneous group in the middle of a continuum ranging from total acceptors to complete refusers. These "hesitant" individuals may refuse some vaccines, but agree to others, delay vaccines, or accept vaccines but are unsure of doing so [11,12].

The behaviour of vaccine-hesitant individuals or communities is complex, and determinants of hesitancy are highly variable. In Greece [13], socioeconomic factors, such as number of other siblings and father's education, were the most important predictive factors of both under- and delayed childhood vaccination, and parental attitudes and beliefs about vaccination were found to be non-significant in this regard. A study in Nigeria found that partial immunization was most influenced by factors such as maternal availability, and lack of knowledge, whereas parental disapproval played a more influential role on non-immunization [14]. Another

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study, on MMR vaccine in the UK, found that different factors influenced decision-making at each dose, with degrees of influence also varying at each dose [15]. While several systematic reviews have investigated factors that influence vaccine hesitancy across different populations and vaccines [16–19], there is evidence to suggest that not all potentially relevant factors have been identified or thoroughly investigated [15,20].

Recognizing that vaccine hesitancy is an important issue, and given its potential to impact on vaccine coverage, the Strategic Advisory Group of Experts [SAGE] on Immunization established a Working Group dealing with vaccine hesitancy in March 2012 [21]. In line with its assigned terms of reference, the SAGE working group first defined "vaccine hesitancy" as:

> A behaviour, influenced by a number of factors including issues of **confidence** [do not trust vaccine or provider], **complacency** [do not perceive a need for a vaccine, do not value the vaccine], and **convenience** [access]. Vaccine-hesitant individuals are a heterogeneous group who hold varying degrees of indecision about specific vaccines or vaccination in general. Vaccine-hesitant individuals *may accept* all vaccines *but remain concerned* about vaccines, some may refuse or delay some vaccines, but accept others; some individuals may refuse all vaccines.

Building on the above definition, the working group also drafted a "Model of determinants of vaccine hesitancy" (Fig. 1) organized around three key domains: 1. Contextual influences – including historic, socio-cultural, environmental, health system/institutional, economic or political factors; 2. Individual and group influences – including influences arising from personal perception of the vaccine or influences of the social/peer environment; and, 3. Vaccine and vaccination-specific issues which are directly related to the characteristics of the vaccine or the vaccination process (Fig. 1). This model includes a broad selection of factors that have been identified as potential influencers of vaccine hesitancy drawn from the collective experience and insights of the SAGE WG members, all of whom are considered experts in their field, and represent diverse disciplines.

With reference to the above definition and model, the specific objectives of this systematic review were to:

1) Identify research on vaccine hesitancy and related terms globally;
2) Gain an appreciation of vaccine hesitancy in different settings including its context-specific causes, its expression and its impact; [this was approached by identifying factors that act as either barriers or promoters of vaccination]; and
3) Inform the further development of the SAGE model mapping determinants of vaccine hesitancy.

The SAGE WG asked to focus this systematic review on childhood vaccination. Childhood vaccinations are generally scheduled to be received from 0-to-six years of age. As this review was focused on instances of non-conformity to this schedule, the age range for the childhood category was kept flexible. Across the studies included in this review, the oldest child participant was 7 years old, and the cut-off age was therefore set as such.

2. Methods

2.1. Search strategy and selection criteria

A search strategy was developed in Medline and then adapted as required by differential indexing across several multidisciplinary mainstream and regional databases including: Medline, Embase Classic & Embase, PsychInfo, Cochrane, CINAHL Plus, Web of Science, IBSS, LILACS, AfricaWideInfo and IMEMR. The strategy included an extensive list of keywords (Table 1) and related MeSH/subject headings in an effort to capture the many dimensions and expressions of vaccine confidence, trust and hesitancy. All articles in the six UN languages – Arabic, Chinese/Mandarin, English, French, Russian, and Spanish – were included. The keywords of the search strategy were also translated into French and run across the following databases: Medline [via PubMed], Embase, PsychInfo, CINAHL, Cochrane, IBSS, IMEMR, REPERE, Academic search premier and JSTOR. The search was run across all databases during the period 12–19 November 2012. In addition, a request was made to all SAGE Working Group members for relevant studies.

Once retrieved, articles were first screened by title and abstract according to a set of inclusion and exclusion criteria. Articles were included if they were: 1) peer-reviewed articles published between January 2007 and November 2012; and 2) focused on public trust/distrust, hesitancy, perceptions, concerns, confidence, attitudes, beliefs about vaccines and vaccination programmes.

Articles were excluded if they were not about human vaccines, were about vaccines that are not yet available (such as HIV vaccine and malaria) or were publications such as editorials, letters, comment/opinion, protocol (no data), which were not-peer reviewed

Included papers were then coded by country, WHO region [22], language, vaccine, population and study group/methodology [i.e., statistical analyses employed]. In each article, the study group was identified using either keyword searches in RefWorks (reference management software) or manually. Keywords included: multivariate, multivariable, regression, factor analysis, systematic, qualitative, focus group, mixed-method, univariate, bivariate and descriptive.

2.2. Summary descriptive analyses

Several descriptive analyses were run to assess the evidence for our systematic review objective 1) to identify research on vaccine hesitancy and confidence globally.

2.3. Factor analysis – barriers and promoters of vaccination

To support the investigation of objective 2) to gain an appreciation of vaccine hesitancy in different settings including its context-specific causes, its expression and its impact, and objective 3) to inform the further development of the SAGE model mapping determinants of vaccine hesitancy, multivariate studies about childhood vaccines (all vaccines administered $\leq$7 years old) were examined to identify any factors found to be significantly associated with vaccination behaviour as either barriers or promoters. Each significant factor was then mapped onto the vaccine hesitancy model developed by the SAGE Working Group in order to position them within an overarching framework (see Appendix B: Figs. 5–8). This was an important step as the concept of vaccine hesitancy is complex and much of the research tends to focus on one or only a few model elements rather than the entire scope.

A selection of the most frequently cited factors are further discussed in the narrative. This process was designed to: 1) highlight the key determinants of vaccine hesitancy identified in the literature and examine how these played out across different contexts, 2) assess the extent to which these factors verify the model and, finally, 3) determine any gaps in the literature, the model, or both.

Fig. 1. The SAGE Working Group [WG] "Model of determinants of vaccine hesitancy"].

Table 1
Keywords used in search strategy for literature review on vaccine hesitancy.

vaccin*	AND	anxiety	doubt*	trust	intent*	dilemma*
		attitude*	distrust	mistrust	controvers*,	objector*
		awareness	dropout*	Perception*	misconception*	Uptake
immunis*		behavi*r	exemption*	refus*	misinformation	barrier*
		belief*	fear*	Rejection	opposition	choice*
		criticis*	hesitanc*	rumo*r	delay	mandatory
immuniz*		accept*	concern*	compulsory	knowledge	
		confidence	decision making	anti-vaccin*	parent* con*	

3. Results

3.1. Identified literature

31,379 records (all languages) were identified from the databases using the combined searches (Fig. 2). After the removal of duplicates, 16,010 records were shortlisted for screening by title and abstract, of which 1187 were included for full-text assessment. Thirty-three articles were not available in full text and an additional ten articles were added from the SAGE Working Group members, which summed to a total of 1164 articles to be analyzed. All of these articles were included in the descriptive analyses. For the factor analyses, only those articles that used multivariate analyses were included ($n = 76$ for childhood vaccines).

3.2. Summary descriptive analyses

Relevant research identified through the search process was found across all WHO regions, with the majority originating from the AMERICAS [46%], EUR [27%] and WPR [12%] regions (Fig. 3). Over the period 2007–2012, there was a marked increase in research on this topic, particularly within the AMERICAS and EUR regions. The

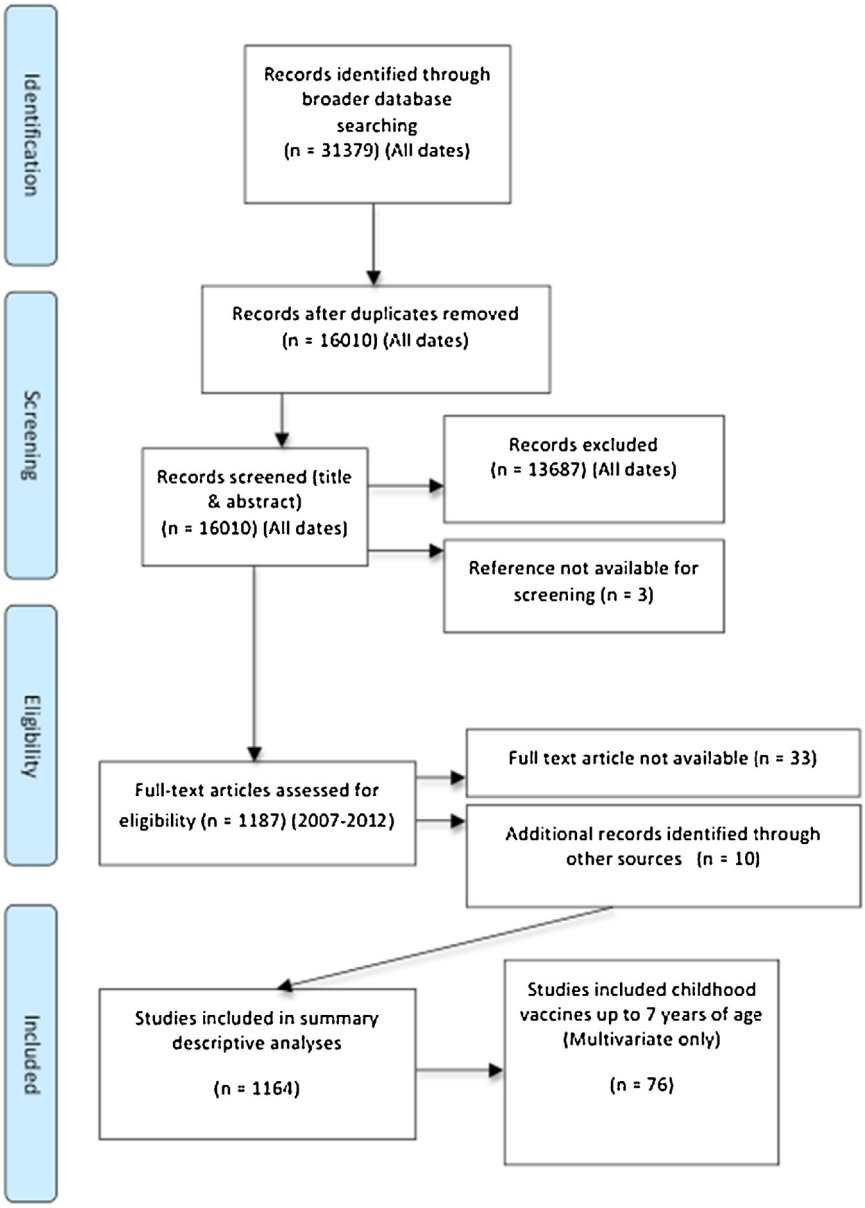

Fig. 2. Flow diagram for systematic review on public trust in vaccines incorporating 164 subset for SAGE literature review].

concept of "vaccine hesitancy" is however relatively new, especially as a core topic, with only six articles found using this term in either the title or abstract, most of which were published in the last two years [8–10,23–25].

There has also been a shift in vaccines studied across all WHO regions over the period 2007–2012. Childhood vaccines have remained a steady focus with an increase in research on both adult and adolescent vaccines (Fig. 4). For these age groups there has been particular interest in influenza vaccines – both pandemic and seasonal – and the newly introduced HPV vaccines. There has been a greater proportion of articles published on adult and adolescent vaccines in the AMERICAS, EUR and WPR; whereas childhood vaccines continue to be the primary focus in AFR, SEAR and EMR. Importantly, the introduction of HPV vaccines and the expanded recommendations for Influenza (H1N1) vaccines led to a three-fold increase in the literature on barriers and promoters of vaccine acceptance during the period 2006–2011. This increase reflects the widespread challenges faced around uptake of the pandemic (H1N1) vaccine and the varied debates around the introduction of the HPV vaccines and the implications for vaccine confidence.

3.3. *Vaccine-specific analyses – childhood*

Among the studies on childhood vaccines ($n = 262$), the majority looked at vaccines in general and were not specific to one vaccine (Fig. 5). Vaccine-specific studies were mostly about influenza and rotavirus in the AMERICAS, and measles in EUR and SEAR. Of the 76 multivariate studies reviewed, most were conducted with parents or primary caregivers ($n = 60$). Sixteen studies examined the perspectives of healthcare workers (e.g., general practitioners, paediatricians and nurses) on the different factors which influenced their intention to or practice of recommending vaccines.

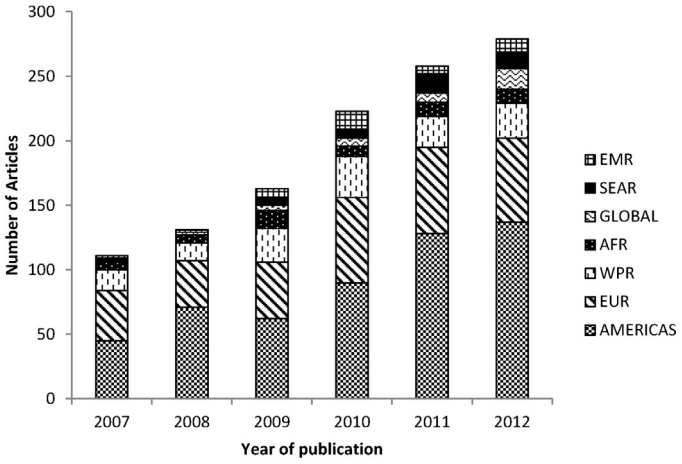

Fig. 3. Articles about vaccine and vaccination hesitancy by year [2007–2012] and WHO region [n = 1164].
NB: Numbers of articles (left axis) exceed the total number of articles reviewed as some articles discuss more than one region. Data is non-cumulative.

3.4. Quantitative factor analysis for childhood vaccines

Several determinants of vaccine hesitancy were observed in relation to childhood vaccines (*Appendix B*). These predominantly clustered around the core constructs of popular social cognitive models (e.g., Health Belief Model (HBM) and Theory of Planned Behaviour (TPB)) adopted to explore determinants of vaccination behaviour. With respect to Objective 2 and 3 of this review, these findings validate the determinants of vaccine hesitancy outlined in the SAGE WG model, but due to the framing of questions in these models (e.g., HBM, TPB), they miss other important factors.

3.5. Contextual influences

3.5.1. Socio-economic

Level of income/Socioeconomic Status (SES) was identified as a significant factor affecting vaccine acceptance in eight studies. In two studies in the USA, both high [26] and low [27] income/SES were indicated as barriers to vaccination. In Nigeria, low income/SES was identified as both a barrier [28] and promoter [29], and in Burkina Faso, two studies identified high income/SES as a promoter [30,31]. In India, higher income was noted as a promoter [32] while in Bangladesh, both high and low income/SES were found to promote vaccination. Middle income was non-significant [33]. The reasons why these factors were influential are not always explained, and when they are, other influencing factors are usually cited. For example, lower income in the USA was linked to issues of trust in the health provider [27] and in Nigeria [28] it was a barrier because it related to both low education as well as to access issues.

Level of education presents an equally mixed set of results. Six studies about India consistently found caregivers' higher education to be a promoter [32,34–38]. Studies about China [39], Lebanon [40], Israel [41], Bangladesh [33] and USA [26] all identified higher education as a potential barrier, whereas studies about Greece [13], The Netherlands [42], Nigeria [43] and Pakistan [44,45] identified it as a promoter of vaccination. Low education was identified as a barrier in studies about Nigeria [14,28,29,46], India [34,47], China [48], Kyrgyzstan [49], and as both a promoter [50] and barrier [51] in the USA. In the DR Congo, both high and low educations were represented as barriers [52]. Additionally, low education was reported as having different effects; in India, illiteracy indicates more of an issue with knowledge, whereas in Nigeria and Kyrgyzstan, low education was associated with higher levels of anti-vaccination attitudes. The evidence from this review suggests that individual factors cannot be considered in isolation as multiple influences are at play.

3.5.2. Communication and media environment

Regular exposure to vaccination messages through mass media or community sources was identified as a promoter of vaccination in Nigeria [14,28,53], India [32] and Bangladesh [33]. Exposure to news stories about vaccination, particularly negative ones, in the mass media acted as a barrier in Taiwan [54] and Canada [55].

3.6. Vaccine and vaccination-specific issues

3.6.1. Costs

Different types of costs were identified in the studies reviewed including financial, time, administrative and general accessibility. In DR Congo [52], having the father pay the transport fare to the vaccination clinic acted as a promoter. In Nigeria [14], India [47], Pakistan [56] and Greece [13], longer distances to the vaccination delivery point, either real or perceived, were a significant barrier. In Nigeria, knowledge was reported as a more important barrier over costs for any level of vaccination. However, the influencing

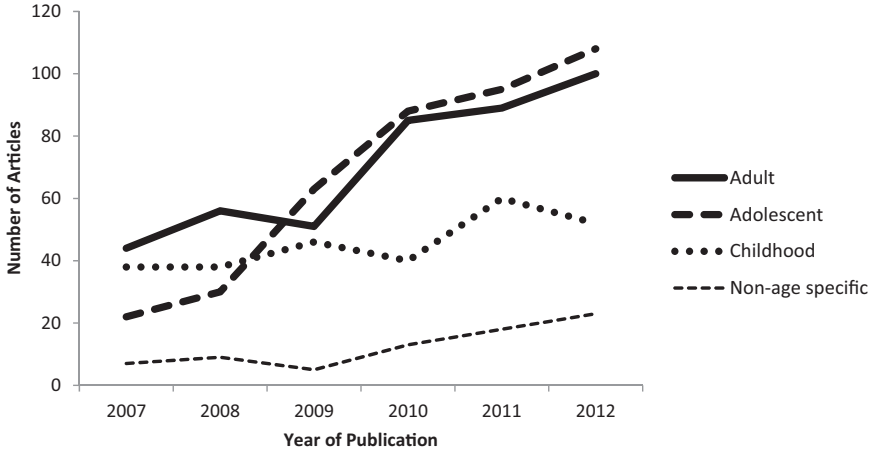

Fig. 4. Articles about vaccine and vaccination hesitancy by age between 2007 and 2012 (*n* = 1164). NB: Data is non-cumulative.

factors were different in relation to partial and non-immunization status. Specifically, supply-side issues such as maternal and familial availability appeared to explain partial immunization whereas for non-immunization, ideational and normative factors, such as parental disapproval, held sway [14]. One study from the USA [57] reported several costs perceived by health providers which acted as barriers to recommendation of the rotavirus vaccine. These included extra time needed to explain the safety profile to patients as well as additional financial and administrative burdens.

3.7. Individual/social group influences

3.7.1. Immunization as a social norm versus immunization not needed or harmful

Encouragement from others, either social or professional [e.g., co-workers, government or health professional recommendation] or belief that immunization should be a social, familial or workplace norm was a promoter across all studies in which immunization as a social norm was identified as a factor. The studies were split across the USA [57–59] and Canada [55,60,61] in the AMERICAS; the UK [15] and The Netherlands [62] in EUR; as well as Taiwan [54] and Nigeria [14,53] and DR Congo [52] in AFR. These findings suggest that perceptions of social and professional support around vaccination behaviour, whether it is positive or negative, are an important explanatory factor with universal appeal.

3.7.2. Beliefs, attitudes & motivation around health

Greater health knowledge in general was found to promote vaccination in India [36,38] whereas health knowledge, influenced by myths or rumours in Nigeria [14] or anthroposophist beliefs and alternative medicine in The Netherlands [63], acted as a barrier. Belief in scientific medicine promoted vaccination in Germany [64]. Predictably, having a positive attitude to, and seeing value in vaccination was found to be a promoter in studies about Italy [65], UK [15], Canada [61,66], The Netherlands [62], and Switzerland [34,67]. Similarly, feeling a sense of self-efficacy and comfort about getting vaccinated acted as a promoter in both The Netherlands [62] and Canada [61] whereas anticipating barriers to immunization acted as a barrier in the USA [68,69] and Taiwan [54] respectively. On the flipside, either ignoring vaccination as health behaviour or generally opposing vaccination acted as a barrier in Senegal [70] and Taiwan [54]. However, one study in the USA [71] showed that is it possible to have a positive attitude to vaccination yet opt for an exemption. Notably, this association was the weakest of all of the significant factors identified but the findings did raise discussion around the contextual influence of other individual and community-level factors.

In terms of health behaviours, studies about Nigeria [14], India [34,36], Burkina Faso [31], China [69], practicing one or more of the following supported vaccination: Accessing antenatal care [31,32,53], giving birth at a health facility [14,31,34,36,53,69], and having an immunization card [30,53]. In Senegal [70] and China [69], not having an immunization card acted as a barrier to vaccination. Further, accessing vaccination through a private clinic or regularly accessing healthcare were both found to be promoters in Nigeria [72] and The Netherlands [42]. In one study in the USA [27], planning on breastfeeding was reported as a barrier, as was being a smoker in Turkey [73].

3.7.3. Knowledge/awareness of what, where, when and why vaccines are needed

Two studies about Nigeria identified awareness of a vaccine-preventable disease [VPD] as a promoter [14,53]. Similarly, a perception that the VPD is dangerous promoted vaccination in Taiwan [54] as did having had experience of or caring for someone with a VPD in DR Congo [52]. Knowledge about vaccine recommendations and schedule was acted as a promoter in India [32] but as a barrier in DR Congo [52] and China [69]. Interestingly, most of the other studies identifying aspects of knowledge as explanatory factors related to health providers responsible for vaccination. Specifically, a greater sense of confidence in personal knowledge and training in vaccination was found to act as a promoter, in terms of recommending vaccines, in France [74], Canada [66,75], New Zealand [76] and Pakistan [56]. Perceived medical severity of the VPD by health providers was also found as a promoter in USA [77], Canada [66,75] and The Netherlands [62], and when the VPD was considered less severe, it was reported as a barrier in the USA [57].

4. Discussion

Peer-reviewed studies on vaccine hesitancy were found across all regions. The majority of studies were conducted in the EUR and AMERICAS regions, which alone have seen a two-fold increase in research on this topic during the period 2007–2012. While this finding might suggest a greater prevalence of vaccine hesitancy and related issues in these regions, the dearth of research available in other regions, where the majority of the world's population lives, makes conclusive statements difficult.

A variety of factors were identified as being associated with vaccine hesitancy but there was no universal algorithm; the independent and relative strength of influence of each factor is complex and context-specific – varying across time, place and vaccines [78,79]. And, even in the regions with more available research, there were few studies examining the inter-relationship of multi-level factors which contribute to vaccine hesitancy. Against the heterogeneity of study methods applied and the fact that the majority of studies were cross-sectional, it is also difficult to make inferences about the influence of individual or a collection of factors on vaccine-hesitant behaviour. Future consideration of qualitative studies in all regions would help balance these shortcomings and enhance understanding around decision-making processes and the ways in which explanatory factors come together to influence vaccination behaviour. What is clear, however, is that there currently exists no established metric to assess either the presence or impact of vaccine hesitancy. One of the tasks of the SAGE WG is to identify "one or several indicator(s) of vaccine hesitancy" based on the reviews being conducted by the group. Preliminary suggested indicators include delayed or incomplete vaccination, but multiple indicators are needed to distinguish "hesitancy" from delays due to supply rather than demand issues.

All of the factors identified in the quantitative analysis were represented in the SAGE WG model, but the reverse was not the same. The determinants most frequently chosen for examination in the quantitative literature are often drawn from the core theoretical constructs of classic social cognitive models (e.g., Health Belief Model, Theory of Planned Behaviour), which do not adequately account for the influence of broader contextual features. This finding does not necessarily downplay the relevance of any of these factors but it does highlight an important gap in thinking and approach.

Encouragingly, within the peer-reviewed literature, there are signs of expansion in the mode of approach adopted by researchers on this topic. For example, a recent study in Pakistan (EMR), sought to understand the mechanisms, or "pathways" of true impact factors, through which vaccination choices are derived. Using this

method the study was able to disaggregate broad factors such as "education" and assess their influence on health outcomes over time. In this example, the education level of the father had a greater influence on childhood immunization and that of the mother's on longer term health outcomes, such as height and weight [80]. In the same vein, a recent study in India (SEAR) [38] examined the broader influence of maternal education in terms of human, social and cultural capital, as well as female empowerment, to explore the pathways through which these factors affect child health.

Similarly, studies that attempt to identify the influence of layers beyond the individual would be worthwhile. For example, one study in northern Nigeria (AFR) used the behavioural-ecological model to explore the influence of factors at five levels of BCG immunization: intrapersonal, interpersonal, institutional, community and public policy levels [53]. This approach allowed for both broad identification of relevant factors and their relative strength. In this case, maternal (e.g. use of prenatal care, knowledge about immunization) and household factors (e.g. social influence) were more important than child characteristics, and vaccine supply factors were the least important. In parallel with multidisciplinary approaches, research like this, which is broad in scope but context-specific, would greatly support global understanding of vaccine hesitancy.

There are other minor limitations but these should not detract from the overall key findings. Limitations include: the exclusion of articles on mandates which may have influenced findings around the influence of policies and politics; database searches were only conducted in English and French, which may have impacted on the sensitivity of searches in other UN languages, although regional databases were used to help mitigate against this.

5. Conclusion

Vaccine hesitancy has emerged as an important concept in understanding the scope of vaccine acceptance behaviours. The development of the SAGE Working Group model of determinants of vaccine hesitancy is a meaningful step towards evolving a set of indicators to effectively monitor the evolution of vaccine hesitancy, in order to engage early in vaccine decision-making processes.

However, our findings clearly show that additional sources of information must be tapped to ensure that the model is adequately informed – especially from countries which are under-represented in the peer-reviewed literature. Vaccine hesitancy is a complex issue and is driven by context-specific factors which require both locally and globally driven approaches to detecting early signals of concerns. The public health community and the public-at-large can benefit from better mutual understanding of the drivers of vaccine hesitancy.

Acknowledgements

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Author contributions: HL and CJ co-lead the review. EE and PP contributed to the review of papers as well as the analysis. DS contributed to the statistical analyses and created the figures. All authors contributed to the preparation of the manuscript.

Appendix A. Search strategy for systematic review of public trust in vaccines and vaccination programmes – Ovid MEDLINE[R] 1948 to November Week 3 2012

1. [[vaccin$ or immunis$ or immuniz$] adj5 [anxiety or attitude$ or awareness or behavio?r or belief$ or criticis$ or doubt$ or distrust or dropout$ or exemption$ or fear$ or hesitanc$ or trust or mistrust or perception$ or refus$5 or rejection or rumo?r$ or intent$5 or controvers$ or misconception$ or misinformation or opposition or delay or dilemma$ or objector$]].ti,ab.
2. [[vaccin$ or immunis$ or immuniz$] adj3 [uptake or barrier$ or choice$ or mandatory or compulsory or concern$ or accepta$ or knowledge or parent$ con$]].ti,ab.
3. [[[vaccin$ or immunis$ or immuniz$] adj5 confidence] not confidence interval].ti,ab.
4. [[vaccin$ or immunis$ or immuniz$] adj5 decision making].ti,ab.
5. [[vaccin$ or immunis$ or immuniz$] and [anti-vaccin$ or antivaccin$]].ti,ab.
6. 1 or 2 or 3 or 4 or 5
7. exp vaccination/
8. Vaccines/
9. Mass Vaccination/
10. Immunization/
11. exp Immunization Programmes/
12. 7 or 8 or 9 or 10 or 11
13. Public Opinion/
14. Attitude to Health/
15. Attitude/
16. Health Knowledge, Attitudes, Practice/
17. "Patient acceptance of health care"/
18. Treatment Refusal/
19. Parental Consent/
20. Decision Making/
21. Prejudice/
22. Internet/
23. 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22
24. 12 and 23
25. 6 or 24
26. limit 25 to humans
27. [[vaccin$ or immunis$ or immuniz$] adj5 [anxiety or attitude$ or awareness or behavio?r or belief$ or criticis$ or doubt$ or distrust or dropout$ or exemption$ or fear$ or hesitanc$ or trust or mistrust or perception$ or refus$5 or rejection or rumo?r$ or intent$5 or controvers$ or misconception$ or misinformation or opposition or delay or dilemma$ or objector$]].ti,ab.
28. [[vaccin$ or immunis$ or immuniz$] adj3 [uptake or barrier$ or choice$ or mandatory or compulsory or concern$ or accepta$ or knowledge or parent$ con$]].ti,ab.
29. [[[vaccin$ or immunis$ or immuniz$] adj5 confidence] not confidence interval].ti,ab.
30. [[vaccin$ or immunis$ or immuniz$] adj5 decision making].ti,ab.
31. [[vaccin$ or immunis$ or immuniz$] and [anti-vaccin$ or antivaccin$]].ti,ab.
32. 27 or 28 or 29 or 30 or 31
33. exp vaccination/
34. Vaccines/
35. Mass Vaccination/
36. Immunization/
37. exp Immunization Programmes/
38. 33 or 34 or 35 or 36 or 37
39. Public Opinion/
40. Attitude to Health/
41. Attitude/
42. Health Knowledge, Attitudes, Practice/
43. "Patient acceptance of health care"/
44. Treatment Refusal/
45. Parental Consent/
46. Decision Making/
47. Prejudice/
48. Internet/
49. 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48
50. 38 and 49
51. 32 or 50
52. limit 51 to humans

Appendix B. Determinants of vaccine hesitancy identified in relation to childhood vaccines and vaccination

See Figs. 5–8.

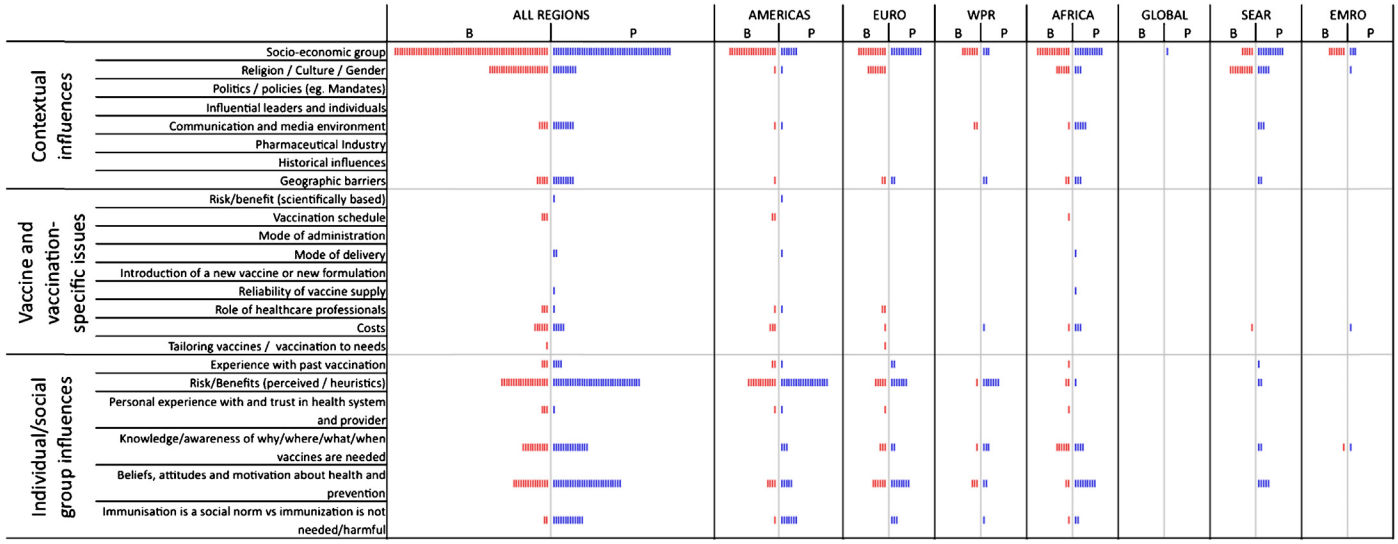

Fig. 5. Factors identified as either barriers [B] to or promoters [P] of childhood vaccination and mapped onto Vaccine Hesitancy model [multivariate studies reviewed, $n = 76$].

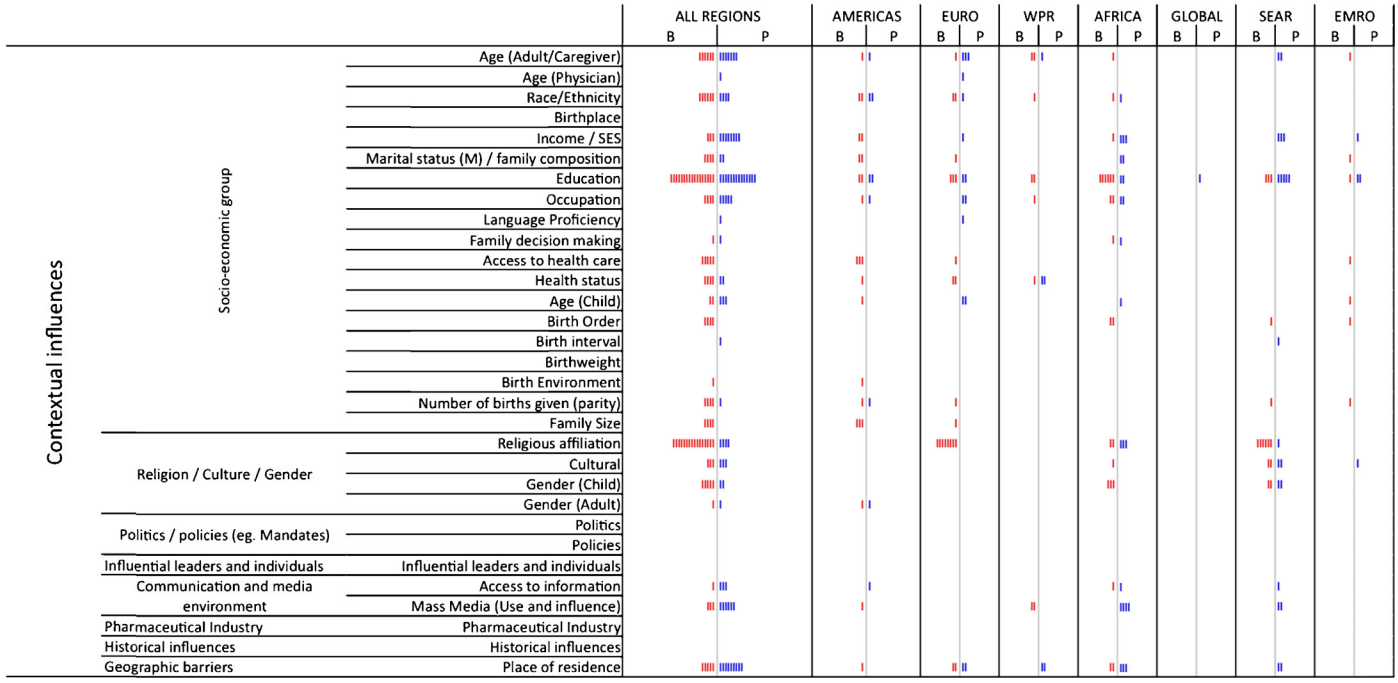

Fig. 6. Breakdown of factors identified as 'Contextual Influences' [see above] for childhood vaccines.

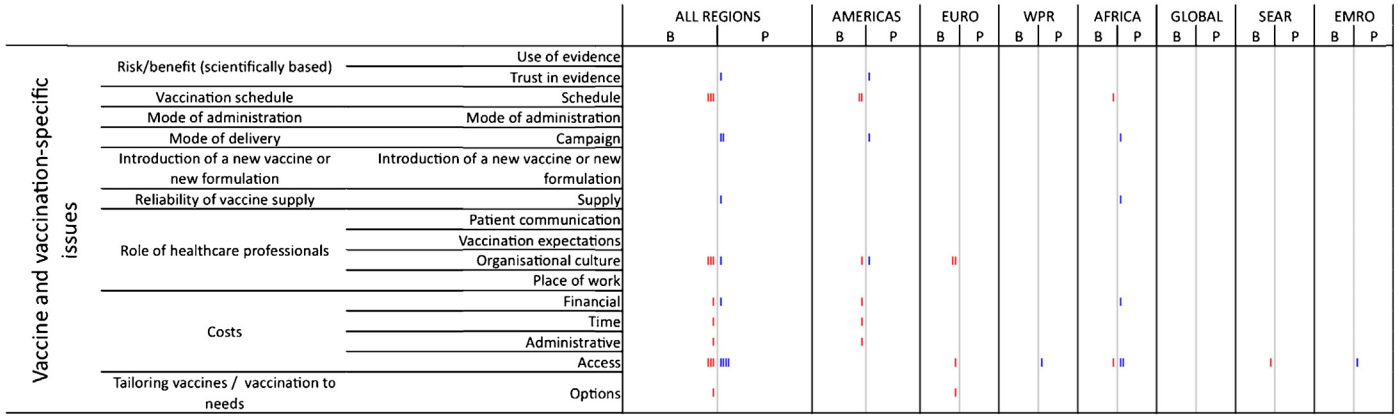

Fig. 7. Breakdown of factors identified as 'Vaccine & vaccination-specific issues' [see above] for childhood vaccines.

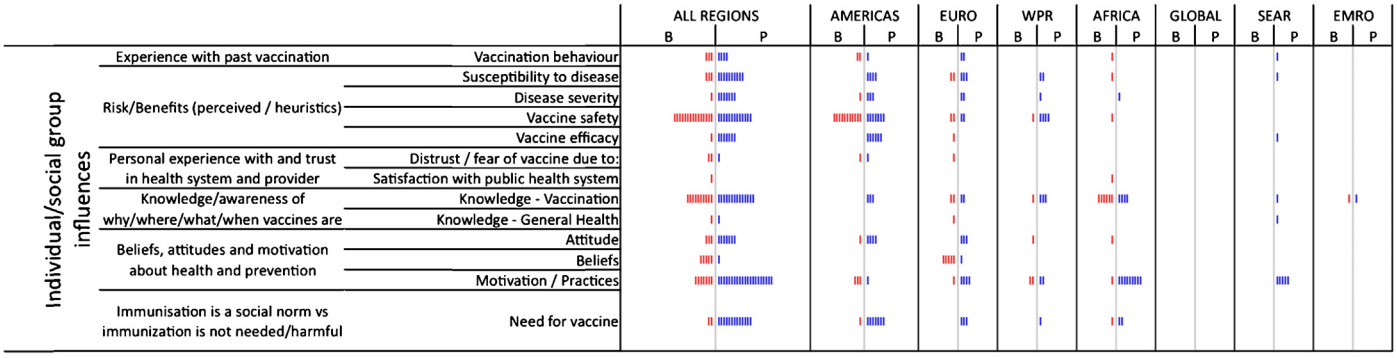

Fig. 8. Breakdown of factors identified as 'Individual and social group influences' [see above] for childhood vaccines.

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