

Social Media, Vaccine Hesitancy and Trust Deficit in Immunization Programs: A Qualitative Enquiry in Malappuram District of Kerala, India

Anoop T Nair

Department of Health, Government of Kerala

Kesavan Rajasekharan Nayar

Global Institute of Public Health, Trivandrum, Kerala

Shaffi Fazaludeen Koya (✉ fmsshaffi@bu.edu)

Ministry of Health Saudi Arabia, Al Taif, Makkah <https://orcid.org/0000-0002-1220-5754>

Minu Abraham

Global Institute of Public Health, Trivandrum, Kerala

Jinbert L. Azariah

Global Institute of Public Health, Trivandrum, Kerala

Chitra Grace

Global Institute of Public Health, Trivandrum, Kerala

Sreekutty Sreekumar

Global Institute of Public Health, Trivandrum, Kerala

Priya Chembon

Global Institute of Public Health, Trivandrum, Kerala

Kamala Swarnam

Ananthapuri Hospitals and Research Institute

Anant Kumar Pandey

Global Institute of Public Health, Trivandrum, Kerala

A. Marthanda Pillai

Ananthapuri Hospitals and Research Institute

BMC Supplements Reviewed

Keywords: vaccine resistance, vaccine hesitancy, trust deficit, anti-vaccine messages, social media

Posted Date: February 4th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-167761/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published at Health Research Policy and Systems on August 11th, 2021. See the published version at <https://doi.org/10.1186/s12961-021-00698-x>.

Abstract

Background

With increased penetration of the internet and social media, there are concerns regarding its negative role in influencing parents' decisions regarding vaccination for their children. It is perceived that a mix of religious reasons and propaganda by anti-vaccination groups on social media are lowering the vaccination coverage in Malappuram district of Kerala. We undertook a qualitative study to understand the factors responsible for generating and perpetuating vaccine hesitancy; to understand the pathways of trust deficit in immunization programs; and to understand the interaction between various social media actors.

Methods

In-depth interviews and focus group discussions conducted among parents/caregivers, physicians, public sector health staff, alternate system medical practitioners, field healthcare workers, and teachers in areas with highest and lowest vaccination coverage in the district as well as with communication experts.

Results

The trust-deficit between parents/caregivers and healthcare providers is created by multiple factors such as providers' lack of technical knowledge, existing patriarchal societal norms, and vaccine critical views of naturopaths and homeopaths. Anti-vaccine groups use social media to influence caregivers' perceptions and beliefs. Religion does not appear to play a major role in creating vaccine resistance in this setting.

Conclusions

A long-term, multi-pronged strategy should be adopted to address the trust deficit. In the short to medium term, health sector can focus on appropriate and targeted vaccine related communication strategies including the use of infographics, soft skill development of health workers, technical competency improvement through a mobile application-based repository of information, and creation of a cell to monitor vaccine related conversations in social media and intervene if needed.

Background

An emerging body of evidence suggests that anti-vaccination campaigns within social media and by some alternate medical practitioners including naturopaths and homeopaths negatively influence immunization [1–3]. Deficiency in trust of healthcare providers and of mainstream medicine is a major determinant of resistance to vaccination [4]. Vaccine hesitancy refers to delay in acceptance or refusal of vaccines despite availability of vaccination services.[5] On, the other hand, the term 'vaccine resistance' refer to a 'conscious decision to refuse the recommended vaccination', or 'the arguments critical of

vaccination policy', and implies a collective action, at times stemming from a 'fundamental opposition to the dominant biomedical understanding of health and disease' [6, 7]

Knowledge level of health workers on vaccines and their confidence in their ability to communicate effectively to parents about vaccines, are important factors which can influence vaccine acceptance, along with trust, attitudes and beliefs [8]. In addition, the emergence of social media enables people with anti-vaccine beliefs to generate, consume and share information [9].

The South Indian state of Kerala has significantly reduced mortality and morbidity due to vaccine-preventable diseases (VPDs) and has brought down infant mortality to 6 per 1000 live births [10]. However, VPDs are re-emerging in Malappuram District in northern Kerala. In 2016, 229 cases of Diphtheria were reported from the district including two deaths [11, 12]. As per the National Family Health Survey (NFHS)2015-16, while Kerala had 82% fully immunized children, the corresponding figures for Malappuram was 70.6%; with a well pronounced urban and rural difference (61.1% and 80. 2% respectively) [13]. The decline in full immunization coverage in the district was accompanied by a decrease in coverage of most individual vaccines. Coverage in urban areas was consistently lower than in rural areas. Another recent survey found that Malappuram district had 23,912 out of 342,657 under-five-children who were not fully immunized, and 36% of children aged 5–10 years had no immunizations [13].

Kerala is the first digital state in India, has the highest mobile penetration (more than 30 million connections for a population of 33 million) with an internet penetration rate of 37% [14, 15]. Malappuram Municipality offers free Wi-Fi to the citizens [16]. However, there is increasing concern among public health workers and administrators that access to social media is increasingly influencing vaccine decisions as has been reported in other contexts experiencing a similar upsurge in social media use [17, 18]. In Malappuram, this is particularly worrying in the context of lower vaccination coverage [19, 20].

One major constraint in dealing with anti-vaccine social media messages, is the inadequate capacity among health workers to respond to these messages, as per literature [21, 22]. But this has not been studied in the context of Kerala which has a well-functioning health system comparable to some of the developed countries. The factors responsible for the resistance and trust deficit are not clearly understood in the context of social media usage. A clearer understanding of the interaction between various social media actors and the pathways involved in generating trust deficit is needed in order to technically empower the health workers.

This study therefore aimed to explore the factors responsible for generating and perpetuating vaccine hesitancy and mistrust in the immunization program in Malappuram district in the context of emerging anti-vaccine social media campaigns and to understand how the trust deficit between caregivers and health workers influences caregivers' decisions on child vaccination.

Methods

We used qualitative methods specifically in-depth interviews (IDIs) and focus group discussions (FGDs). The objective was to gain understanding of the social, and health system factors in the context of increased social media usage and how social media messages contribute to development of vaccine hesitancy and mistrust in the immunization program. In addition, we also did quantitative content analysis of the vaccine related Information Education Communication (IEC) materials and anti-vaccine YouTube videos, which will be published separately.

The study was conducted in four health sub-center (HSC) areas under the Nilambur taluk of Malappuram district in Kerala state of India. These HSCs were selected from the catchment areas of two Primary Health Centers (PHC): one PHC area with the highest (98.9%) and the other with the lowest (79%) vaccination coverage. Each of the PHCs had 5 HSCs and we randomly selected two HSCs under each PHC.

Malappuram is the most populous district in the state (41.13 million; 2011 census) [23]. The Muslim majority (70.24%) district has a literacy rate of 93.57% (males: 95.76%, females: 91.62%) [23] and a total of 124 public health institutions including 20 community health centers (CHC), 20 primary health centers (PHCs) always open, and 66 other PHCs [24].

Study participants

IDIs were conducted among doctors from various disciplines (modern medicine, homeopathy and naturopathy), schoolteachers, religious leaders (Muslim, Hindu and Christian) and communication campaign experts. Separate FGDs were conducted with caregivers (mother, father, grandfather or grandmother) of vaccinated children and with partially vaccinated/unvaccinated children, modern medicine doctors, public health nurses and Accredited Social Health Activist (ASHA) workers. We defined children (aged 0–2 years) as partially vaccinated when they missed one or more National Immunization Program (NIP) vaccines for the age, as unvaccinated when they missed all vaccinations for their age in the program, and as vaccinated when they received all vaccinations as per the program.

Data collection

Prior to data collection, permission was obtained from the Government of Kerala and the District Medical Officer (DMO), Malappuram. For IDIs with providers, religious heads and schoolteachers, respondents were selected through purposive sampling with the help of panchayath (local government) and health authorities in the respective study areas. Face-to-face IDIs were conducted at their offices, ensuring privacy and confidentiality. Communication campaign experts were identified through the websites of national and international health organizations and IDIs were done through emails after obtaining consent. FGDs with health care workers were conducted in the respective PHC or health sub-centers. Using the list of vaccination status of children under 2 years obtained from the PHCs as a sample frame, we identified houses with vaccinated, partial or unvaccinated children and invited consecutive caregivers for interviews. In case of refusals, the next eligible household in the list was included and this process was continued until 8–12 respondents were achieved in each FGD group. FGDs with caregivers of

vaccinated and partially vaccinated /unvaccinated children were conducted separately at Anganwadi (village level pre-school childcare) centers. All IDIs and FGDs were audio recorded without any personal identifiers. Data was collected between November 2017 and March 2018 till it was felt that saturation was achieved as no new themes or trends were emerging.

Data analysis

After transcription and translation, KRN and SS did the content analysis. The responses were repeatedly read to identify frequently reported patterns with similarity and differences. These transcripts along with field notes were used to code and categorize in order to conceptualize the conversations into themes. They also read the information and field notes in order to cross-check and finalize the themes and prepared an abridged transcript related to the research question. A process of triangulation was attempted by constantly referring to the field notes prepared by the researchers. KRN and SS did this entire process manually and the emergent themes were discussed with other authors to refine the themes. This process enabled the authors to identify the three main themes-social factors, service delivery factors and factors related to health workers as discussed below.

Results

In total, we held 34 IDIs and 22 FGDs with 252 respondents. We held IDIs with government and private physicians (n = 4), Homeopathic and Naturopathic practitioners (n = 8), schoolteachers (n = 4), religious heads(n = 12), district health officials (n = 2) and communication experts(n = 4). The FGDs were conducted among caregivers of vaccinated(n = 8) and unvaccinated children (n = 8), private physicians (n = 2), public health nurses(n = 2) and ASHA workers (n = 2). Details of the respondents are given in Table 1.

Table 1 Details of study participants

In-depth interviews (N = 34, Females-14)	Government physicians	Two; one per study area, both females
	Private physicians	Two; one per study area, both males
	Homeopathic practitioners	Four; two per study area, three females
	Naturopathic practitioners	Four; two per study area, all females
	School teachers	Four; two per study area, two males and two females
	Religious heads	All males
		Muslim- Four, two per study area
		Hindu- Four, two per study area
Christian- Four, two per study area		
Communication experts	Three males out of total four	
District officers	Two females; one medical and one immunization officer	
Focus group discussion (N = 218, Females-128 (One FGD per group per study area)	Caregivers of vaccinated children	Mothers- 12 participants per FGD
		Fathers- 12 in FGD1 and 8 in FGD 2
		Grandfathers- 10 in FGD1 and 9 in FGD 2
		Grandmothers- 10 participants per FGD
	Caregivers of un-vaccinated children	Mothers- 12 in FGD1 and 8 in FGD 2
		Fathers- 10 participants per FGD
		Grandfathers-8 in FGD1 and 12 in FGD 2 Grandmothers- 11 in FGD1 and 9 in FGD 2
Private physicians	8 in FGD1 and 9 in FGD 2	
Public health nurses	8 in FGD1 and 9 in FGD 2	
ASHA workers	11 in FGD1 and 10 in FGD 2	

The IDIs and FGDs were analyzed thematically to find out the factors leading to the trust deficit between caregivers and health workers with respect to vaccination in the context of emergence of social media campaigns. Personal factors (religion, patriarchal societal structure of the study area); the presence of an anti- vaccine group (inclusive of certain individuals practicing alternative systems of medicine; influence of the anti- vaccine views of international anti- vaccine groups); health system factors (lack of trust on

the health system by caregivers and the inability of the health system staff to address the doubts and concerns of the caregivers regarding vaccination) are the main three themes which emerged from the analysis.

The complete set of themes and narratives are available as supplementary material to this article. The three themes were divided into sub-themes and are summarized below with a few selected relevant quotes.

Social factors

Issues related to faith and religion- Most caregivers were of the opinion that religion does not play a negative role in the decision to vaccinate. However, many providers suggested that certain communities or sects within the Muslim and Christian religions do not believe in taking medications or vaccination.

They (religious leaders) usually tell us to take vaccination.

Mother of unvaccinated child, FGD, Study area 2

A group of Muslims do not believe in medicines and treatment. For them, Allah is the one who gives diseases to the child and if the child dies, it's Allah's destiny. They ask why they should try to change that destiny by using vaccines.

FGD, ASHAs, Study area 1

Patriarchy-Mothers of unvaccinated children opined that husbands usually make the decision to vaccinate the children or not- even if the mother is willing to give vaccination. An interesting feature is that the male heads of many of these families work in middle east countries. These men seem to be negatively influenced by anti-vaccine social media messages.

The main decision makers of the family are fathers... The only media they have access to...is social media like WhatsApp.... They are mostly non-resident Keralites.... Newspapers and television are the main source of positive messages on vaccination. Social media is mostly spreading negative messages on vaccination.

FGD, Fathers of vaccinated children, Study area 1

Past negative experiences and doubts- Negative experiences with regard to vaccination were found to be a major concern of caregivers. They also have doubts regarding the need for vaccination for a healthy child.

My child was very active before vaccination. After that particular vaccination, he couldn't move his leg. This is the main reason for not taking my younger child for vaccination.

Father of unvaccinated child, FGD, Study area 1

We need to treat only when the child is affected with disease. What is the point in taking prior medication?

Mother of unvaccinated child, FGD, Study area 2

Access to internet and social media-Many respondents said that they are exposed to both positive and negative vaccine related messages through social media like WhatsApp, Facebook, and YouTube videos which make them confused regarding which decision to make. The anti-vaccine groups propagate negative messages focused on “horrifying side effects” of vaccination, depopulation, international lobbying and the presence of harmful contents in vaccines.

“Which view are we, the less educated people, supposed to believe? If he (anti vaccine naturopath) is spreading false information, the government should take proper action. Then we will have more trust in the government health department.” -Mother of unvaccinated child, FGD, Study area 2

Negative messages get more visibility and circulation at all times.
Communication Expert, IDI

Service delivery factors

Lack of trust by caregivers- Many respondents refused vaccination because of their lack of trust in the allopathic system of medicine. Also, they were concerned about vaccine administration procedures.

“Regarding vaccination, I have no trust in allopathy. I follow homeopathy which is giving good results.” -
Father of unvaccinated child, Study area 1

We don't know whether they are keeping vaccines in ice boxes or not. I doubt the quality
Father of unvaccinated child, FGD, Study area 2

Factors related to health workers- Field level health workers themselves expressed their lack of information and training to respond to the queries and doubts posed by caregivers, especially in response to negative messages in social media. Lack of coordination between different systems of medicine with regard to vaccination is another issue.

We find it difficult to convince the laymen about the science behind vaccination. It is a very complex one and we are not trained.
ASHA, FGD, Study area 1

Discussion

Based on the findings, we developed a framework to explain the trust deficit of caregivers in the district of Malappuram (Fig. 1). As compared to the Complacency, Convenience and Confidence (3Cs) model and the 2014 WHO- SAGE group Determinants of Vaccine Hesitancy Matrix report [25], our data suggest social media usage as a key factor in the framework which drives vaccine hesitancy in the study area. Social factors like caregivers' faith and religion, patriarchy, negative experiences and doubts of caregivers and their access to the internet and social media influence the trust of caregivers. Furthermore, the anti-

vaccine influencers affect caregivers' decisions through extensive utilization of social media platforms like Facebook, WhatsApp and YouTube to propagate their ideas. As reported in many other contexts, health system related factors also influence the complex issue of resistance to immunization and the trust of caregivers in these programs. Here, the general lack of trust of public health care services, which is dominated by allopathic medicine; is extended to the realm of immunization services. The inability of the health care workers to clarify queries about vaccination adds to furthering the mistrust of caregivers.

The role of religion and faith is considered as a key player in the decision to vaccinate in studies around the world including India [26, 27]. However, our study results show that individual's faith and religion were not definitive factors regarding decision-making. However, vaccine-resistance related beliefs exist in the community; especially prominent was the belief that vaccination is part of a depopulation agenda for certain communities with differential vaccine vials for different communities. It is also seen that external forces such as any authority, advisors or technology do not influence certain resistant areas; they are inherently resistant and hold a different worldview on health and medicine. This is in contrast to the scenario which exists in other parts of Kerala with high vaccination coverage [28]. Past negative experiences also play a key role in the decision to vaccinate. Most parents are concerned about the side-effects, along with the impact of vaccination on natural immunity of children. These concerns are largely a product of their interactions with indigenous practitioners and naturopaths, and contributes to vaccine resistance and hesitancy, as reported in previous studies [29, 30].

Milieu of vaccine related doubts prevail in the global media [31, 32]. This is reflected in the local media too, which has added to vaccine resistance among caregivers. Another key factor is the influence of patriarchy in the decision to vaccinate [33]. This may be linked to religion also, though only in a limited sense because it is largely a social reality that fathers are the decision-makers in many families and therefore patriarchal norms cut across religions. In most cases, these are absentee fathers who work in Middle Eastern countries who obtain their information against vaccination through the internet and social media, such as Facebook and WhatsApp [34]. Since they are casual visitors to the district, health workers do not get a chance to communicate with them and often the well- educated and well-off mothers are not able to convince the absent fathers and the present grandfathers of the household to give permission for child vaccination.

In this context, the influx of anti-vaccine messages which are widely accessible through social media is a key factor [35, 36]. Anti-vaccine groups including naturopaths and homeopaths use retracted and withdrawn journal articles from the past as well as edited and manipulated videos which highlight trivial and known short- term adverse effects like fever, excessive crying and restlessness and non-associated problems like paralysis, allergy, tiredness, weakness and use them as arguments to abstain from vaccination. Such negative messages are widely circulated by social media. At the same time, anti-vaccine activists in Kerala also exhibit "denialism", as explained by Diethelm and McKee [36]. Anti-vaccine lobbyists use "rhetorical arguments to give the appearance of legitimate debate and unresolved debate about matters generally considered to be settled" and in the process, use and create untrue reports, views, expert opinions and results to maintain the "conspiracy theory" regarding vaccination [31, 32, 37]. In our

study, an important driver that contributed to mistrust is the role of naturopathy and homeopathy, which openly criticize vaccination. Parents who follow such systems are given wrong information to create an impression that allopathic medicine has many side-effects which leads to mistrust. This was also reported in other parts of the world [38].

From the service delivery point of view, it was noted that there is a lack of trust in the public health sector, in all levels of care. Parents expressed concerns regarding vaccine safety, especially related to vaccination storage during mass vaccination campaigns. Lack of trust is worsened when the health workers (ASHAs and Anganwadi workers) are unable to answer the questions and concerns of caregivers. Health workers lack of training and preparedness in managing difficult conversations with vaccine resistant caregivers, limited knowledge about vaccines and lack of specific training for such situations contribute to trust issues [38]. Respondents felt that the health workers reach out to only on vaccine related matters, which creates mistrust. Doubts persist as to why the government is 'so overtly interested' in only vaccinating the children and not in other issues of public health relevance. Heightened campaigns by the public health system staff during mass vaccination programs also led to suspicions and hesitancy among the caregivers. In the local setting, allopathic practitioners are largely curative-oriented, giving less priority to stress on healthy life-style practices such as exercise, walking etc. This leads to the wrong impression that such healthy practices belong to the alternate systems of medicine. Furthermore, there is lack of coordination between different systems of medicine within the government health system, especially when practitioners of certain alternate systems have a different viewpoint on vaccines

Limitations of the study

The results of the study are relevant to countries and contexts with relatively higher internet coverage and social media usage. Most of the health workers we interviewed belonged to the public sector. However, in most health systems, immunization is a service largely delivered by the public sector. Furthermore, we collected data from all relevant stakeholders at the household level (fathers, mothers, grandfathers and grandmothers) which should have given us enough information on the demand side factors in the decision-making process.

Conclusions

The trust-deficit between parents/caregivers and healthcare providers is created by multiple factors such as providers' lack of technical knowledge, existing patriarchal societal norms, and vaccine critical views of naturopaths and homeopaths. Anti-vaccine groups use social media to influence caregivers' perceptions and beliefs. Religion does not appear to play a major role in creating vaccine resistance in this setting.

Addressing the issue of trust deficit is a challenging task and requires a multi-pronged, long-term strategy. However, we propose four practical interventions from the health sector point of view, that can give results in short to medium term. One, develop appropriate and targeted vaccine related communication strategies including the use of infographics, that can be shared through social media platforms. Two,

enable health workers through soft skill training programs so that they can address the anti-vaccine propaganda with confidence. Three, enhance their technical competence on vaccines through a mobile application-based repository of information and FAQs. Finally, start a social media cell for the Department of Health with the responsibility to monitor vaccine related conversations in social media and intervene if needed.

Abbreviations

ASHA	Accredited Social Health Activist
CHC	Community Health Centers
DMO	District Medical Officer
ERC	Ethical Review Committee
FAQ	Frequently asked questions
FGD	Focus Group discussion
HSC	Health Sub Centre
IDI	In-depth Interview
IEC	Information Education Communication
NFHS	National Family Health Survey
NIP	National Immunization Program
PHC	Primary Health Centers
VPD	Vaccine-Preventable Diseases

Declarations

Ethical approval and consent to participate

The study protocol was approved by the Institutional Ethics Committee of Ananthapuri Hospitals and Research Institute, Trivandrum, Kerala, India (No. AHRI/ EC/42/Oct/2016) and by the Ethical Review Committee (ERC) of the World Health Organization, Geneva (No. ERC.0002847). Written informed consent was obtained from all study participants

Consent to publish

The informed consent included the consent for publication of study findings.

Availability of data and materials

All data analyzed during this study are included in this published article [and its supplementary information file].

Competing interests

The authors declare that they have no competing interests

Funding

This paper is the output of an implementation research project (Decision maker led implementation research- DELIR) supported by the Alliance for Health Policy and Systems Research, World Health Organization, UNICEF, and Gavi, The Vaccine Alliance. These organizations did not have any role in the design of the study, collection, analysis and interpretation of the data, and writing of the manuscript, other than mentoring and technical support.

Source of publication cost

Publication costs are funded by the Decision maker led implementation research (DELIR) project supported by the Alliance for Health Policy and Systems Research, World Health Organization, UNICEF, and Gavi, The Vaccine Alliance.

Authors' contributions

ATN contributed to the design of the study and data acquisition; KRN contributed to the design of the study, data acquisition, data analyses, interpretation and writing of the manuscript; SFK contributed to the concept and design of the study, data interpretation and writing of the manuscript; MA and CG contributed to the data acquisition, data analyses, interpretation and writing of the manuscript; JL, SS and PC contributed to data acquisition and data analyses; SS contributed to data acquisition and data analyses, KS and MP contributed to the data interpretation and AKP contributed to the design of the study. All authors provided input into drafts, read and approved the final version of the manuscript.

Acknowledgements

The authors greatly acknowledge the contribution of Professor KE Elizabeth MD, PhD for her critical review of the study findings. We are thankful to Alyssa Sharkey (UNICEF), and Arielle Mancuso (Alliance for Health Policy and Systems Research, WHO) for their comments on this manuscript. We are thankful to all the data collectors for their effort in generating valuable information from the field. We thank the doctors, health workers, teachers, caregivers, alternate health practitioners, religious heads who gave valuable insights and the local health and village authorities for facilitating data collection.

References

1. Evrony A, Caplan A. The overlooked dangers of anti-vaccination groups' social media presence. *Hum Vaccin Immunother.* 2017;13:1–2. doi:10.1080/21645515.2017.1283467.
2. Caulfield T, Marcon AR, Murdoch B. Injecting doubt: responding to the naturopathic anti-vaccination rhetoric. *J Law Biosci.* 2017;4:229–49. doi:10.1093/jlb/lxx017.
3. Hussain A, Ali S, Ahmed M, Hussain S. The Anti-vaccination Movement: A Regression in Modern Medicine. *Cureus.* 2018;10:e2919. doi:10.7759/cureus.2919.
4. Schmidt AL, Zollo F, Scala A, Betsch C, Quattrociocchi W. Polarization of the vaccination debate on Facebook. *Vaccine.* 2018;36:3606–12. doi:10.1016/j.vaccine.2018.05.040.
5. World Health Organization. Improving vaccination demand and addressing hesitancy. web page. https://www.who.int/immunization/programmes_systems/vaccine_hesitancy/en/. last accessed on 23 May 2020.
6. Hobson-West P. Understanding vaccination resistance: moving beyond risk. *Health Risk Soc.* 2003;5:273–83. doi:10.1080/13698570310001606978.
7. Streefland P, Chowdhury AM, Ramos-Jimenez P. Patterns of vaccination acceptance. *Soc Sci Med.* 1999;49:1705–16.
8. Falagas ME, Zarkadoulia E. Factors associated with suboptimal compliance to vaccinations in children in developed countries: a systematic review. *Curr Med Res Opin.* 2008;24:1719–41. doi:10.1185/03007990802085692.
9. Stein RA. The golden age of anti-vaccine conspiracies. *Germs.* 2017;7:168–70. doi:10.18683/germs.2017.1122.
10. International Institute for Population Sciences. National Family Health Survey - 4. State Fact Sheet Kerala. Mumbai: International Institute for Population Sciences; 2016. http://rchiips.org/nfhs/pdf/NFHS4/KL_FactSheet.pdf; last accessed on 9 December 2020
11. Sangal L, Joshi S, Anandan S, Balaji V, Johnson J, Satapathy A, et al. Resurgence of Diphtheria in North Kerala, India, 2016: Laboratory Supported Case-Based Surveillance Outcomes. *Front Public Heal.* 2017;5:218. doi:10.3389/fpubh.2017.00218.
12. Nayar KR, Shaffi M, Lal S. Diphtheria Deaths in Kerala. *Econ Polit Wkly.* 2015;50. <http://www.epw.in/journal/2015/43/reports-states-web-exclusives/diphtheria-deaths-kerala.html>, last accessed on 9 December 2020
13. International Institute for Population Sciences. National Family Health Survey - 4 (2015- 16) District Fact Sheet: Malappuram, Kerala. Mumbai: International Institute for Population Sciences; 2015.
14. Mathews VK. Kerala best suited for digital era. *Deccan Chronicle.* 2018. www.deccanchronicle.com/nation/in-other-news/210318/kerala-best-suited-for-digital-era.html.
15. Salman SH. Rural internet trends. *Medianama.* 2016. <https://www.medianama.com/2016/08/223-rural-internet-usage-pattern/>. Accessed 26 Jun 2018.
16. Staff reporter. Malappuram rides on free Wi-Fi wave. *The Hindu (Newspaper).* 2015. <https://www.thehindu.com/news/national/kerala/malappuram-rides-on-free-wifi->

wave/article7571208.ece, last accessed on 9 December 2020

17. Orr D, Baram-Tsabari A, Landsman K. Social media as a platform for health-related public debates and discussions: The Polio vaccine on Facebook. *Isr J Health Policy Res.* 2016;5:1–11. doi:10.1186/s13584-016-0093-4. <https://ijhpr.biomedcentral.com/articles/10.1186/s13584-016-0093-4>; last accessed on 9 December 2020
18. National Vaccine Advisory Committee. Assessing the State of Vaccine Confidence in the United States: Recommendations from the National Vaccine Advisory Committee. *Public Health Rep.* 2015;130:573–95. doi:10.1177/003335491513000606.
19. Subramanian S. India doctors use Facebook to battle vaccinations fearmongering. *The National (Newspaper)*. 2017. <https://www.thenational.ae/world/asia/india-doctors-use-facebook-to-battle-vaccinations-fearmongering-1.668327>.
20. Philip S. Kerala vaccination mission battles resistance spread on social media. *The Indian Express (Newspaper)*. 2017. <https://indianexpress.com/article/india/kerala-vaccination-mission-battles-resistance-spread-on-social-media-4878355/>, last accessed on 9 December 2020
21. Goldstein S, MacDonald NE, Guirguis S, Eskola J, Liang X, Chaudhuri M, et al. Health communication and vaccine hesitancy. *Vaccine.* 2015;33:4212–4.
22. Global Polio Eradication Initiative. 8th meeting of the Independent Monitoring Board 4. *Wkly Epidemiol Rec.* 2013;28:297–300.
23. Directorate of Census Operations- Government of Kerala. District census handbook 2011: Kerala: Series 33, Part XII-B. 2011.
24. Directorate of Health Services: Government of Kerala. List of Modern Medicine Institutions Under Directorate of Health Services. Thiruvananthapuram: Directorate of Health Services: Government of Kerala; 2020. https://dhs.kerala.gov.in/wp-content/uploads/2020/03/list_10052019.pdf, last accessed on 9 December 2020
25. World Health Organization. Report of the Sage Working Group on Vaccine Hesitancy. Geneva, Switzerland: World Health Organization; 2014.
26. Ruijs WLM, Hautvast JLA, Van Ijzendoorn G, Van Ansem WJC, Van Der Velden K, Hulscher ME. How orthodox protestant parents decide on the vaccination of their children: A qualitative study. *BMC Public Health.* 2012;12:1. doi:10.1186/1471-2458-12-408.
27. Lahariya C. A brief history of vaccines and vaccination in India. *Indian J Med Res.* 2014;139:491–511, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4078488/>, last accessed on 9 December 2020
28. Varghese J, Kutty VR, Ramanathan M. The interactions of ethical notions and moral values of immediate stakeholders of immunisation services in two indian states: A qualitative study. *BMJ Open.* 2013;3:1–9.
29. Shui I, Kennedy A, Wooten K, Schwartz B, Gust D. Factors influencing African-American mothers' concerns about immunization safety: a summary of focus group findings. *J Natl Med Assoc.* 2005;97(5):657-666. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2569331/>, last accessed on 9 December 2020.

30. Gowda C, Dempsey AF. The rise (and fall?) of parental vaccine hesitancy. *Hum Vaccines Immunother.* 2013;9:1755–62.
31. Edwards KM, Hackell JM. Countering Vaccine Hesitancy. *Pediatrics.* 2016;138:e20162146–e20162146. doi:10.1542/peds.2016-2146.
32. Larson HJ, Cooper LZ, Eskola J, Katz SL, Ratzan S. Addressing the vaccine confidence gap. *Lancet.* 2011;378:526–35.
33. Abakar MF, Seli D, Lechthaler F, Schelling E, Tran N, Zinsstag J, et al. Vaccine hesitancy among mobile pastoralists in Chad: a qualitative study. *Int J Equity Health.* 2018;17:1–10. doi:http://dx.doi.org/10.1186/s12939-018-0873-2.
34. Zimmerman RK, Wolfe RM, Fox DE, Fox JR, Nowalk MP, Troy JA, et al. Vaccine criticism on the world wide web. *J Med Internet Res.* 2005;7:1–8.
35. Gu Z, Badger P, Su J, Zhang E, Li X, Zhang L. A vaccine crisis in the era of social media. *Natl Sci Rev.* 2018;5:8–10.
36. Diethelm P, McKee M. Denialism: what is it and how should scientists respond? Black is white and white is black. *Eur J Public Health.* 2009;19:2–4.
37. Peretti-Watel P, Larson HJ, Ward JK, Schulz WS, Verger P. Vaccine hesitancy: Clarifying a theoretical framework for an ambiguous notion. *PLoS Curr.* 2015;7 Outbreaks:1–11.
38. Paterson P, Meurice F, Stanberry LR, Glismann S, Rosenthal SL, Larson HJ. Vaccine hesitancy and healthcare providers. *Vaccine.* 2016;34:6700–6. doi:10.1016/j.vaccine.2016.10.042.

Figures

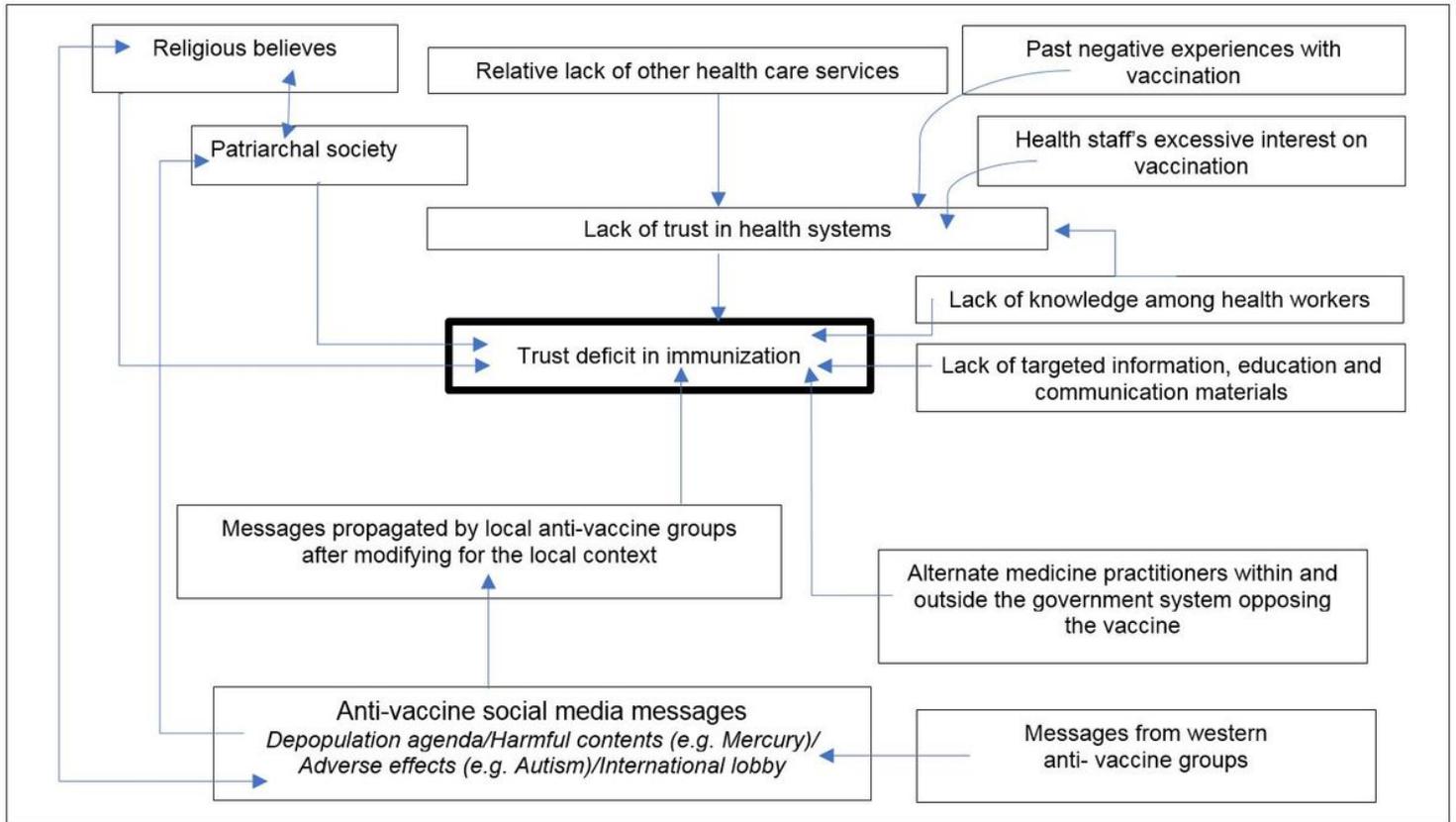


Figure 1

Pathways in the process of generating trust deficit in immunization program.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Additionalfile1.docx](#)