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Review Article

Vaccine Hesitancy- A Review of Literature

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Abstract

Vaccine hesitancy is the refusal by members of the public to take safe and recommended vaccines. This has been recorded since many decades. With each infection that modern medicine tries to eradicate via vaccines, there has been hesitancy from the public in different forms towards getting the said vaccines. However, successful strategies have been adopted to ensure maximum coverage of vaccination thereby facilitating elimination of the particular disease. Today, vaccine hesitancy stands in the way of successful resolution of the COVID- 19 pandemic. This article reviews the history of vaccine hesitancy, some important concepts about hesitancy and strategies that were carried out to overcome them. It is hoped that this article could help healthcare workers better understand vaccine hesitancy and use some of the methods mentioned here in achieving maximum rates of COVID 19 vaccinations.

Keywords: Vaccine hesitancy; Vaccines; COVID 19

Introduction

Vaccinations are considered to be one of the most successful public health solutions in the prevention of communicable diseases [1,2]. Many potentially lethal diseases have been successfully eliminated, or at least brought to a controllable level which is attributable to widespread vaccination programs. Some of these include measles, smallpox, polio, pertussis and diphtheria [3]. While the positive effects of vaccinations are there for all to see, doubts and concerns about vaccines are also on the rise. The World Health Organization defines vaccine hesitancy as "delay in acceptance or refusal of vaccines despite availability of vaccination services" [4]. For a vaccination program to achieve its intended goals, it is essential that a substantial proportion of the population utilize the immunization services. This is because the vaccine not only protects the vaccinated individual, but also the entire community via herd immunity [5].

It was once thought that a person might be pro or anti vaccines. However, we now know that vaccine acceptance or hesitancy is better described on a continuous scale (with acceptance on one end of the spectrum and hesitancy on the other end) (Figure 1) [6].

Vaccine hesitancy seen now during the COVID 19 pandemic has also been seen during previous pandemics. Hence, it might be useful to review the reasons for reduced vaccine uptake in the past and the strategies adopted to negate it. These methods, along with the ones used today could help us in better understanding vaccine hesitancy and overcome it effectively, thereby achieving the primary goal of mass vaccination to bring this pandemic under control.

Figure 1: Vaccine hesitancy continuum.

History of vaccine hesitancy

One of the earliest records was from China where scabs from smallpox were collected and powdered, to be inhaled. This earliest form of variolisation led to varying degrees of immunity to smallpox. The variation in success of this 'vaccine' was probably due to the lack of standardisation in the procedure at that time [7]. This was then followed by the famous experiment by Dr. Edward Jenner in the late 18th century when he took samples of cowpox lesions from his maid and inoculated his gardener's son with it in order to develop immunity towards smallpox. It is, but obvious, that at that time, these experiments were met with suspicion [8].

Two main patterns can be noticed while observing past incidents of vaccine hesitancy. One is the concept that vaccines cause more harm than good, i.e., their side effects are more harmful than the diseases which they help prevent. This has been noticed with most recent vaccines, where initially the vaccine uptake by the public is really good, which causes the serious effects of the disease to diminish significantly from the society. With time, parents, and even healthcare professionals stop seeing, first-hand, the horrible symptoms of the disease (which the vaccine helped prevent). This causes a bias in the minds of the public, where risks are clearly visible but the benefits of the vaccine are not discernible for the above mentioned reason. This has led to many authors stating that vaccines tend to become victims of their own success [9].

The second pattern seen is related to compulsory vaccination legislations. In many countries, it was, and is viewed as an infringement of their freedom and fundamental rights [9]. Compulsory vaccination programs are met with their fair share of scepticism by members of the public who fail to see the larger picture and are concerned only with their individual rights and freedoms. Among this, three main reasons stand out; a general lack of trust in modern medical science, religious beliefs and infringement of personal freedom [10]. An interesting example is regarding smallpox vaccination in the US in 1902, a resident of Massachusetts refused to get vaccinated citing a violation of his freedom. He was fined only a measly amount of five dollars, which was followed by a lengthy court battle, which resulted in a landmark judgement that a state or municipal body could enact a public health law and enforce it if it ensured safety of the general public [11].

One of the most noteworthy papers was by Dr. Andrew Wakefield, who in 1998, published an article in The Lancet linking MMR vaccine to autism and inflammatory bowel disease. He theorized that the measles vaccine interacts with the intestine and releases toxic compounds to enter the brain, causing autism. He was later charged with medical fraud, poor research methods and his study has been largely discredited by the medical community [12]. However, since the general public gets their information from mainstream media and not medical journals, this theory is still seen doing its rounds in society today. The fact that anti vaccine movements have been garnering unwanted publicity by celebrities hasn't helped the medical community in increasing vaccine awareness [13].

Vaccine hesitancy in the age of social media

Even though vaccines have progressed rapidly when compared to their initial years (in terms of methods of production, relative safety, standardisation etc), the reasons for hesitancy expressed by the general public are more or less the same. Some of these common reasons include that risks of vaccines are greater than their benefits, and that compulsory vaccination programs invade upon personal freedoms. Authors who have tracked vaccine hesitancy over the past decades seem to land upon a TV documentary aired in 1982 in the US where parents of children who received the DPT

vaccine came on the show and expressed very emotionally the 'supposed harm' that the vaccine caused to their children [14]. A similar pattern is being seen in today's age of wide spread use of the internet where parents share experiences of vaccination to the general public. Many studies have shown that majority participants cited the internet as their source of information about vaccines [15-17]. In some instances, they might seem overly emotional about normal side effects such as pain around the injection site, fever, weakness etc thereby making a larger portion of the public believe that vaccines do more harm than good. The general public, for the most part, do not have the time or skill to go through peer reviewed scientific articles; they would rather watch a video on social media that is quicker but most often erroneous in content. Another concept that affects what a person sees on the internet is their previous internet searches. Search engines are user based, meaning that if a person has searched repeatedly over the past few days about ill effects of vaccines, he/she will be shown similar content across other platforms. This would lead to content about benefits of vaccines not being shown to this user [18]. An analysis of videos on YouTube about vaccinations show that around 30% videos are anti-vaccines and most of them provide data that do not conform to normal standards. In today's times, this is a matter of concern for public health professionals as internet celebrities and social media are given more credibility than actual qualified doctors [19].

Some studies have taken an interesting approach in finding about the impact of anti- vaccination websites on the attitude of general public towards vaccines. The methodology was the creation of a fake website which intentionally had lot of anti- vaccination information including fake personal stories and testimonies [20-23]. Interestingly, they found that a fake anti-vaccination website influenced a person's decision about vaccination more significantly than a fake pro- vaccination website [20]. Another study has shown that HPV vaccine uptake is lesser in those areas where Twitter feeds contained a relatively higher amount of anti- vaccination content such as conspiracy theories, misinformation and vaccine risks [24].

Political and socioeconomic factors affecting vaccine uptake today

Similar to the spectrum of vaccine hesitancy as described in the beginning of this article, throughout history varying degrees of trust/ mistrust can be seen between the general public and the ruling government. Rightly or otherwise, this has increased in contemporary society. If a person doesn't trust the government on other issues, then as a fall over effect, he/ she would not trust the government about public health measures such as vaccinations. Studies backing this concept have shown that in lower income sections, sections of society that have been discriminated against, and other marginal sections of society show a higher percentage of anti- vaccine sentiment [14,25-27]. At the same time, in well-educated and richer countries where parts of the community show alternative types of lifestyle, vaccine hesitancy is also seen; but here it serves as a way to reinforce their alternative identity in society [28].

Strategies to combat vaccine hesitancy

The concepts of 5as and 5cs

Reasons for reduced vaccine uptake are varied across different strata of society. In order to achieve better vaccination rates, it is important for public health professionals to first understand the reasons behind vaccine hesitancy. Two main models have been proposed which might help in better understanding about attitudes regarding vaccines, i.e., the 5 As and the 5 Cs.

Thomson., *et al.* in 2015 [29], proposed the 5As model which aimed to explain some of the factors behind vaccination rates. These included Access, Affordability, Awareness, Acceptance and Activation. The working definition of these terms are provided in figure 2.

Figure 2: Working definitions of the 5 As.

- **Access:** The authors suggested that those children that were born in hospitals and health centres showed higher rates of vaccination probably due to the easier access to vaccines at these places. Vaccine uptake was higher if vaccination drives were organised by institutions such as schools, workplace or universities. They also said that ensuring convenient access

to vaccines was necessary. For example, vaccines given during school hours had better uptake than those given after school hours.

- **Affordability:** Those vaccination drives that were financed by the State had better acceptance rates. Parents also had non-financial costs; they had to take time off work to bring their children to the health centres to get vaccinated and this is something that is not feasible for many sections of the population such as daily wagers.
- **Awareness:** The most common reason told by parents is that they weren't aware of the vaccines or the vaccination schedule. Those parents who did not come in contact with a healthcare worker during the initial months of their child's life tend to question the importance of immunisation before the age of schooling.
- **Acceptance:** Concerns regarding the safety of the vaccine can have direct effects on the rates of vaccination. If a vaccine is considered to be safe, it is likely to be accepted five times more than if a vaccine is thought of as being unsafe. Another factor that influences acceptance is the general lack of belief that the vaccine is effective. If the perceived severity of the particular disease is higher, then it correlates with higher rates of vaccination against that particular disease. For example, vaccination rates for the influenza vaccine is low as the disease is not perceived to be a very serious one according to the general public. Individual health beliefs play a major role in rates of vaccine uptake. For example, those parents who consulted alternate medicine professionals such as homeopaths are less likely to get their children vaccinated. Parents who prefer their child to 'get immunity naturally' are less likely to get their children immunized. Cognitive and emotional maturity, past behaviour with medical procedures and previous experiences with vaccines were strong factors in predicting vaccine uptake.
- **Activation:** Two main methods can be used to nudge reluctant people into getting vaccinated; these are reminders and prompts as well as policies in the workplace. Those children who attend healthcare facilities that contain constant reminders about vaccination schedules, benefits etc are five times more likely to get vaccinated than those children attending healthcare centres where such reminders were not placed. Similarly, workplace policies that require employees to be vaccinated against particular diseases showed higher rates of vaccination compared to workplaces that did not have any such policy.

Betsch., *et al.* in 2018 [30], proposed the 5 Cs model which aimed to understand the 'psychological precedents to vaccination'. They used existing psychological models of health behaviour to come up with this model. The 5Cs include confidence, complacency, constraints, calculation and collective responsibility.

- **Confidence:** It is trust placed in the general safety and effectiveness of the vaccines, the healthy system that provides these vaccines including the competency and reliability of the healthcare workers, and the motivations of the public policy makers who deemed that a particular vaccine is needed. Poor sources of information, belief in conspiracy theories are some of the reasons a few people have less confidence in vaccines. At the same time, a general trust in the healthcare system is correlated with increased confidence in vaccines.
- **Complacency:** It refers to a situation where the individual perceives the risk of the vaccine preventable disease as being low and does not see a point in getting vaccinated. As per the Health Belief model [31] of health behavioural psychology, when the perceived risk of a disease is low, then action taken to prevent it is also weak. It is thought that since vaccination is a preventive step taken to prevent future harm, those who are complacent towards vaccines might also show a higher risk-taking attitude as the fear of potential future harm is low in such individuals [32].
- **Constraints:** It refers to a situation when some issues act as barriers towards vaccine uptake. These could be the actual availability of the vaccines, need to pay to get vaccinated, geopolitical situations, ability to understand benefit of vaccines due to illiteracy/ language barrier.
- **C**alculation: It refers to extensive in depth searching of information by an individual about the vaccines. It is assumed that those individuals who have a higher calculative way of thinking would research more about the risks and benefits of vaccines and act accordingly. However, this can backfire if the source of information is poor, especially with high amount of anti- vaccination material available online [33].
- **Collective responsibility:** The authors define it as the willingness to protect others by vaccinating oneself via herd immunity. The other side of this coin is that some individuals might not be willing to get vaccinated citing that other member of the community are vaccinated. In those individuals/ communities that show higher amounts of collectivism, communal approach and empathy, a higher rate of collective responsibility, and hence higher rates of vaccination.

If the 5 As and 5 Cs methods are analysed, it is obvious that there isn't one reason for vaccine hesitancy and the public health professional's approach should be multi- faceted and tailor- made to suit the target population. There is some degree of overlap between these two systems, but the point to be taken is that both of these methods could be used in better planning of vaccine interventions as well as assessment of the success rates of vaccination programs.

Summary of some of the methods used in the past to address vaccine hesitancy

Sl. No.	Author (Year)	Method	PICO
1	Anderson (2009) [34]	Cluster Randomised Controlled Trial	Participants: 180 members, each of whom was recognised as a trusted member of the community. Intervention: Dialog based. Each field member met with the participants and explained about the intervention in 3 phases. First phase included community groups discussing state of child vaccination and prevalence of measles, and risks and benefits of vaccination. Second phase included community groups discussing costs and benefits vs risks of measles vaccination. Third phase included community groups identifying specific barriers to child vaccination in their community and methods to overcome it. Control: 14 other sites undergoing routine immunisation. Outcome: Measles vaccine uptake doubled in the intervention group and rates of DPT vaccination tripled.
2	Ansari (2007) [35]	Cohort (Pre and Post)	Participants: 1025 muslim families in Aligarh, India who were resistant againt polio vaccination. Intervention: HCW visited each house and imparted health education. Aim was to try and convince each household that polio vaccine drops were safe. Those that were convinced were vaccinated and those that weren't were visited by a second team 2-3 days later. Control: Normal house to house immunisation program. Outcome: After the initial round, 49 percent of households were converted. 51 percent still remained hesitant. After visit by the second team, 60 percent of the resisting families were converted. 20 percent could not be vaccinated even after the second round.
3	Banerjee (2010) [36]	Cluster Randomised Controlled Trial	Participants: 1640 children aged 1 to 3 years in 134 villages in Rajasthan, India. Intervention: Dialogue based and non-financial incentives. Under the dialogue based method, they setup immunisation camps in areas where HCW were mostly absent to show the availability of vaccines. These camps were conducted on a fixed date and time every month. In addition, a social worker identified children to be vaccinated and informed mothers about benefits of vaccines. Under the non- financial incentives method, 1 kilo of raw lentils and set of metal plates were distributed upon vaccination of one child. The cost of the incentives were approximately equal to the loss of pay to the mothers. Control: Control group without the intervention. Outcome: Both the methods increased rates of vaccination with the incentives method showing 20% higher vaccination.

4	Nasiru (2012) [37]	Cohort (Pre and Post)	Participants: Children aged under 5 years of age in 4 settlements in Nigeria whose communities were identified as those with the least rates of polio vaccination. Intervention: Based on Majigi, which is a road side film show conducted in mobile vans. Campaign involved different leaders in the communities such as Imams, political leaders, town criers and traditional surgeons. The video clips were first shown to the leaders and then shown to the general public. Apart from the video, a play was also staged to show the harm caused by polio and benefits of the vaccine. Control: Baseline values of polio vaccination in the same communities. Outcome: 1047 children got vaccinated which was a significant increase compared to the baseline values.
5	Stockwell (2012) [38]	Two-group cohort (Intervention study)	Participants: 361 (195 intervention group and 166 control group) children aged 11-18 years of age from low income households in USA. It was assumed that these families would have less health literacy. Only those children that had incomplete vaccination schedules were included. Vaccines in question were the meningococcal vaccine and the tetanus- diphtheria- acellular pertussis vaccine. Intervention: Text message based. Parents received automated text messages reminding them about their children's vaccination. Messages were stopped if their data was updated in the system after being vaccinated. Text messages included patient's name, clinic name, times during which the vaccines may be obtained from the clinic. Messages were sent in English and Spanish. Control: Parents who received normal standard of care, except for the reminder messages. Outcome: Children in the reminder group were, on an average, 50 percent more likely to get vaccinated than in the control group.
6	Usman (2007) [39]	Randomised controlled trial (Individual)	Participants: 1500 mother- child units were recruited from urban vaccination centres in Karachi. They were enrolled during their DTP 1 vaccination. Intervention: Reminder and recall. Participants were randomly divided into 4 groups- Group 1 had 375 participants who received a redesigned immunisation card, group 2 had 375 members who received vaccine education at the centres, group 3 received the education at the centre and the redesigned cards, and group 4 was the control group (no intervention apart from standard care). The vaccination card was modified by making it larger, and when folded showed the next date and day of vaccination on the outside. Remaining details such as name, vaccination center etc were on the inside. The card was tied to a string and the mothers were asked to hang this card in a very visible place in the house. Control: group 4 was the control group (no intervention apart from standard care) Outcome: Those that received the modified cards were 25% more vaccinated.

Table a

As per the SAGE (Strategic Advisory Group of Experts) working group on immunisation at the WHO, in their systematic review (2014) [6], summarized the various methods used to address vaccine hesitancy and their effectiveness. Strategies to address vaccine hesitancy can be broadly divided into 3 methods- Dialogue- based interventions, non- financial incentives and reminder/ recall.

Dialogue based interventions

- Involvement of religious or traditional leaders improves rates of vaccination. This method seems to address the most common reason behind vaccine hesitancy, i.e., misconception and distrust.
- Social media is a very powerful tool in addressing vaccine hesitancy. However, it could prove to be a double- edged sword as anti- vaccination voices also find their platform on social media.
- Social mobilisation and sensitisation including dialogue with leaders and one to one interpersonal communication with the community members increased rates of vaccination.
- **Non-financial incentives:** If the target group is identified as being underprivileged, any incentives related to basic survival such as food would be readily accepted. It is also possible that since basic needs such as food was addressed, it can help in building confidence around the governing body and the public health machinery.
- **Reminder- recall methods:** On its own it is not very effective, but can be a potent tool when combined with other methods.

Conclusion

Vaccine hesitancy is a complicated issue and no single strategy can help address vaccine hesitancy. The interventions with higher rates of vaccination have mostly employed multiple methods to address the issue. Strategies have to be tailor- made as per the community's needs and specific intricacies such as social norms, socioeconomic status, beliefs and religion. Level of evidence available is low to moderate across literature and hence, while attempting to apply one or more of the methods mentioned in this article, it has to be taken with a grain of salt and customised after assessing the target population using the 5As and 5Cs method. As mentioned before, an individual lies on a vaccine hesitancy continuum. Accurate assessment as to where in this continuum does the individual lie can help in moving the person away from hesitancy and towards acceptance.

The WHO recommends [6], that before embarking on any intervention aimed at addressing vaccine hesitancy, the following points should be considered;

- Clear identification of the target population in terms of reasons behind vaccine hesitancy, social norms and any other specific issues.
- Interventions should involve meaningful engagement with the stakeholders that results in meaningful action.
- Acknowledgment and appreciation of contextual influences from the individual all the way till the healthcare system.
- Use of multicomponent strategies rather than a single method.
- Continuous evaluation of the strategies that will help in increasing success rates of future interventions.

Bibliography

1. World Health Organization (2021).
2. World Health Organization (2020).
3. Centers for Disease Control and Prevention (CDC). "Ten great public health achievements--United States, 1900-1999". *Morbidity and Mortality Weekly Report* 48 (1999): 241-243.
4. MacDonald NE. SAGE Working Group on Vaccine Hesitancy. "Vaccine hesitancy: definition, scope and determinants". *Vaccine* 33.34 (2016): 4161-4164.
5. Dube E., *et al*. "Vaccine hesitancy: an overview". *Human Vaccines and Immunotherapeutics* 9.8 (2013): 1763-1773.
6. World Health Organization. "Report of the SAGE working group on Vaccine Hesitancy" (2014).
7. Rathbone J. "Lady Mary Wortley Montague's contribution to the eradication of smallpox". *Lancet* 347.9014 (1996): 1566.
8. Riedel S. "Edward Jenner and the history of smallpox and vaccination". *Proceedings Baylor University Medical Center* 18.1 (2005): 21.
9. Jason L. " New Media, Old Messages: Themes in the History of Vaccine Hesitancy and Refusal". *American Medical Association Journal of Ethics* 14.1 (2012): 50-55.
10. Jackson CL. "State laws on compulsory immunization in the United States". *Public Health Reports* 84.9 (1969): 787-795.

11. Mariner WK., *et al*. "Jacobson v Massachusetts: it's not your great-great-grandfather's public health law". *American Journal of Public Health* 95.4 (2005): 581.

12. Wakefield AJ., *et al*. "Ileallymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children". *Lancet* 351 (1998): 637-641.

13. Gross L. "A broken trust: lessons from the vaccine-autism wars". *PLoS Biology* 7.5 (2009): e1000114.

14. Colgrove J. "State of Immunity: The Politics of Vaccination in Twentieth Century America". Berkeley: University of California Press (2006).

15. Betsch C., *et al*. "Dr. Jekyll or Mr. Hyde? How the Internet influences vaccination decisions: recent evidence and tentative guidelines for online vaccine communication". *Vaccine* 30 (2012): 3723-3726.

16. Brunson EK. "The impact of social networks on parents' vaccination decisions". *Pediatrics* 131 (2013): e1397-404.

17. Wheeler M and Buttenheim AM. "Parental vaccine concerns, information source, and choice of alternative immunization schedules". *Human Vaccines and Immunotherapeutics* 9 (2013): 1782-1789.

18. Marshall GS. "Vaccine hesitancy, history, and human nature: the 2018 Stanley A. Plotkin lecture". *Journal of the Pediatric Infectious Diseases Society* 8 (2018): 1-8.

19. Kata A. "Anti-vaccine activists, Web 2.0, and the postmodern paradigm-An overview of tactics and tropes used online by the antivaccination movement". *Vaccine* 30.25 (2012): 3778-3789.

20. Betsch C., *et al*. "The influence of vaccine-critical websites on perceiving vaccination risks". *Journal of Health Psychology* 15 (2010): 446-455.

21. Betsch C., *et al*. "Effect of narrative reports about vaccine adverse events and bias-awareness disclaimers on vaccine decisions: a simulation of an online patient social network". *Medical Decision Making* 33 (2013): 14-25.

22. Haase N., *et al*. "Impact of disease risk on the narrative bias in vaccination risk perceptions". *Psychology and Health* 35 (2020): 346-365.

23. Nan X and Madden K. "HPV vaccine information in the blogosphere: how positive and negative blogs influence vaccine-related risk perceptions, attitudes, and behavioral intentions". *Health Communication* 27 (2012): 829-836.

24. Dunn AG., *et al*. "Mapping information exposure on social media to explain differences in HPV vaccine coverage in the United States. *Vaccine* 35 (2017): 3033-3040.

25. Conis E. "Vaccine Nation: America's Changing Relationship with Immunization". Chicago: Univ. Chicago Press (2014).

26. Holmberg C., *et al*. "The Politics of Vaccination: A Global History". Manchester, UK: Manchester Univ. Press (2017).

27. Jamison AM., *et al*. "You don't trust a government vaccine": narratives of institutional trust and influenza vaccination among African American and white adults". *Social Science and Medicine* 221 (2019): 87-94.

28. Sobo EJ., *et al*. "Information curation among vaccine cautious parents: Web 2.0, Pinterest thinking, and pediatric vaccination choice". *Medical Anthropology* 35 (2016): 529-46.

29. Thomson A., *et al*. "The 5As: a practical taxonomy for the determinants of vaccine uptake". *Vaccine* 34 (2016): 1018-1024.

30. Betsch C., *et al*. "Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination". *PLoS ONE* 13.12 (2018): e0208601.

31. Schwarzer R and Fuchs R. "Self-efficacy and health behaviours". *Predict Health Behaviour Research and Practice with Social Cognition Models* (1996): 163-196.

32. Johnson JG., *et al*. "DOSPERT-G Bereichsspezifische Risikoskala-Deutsche Version Domain-specific Risk-taking Scale-German version (2004).

33. Kata A. "Anti-vaccine activists, Web 2.0, and the postmodern paradigm-An overview of tactics and tropes used online by the anti-vaccination movement". *Vaccine* 30 (2012): 3778-3789.

34. Andersson N., *et al*. "Evidence-based Discussion increases Childhood Vaccination uptake: A Randomised Cluster Controlled Trial of Knowledge Translation in Pakistan". *BMC International Health and Human Rights* (2009): 9.

35. Ansari MA., *et al*. "Reducing resistance against polio drops". *Journal of The Royal Society for the Promotion of Health* 127.6 (2007): 276-279.

36. Banerjee A., *et al*. "Improving immunisation coverage in rural India: clustered randomised controlled evaluation of immunisation campaigns with and without incentives". BMJ 340 (2010): 2220.

37. Nasiru SG., *et al*. "Breaking Community Barriers to Polio Vaccination in Northern Nigeria: the impact of a Grass roots Mobilization Campaign (Majigi)". *Pathogen Glob Health* 106 (2012): 166-171.

38. Usman HR., *et al.* "Redesigned Immunization Card and Center-based Education to Reduce Childhood Immunization Drop-outs in Urban Pakistan: A Randomized Controlled Trial". *Vaccine* 27.3 (2009): 467-472.