Overcoming vaccine deployment challenges among the hardest to reach: lessons from polio elimination in India

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ABSTRACT

After more than 30 years of efforts to eliminate polio, India was certified polio free by WHO in 2014. The final years prior to polio elimination were characterised by concentrated efforts to vaccinate hard-to-reach groups in the state of Uttar Pradesh, including migrant workers, religious minority Muslims and impoverished communities with poor pre-existing social support systems. This article aims to describe the management strategies employed by India to improve the deployment and acceptance of vaccines among hard-to-reach groups in Uttar Pradesh in the final years prior to polio elimination.

Three main management principles contributed to polio elimination among the hardest to reach in Uttar Pradesh: bundling of health services, local stakeholder engagement and accountability mechanisms for public health initiatives. In an effort to market the polio campaign as an authentic health-oriented programme, vaccine acceptance was improved by packaging other basic healthcare services such as routine check-ups and essential medications. India also prioritised local stakeholder engagement by using influential community leaders to reach vaccine hesitant groups. Lastly, the accountability mechanisms developed between non-profit organisations and decision-makers in the field ensured accurate reporting and identified deficiencies in healthcare worker training. The lessons learnt from India's polio vaccination programme have important implications for the implementation of future mass vaccination initiatives, particularly when trying to reach vulnerable communities.

Summary box

- Vaccine hesitancy in vulnerable groups, such as within religious minorities and impoverished communities, was a significant barrier to the elimination of polio in India.
- Underserved communities were sceptical of vaccinations due to perceived religious incompatibilities and conspiracy theories that arose as a result of historical tensions within the community and the lack of infrastructure in impoverished neighbourhoods.
- While the scientific expertise and the logistical capacity to eliminate polio existed in India for decades, it was necessary to employ unique managerial interventions to vaccinate hesitant populations as the final step to eliminating the disease.
- India's polio elimination experience suggests that in areas with historic tensions, an approach which incorporates community trust building may reduce the risk of lingering transmission during pandemics.
- In an international environment where vaccines will become increasingly important to prevent infectious disease outbreaks, promoting vaccines through parties that the public perceives as trustworthy is as important as providing scientific evidence of a vaccine's safety and efficacy.
- Directly engaging with local leaders of hesitant communities and implementing mechanisms to hold the government accountable were effective strategies in overcoming vaccine hesitancy.

INTRODUCTION

India's polio-free certification in 2014 represented decades of efforts to vaccinate its few remaining polio-affected regions and stop endemic transmission. In 1987, India faced 28 757 polio cases and widespread transmission.[1] By 2009, transmission only occurred in two states and total cases had fallen to 741.[2] While technological advancement in vaccine efficacy was a large contributor to polio elimination, many of the obstacles faced in the final endemic regions in Uttar Pradesh were related to vaccine deployment and acceptance among specific hard-to-reach populations.

A key challenge to polio elimination in the final years was resistance from vaccine hesitant groups. In Uttar Pradesh, opposition to vaccine uptake developed through a history of mistrust between the government and segments of its vulnerable populations.[3] Vulnerable populations in India refer to disadvantaged subsegments of the population requiring additional care, support and tailored interventions, often due to historical, structural and institutional challenges.[4] This includes groups such as migrant workers, religious minorities and socioeconomically impoverished segments of the population.

These groups were sceptical towards the vaccination programme's intentions, especially as they believed other issues to be more pressing such as access to basic services including sanitation and food security.[3] Similarly, sections of the minority Muslim population impacted by the 1970s government-run family planning programmes were later resistant to vaccinating their children due to a history of mistrust.[5] Allegations that the polio vaccine contained materials derived from pigs furthered resistance of the vaccine as it is considered 'haram', or forbidden as per Islamic law.[6] Lastly, many of these hard-to-reach populations also consisted of migrant groups, including brick kiln and factory workers, who moved seasonally for employment, presenting logistical challenges on tracking vaccination records.[7] In 2009, with the implementation of the 107 Block Plan, the government reinforced its commitment to addressing the communication gaps in its polio elimination programme to specifically target these vulnerable populations.[8]

To target pockets of reduced vaccine uptake among these hard-to-reach groups, in 2002 the Social Mobilisation Network (SMNet) was formed.[9] Funded by US Agency for International Development, SMNet was led by UNICEF and the CORE Group, with support from grassroots non-governmental organizations (NGOs) and partners such as the Government of India and Rotary International. Under SMNet, community health workers, termed community mobilisation coordinators (CMCs), were in charge of tracking and educating their community's households about the polio vaccine.[10 11] CMCs were central in finding unreached segments of the population and encouraging resistant families to agree in taking the vaccine.[12] However, as with any public health initiative of this scale, the effectiveness of the polio vaccination programme relied on management strategies that allowed local community-level actors, governmental departments, and external organisations to operate seamlessly. With time, challenges related to a lack of training, human errors and data falsification were resolved as external stakeholders were integrated into the final stretch of the vaccination programme.

Ultimately, the strategies that India used to eliminate polio among its hardest to reach populations show that a successful vaccination programme not only requires medical advancement, but also hinges on the implementation of robust management strategies to overcome social and economic inequalities. In this paper, we aim to describe the overarching management strategies that India employed to overcome the vaccine hesitancy that develops as a result of these inequalities. We interviewed individuals in India that were involved in implementing or analysing the polio vaccination programme. This included former members of the Indian Expert Advisory Group (IEAG), UNICEF, the CORE Group, Rotary International and the World Health Organization (WHO), as well as researchers from local academic institutions such as Aligarh Muslim University (AMU). Table 1 provides an overview of major partners involved and their roles in the polio elimination campaign. In taking a qualitative approach, we hope to add depth to the current understanding of India's polio vaccination campaign through the first-person experiences of ground-level actors. Patients or the public were not involved in the analysis of this work.

BUNDLING CLINICAL SERVICES: MARKETING THE POLIO VACCINE WITH HORIZONTAL HEALTH SERVICES

Vaccine hesitancy among vulnerable groups in India was indicative of the mistrust that healthcare-deficient communities have towards nonessential government interventions. While vaccine hesitancy was prevalent among religious minority groups due to distrust from previous family planning programmes, other groups from lower socioeconomic statuses also opposed the vaccine. Impoverished groups were sceptical of the government's focus on polio vaccination because they were receiving a product that they did not deem as a fundamental healthcare necessity compared with services like basic sanitation and nutrition, which they had been lacking for years. When talking about healthcare services in urban slums, an interviewee described that, 'it's not a matter of hard-to-reach but rather, hardly reached.' Communities felt ignored by their government, and were thus mistrusting and sceptical of government or NGO intervention during polio vaccination rounds.

Starting in 2008, a conscious change was made to market the polio vaccine initiative as a genuine healthcare-oriented programme. The polio campaign pivoted to horizontal health services, an approach taken by regional health centres where additional medical services or medications were bundled with polio vaccines. Academic institutions mobilised students to engage with underserved households individually to build trust in the polio vaccine. For example, social work students invited hesitant households for coffee or tea to build rapport. Similarly, medical interns performed routine check-ups and addressed basic healthcare issues at homes by providing health supplies for basic medical presentations such as a runny nose, fever or cough. This personalised outreach by students humanised the initiative by providing individuals with an outlet to voice their concerns about the vaccine.

The use of additional healthcare resources was a reactionary strategy responding to underserved groups' requests. An AMU official commented that when they went to resistant homes, women would see it as an opportunity to ask for additional medications for maternal health or minor ailments. In response to the request for more horizontal health services, organisations such as Rotary International partnered with local hospitals to set up monthly health camps to address community concerns about their general health. In some instances, doctors incentivised hesitant families by providing 'skip the line' tickets that could be used in local clinics.

Table 1 Role of different partners in India's polio elimination campaign

Partner	Role
Government of India	▶ Largest financial contributor ▶ Purchased the vaccines ▶ Oversaw overall direction of polio programme ▶ Hired community health workers, district immunisation officers, accredited social health activists and auxiliary nurse midwives ▶ Decided what policies would be implemented
WHO	▶ Led the National Polio Surveillance Programme ▶ Provided technical and organisational support for surveillance
The CORE Group	▶ Alongside UNICEF, led the Social Mobilisation Network (SMNet), an infrastructure of community health workers who operated in each high risk community. SMNet's work involved the community mapping of households, tracking immunisation of households and recruitment of local sources of authority to build vaccine credibility ▶ Contributed to the production of communication and media materials ▶ In addition to social mobilisation, CORE community mobilisers collected census data and recruited informants for surveillance of acute flaccid paralysis (AFP)[15]
UNICEF	▶ Alongside the CORE Group, led the SMNet, an infrastructure of community health workers who operated in each high risk community in Uttar Pradesh ▶ SMNet's work involved the community mapping of households, tracking immunisation of households, and recruitment of local sources of authority to build vaccine credibility ▶ Led the Underserved Strategy to overcome socioeconomic resistance
Rotary International	▶ Provided advocacy and mobilisation at religious, political and bureaucratic levels ▶ Assembled the Ulama Committee, consisting of Islamic scholars who helped address vaccine misinformation among some vaccine-hesitant Muslim groups ▶ Created general health camps
IEAG	▶ An advisory group composed of experts who provided recommendations to the government
Religious and academic organisations/institutions	▶ Partners of the 'Underserved Strategy' to overcome socioeconomic and cultural resistance ▶ Examples: Aligarh Muslim University, Jamia Millia Islamia, the Ulama Committee
International donors	▶ Provided financial support for India's polio eradication programme ▶ Examples: US Agency for International Development, Bill & Melinda Gates Foundation, US Centers for Disease Control and Prevention

While vaccinations are key aspects of public health, they may not be perceived to have such importance by community end-users with low access to foundational clinical services. Conversely, these communities may not reject the entirety of the health system. Vulnerable communities in India did not resist public health needs that they considered more urgent, such as maternal health and were vocal in expressing their desire to have access to them. Vaccines, on the other hand, are difficult interventions for vulnerable populations to accept, because they are less pressing and offer no immediately observable clinical benefit.

With this in mind, vaccine uptake in areas that are deficient in healthcare resources will likely benefit from the provision of bundled health services that address existing essential healthcare concerns. By listening to the community's worries and providing a solution, the public health intervention gains legitimacy. The bundled services should address the community's most basic needs, as defined by the community itself. These services can go outside of the realm of medicine and include legal, tax or financial planning support. Conversely, scepticism towards a vaccine by the mainstream population who already have essential social services coverage would require different strategies.

LOCAL STAKEHOLDER ENGAGEMENT TO SECURE IN-GROUP VACCINE ADVOCACY

While national polio media campaigns led by famous Indian celebrities were a contributing factor towards overcoming vaccine hesitancy in the general population and creating a positive enabling environment, our research revealed that these celebrities were less effective in securing buy-in from the most vulnerable populations. Rather, it was the local stakeholders that led to the success of the programme among the hardest-to-reach populations. Organisations involved in polio elimination observed pre-existing social structures and identified key actors that could improve the efficiency of the vaccination effort. They collaborated with four main stakeholder categories: employers of migrant workers, private healthcare providers, local media outlets, and religious leaders.

Employers of migrant workers

Vaccinating migrant groups came with the challenge of tracking their movement. WHO, SMNet and the government identified that it would save time to vaccinate migrants at their places of work. This consisted of factories, brick kilns, construction sites and tea farms. To integrate employers into the vaccination programme, SMNet representatives contacted employers with a letter from

the district official. Employers then set up vaccination booths at the work site, allowing new migrants entering the community to be vaccinated promptly. Multiple interviewees stated that employers felt it was their responsibility to help in the vaccination campaign.

Private healthcare providers

Detection rates of acute flaccid paralysis (AFP) can signal a surveillance system's ability to find polio cases.[13] To improve surveillance of AFP cases, WHO developed a community-level surveillance network in partnership with local private physicians and faith healers without formal medical training. These practitioners were previously not included in India's surveillance network, making the system more robust. A former member of an NGO in Uttar Pradesh stated that some of these informal faith healers were initially worried that WHO would shut them down if they collaborated with surveillance officers. 'We recognised people that had local knowledge. First, we needed to make sure that the 'quacks' (healthcare providers without licensed medical training) were not afraid of us.' By gaining the trust of these unlicensed practitioners, surveillance officers were able to rely on them to get reports of cases of AFP among children in their community. Additionally, using private healthcare providers with local expertise reduced the need for external surveillance officers in vaccine hesitant communities. In return, these private healthcare providers received training on how to recognise AFP, access to polio testing, and certificates from WHO that recognised their contributions to the surveillance effort.

Local media outlets

SMNet's efficiency was grounded in local-level communication strategies to improve the credibility of the vaccination programme. The CORE Group produced tailored material for targeted communication campaigns, mostly directed towards mothers of households. The messaging was simple and often published in local newspapers to avoid appearing foreign. The CORE Group and UNICEF also worked with local journalists to encourage the publication of articles tackling vaccine hesitancy from well-respected journalists in the community to facilitate a dialogue on the safety and importance of the polio vaccine.

Religious leaders

As part of the Underserved Strategy, SMNet sought partnerships with Muslim leaders and academics, as the Muslim minority population was a group overrepresented in polio cases. SMNet worked with prominent Muslim universities such as AMU and Jamia Millia Islamia University (JMI). In our interviews with AMU alumni, they shared their experiences going door-to-door and explained how deep the hesitancy and fear ran in many communities. Certain students revealed having doors slammed in their face, while others admitted to taking the vaccine themselves in front of other parents to garner

trust that the vaccine was safe. Using references from the Quran and Islamic literature, JMI created a 'Green Book' that compiled the religious reasoning behind the duty to protect children. This book was used as a communications tool to help educate and promote polio vaccination.

In addition, Rotary International formed an Ulama Committee consisting of six prominent Islamic scholars. The committee held events where Imams cited verses from the Quran that preach a parent's responsibility to take care of the health and well-being of their child. For example, one professor explained how among Muslim groups who were resistant to vaccines because of the purported use of pig derivatives, a scientific explanation of vaccine safety was unlikely to change opinions. Rather, some Imams used existing religious principles to reason that allowing a child to die was worse than possibly consuming pig products, tackling the resistant groups' justifications for vaccine refusal. Engagement with local students, alumni, prominent religious scholars and references to Islamic literature played important roles in tackling vaccine hesitancy and ultimately improving vaccine deployment in many Muslim communities.

The dedication of resources and time to work with community-level leaders was an effective measure to reach populations where the government lacked expertise. For migrants, rural residents, or Muslim communities, informal structures of leadership existed among employers, private healthcare providers, and religious institutions respectively. Government officials tapped into pre-existing social structures to identify key stakeholders with pre-existing credibility with vulnerable groups. These local leaders provided feedback to the government and became advocates for the vulnerable communities that they represented.

For future vaccination efforts, this suggests that the advocacy of vaccine uptake is more effective when it comes from ingroup members. In India, vulnerable households were able to relate more to their local shopkeeper rather than a famous celebrity, and thus were more likely to trust them. Likewise, in Muslim communities, hesitant groups were more easily convinced when they were being approached by Muslim individuals who explained the value of vaccination within their own cultural and religious belief system. This shows that it is also key to understand resistant groups' justifications for not taking the vaccine and speak to their own framework of understanding. As vaccines become increasingly instrumental in preventing disease outbreaks, public health authorities should acknowledge that promoting vaccines through actors that the public perceives as trustworthy is essential in improving vaccine uptake.

THE VALUE OF ACCOUNTABILITY MECHANISMS IN THE CONTEXT OF A PUBLIC HEALTH CRISIS

In collaboration with WHO, SMNet and other external stakeholders, the Indian government developed strong accountability and quality improvement mechanisms to

ensure that the polio programme was implemented effectively. This addressed gaps in training as well as issues with falsification and underreporting of data during the programme's early stages. There were instances where vaccination data suggested that immunisation coverage was high in certain areas when in fact the numbers were being misreported or falsified. One interviewee used the phrase, 'beg, steal and borrow,' to describe the extent that community healthcare workers would go to achieve immunisations because of the strong central mandate towards polio elimination. However, as an official from AMU stated, these mistakes during reporting were not always ill willed—physicians and community healthcare workers were under significant pressure by officials to meet immunisation targets and produce positive results.

To address these issues, a task force was established to monitor surveillance and immunisation activities in every district, meeting frequently during vaccination rounds. These district task forces were chaired by a government-employed district magistrate (DM) and included local physicians and various district-level officials, such as chief medical officers, surveillance medical officers (SMOs), district immunisation officers (DIOs). SMNet workers from the CORE Group were also instrumental in gathering census-level data to provide granular information on programme coverage.[14] District task force meetings served as an opportunity to compare documents and flag instances of misreporting. An example of this is the double-checking mechanism that was used to verify vaccine refusals. The DIO compiled a report based on data from a team of front-line workers who visited all of the houses in a community and recorded refusals. Concurrently, the SMO created a separate report by hiring a group of independent monitors to double check the same houses in a community. If the findings differed when these reports were presented to the DM at a district task force meeting, the DM identified the source of the discrepancy and developed immediate solutions.

For instance, if monitors determined that frontline workers required more training, the DM temporarily stopped immunisation activities to provide additional education and reorient teams. If information was falsified, the DM held those at fault accountable. Workers who falsified information were made to redo training or repeat entire rounds of house-to-house microplanning. In certain cases, physicians even lost a day of salary or were publicly shamed during district task force meetings. Ultimately, while NPSP and SMNet officials were instrumental in providing data and highlighting problem areas, the DMs were responsible for providing leadership, guidance and holding workers accountable.

The Indian government's strong central leadership was a major factor that led to widespread commitment by ground-level actors towards achieving better vaccination and surveillance coverage. While this top-down focus on polio elimination was important, the pressure associated with achieving positive outcomes may have also contributed to a climate of data falsification by local officials.

With this in mind, it is important that future vaccination efforts stay vigilant to the unintended consequences of a strong disease elimination mandate. Ultimately, to achieve positive public health outcomes, there not only needs to be strong top-down leadership, but it is also important to have systems in place to ensure accurate reporting.

In the case of polio elimination in India, these systems largely involved creating redundancies in data reporting. By using WHO employees to independently acquire data, a mechanism to double-check metrics reported by government officials was created. In a broader international context, countries innately tend to prioritise disease elimination in the setting of a public health crisis. This case study in India illustrates the utility that independent NGO stakeholders have in ensuring accurate reporting in the context of a country's disease elimination mandate, lending to an accountability framework that requires multiple parties working in tandem. For future public health initiatives, it can be useful to triangulate data and include smaller organisations, as each institution can carry different interests in their reporting and data collection. This framework can also allow vulnerable communities to hold their public health officials and community health workers accountable.

CONCLUSION

Although infectious diseases have traditionally been in the purview of medicine, the findings from this report suggest that medicine alone is insufficient for the elimination of disease. Instead, even when equipped with the medical capacity to immunise, public expectation and community receptiveness towards vaccination can compromise comprehensive disease elimination. In India, the barriers to vaccination were deeply rooted in larger issues of social trust and political vulnerability. The urgency to overcome the health crisis revealed a series of barriers that were historically disregarded, including access to basic healthcare services. Thus, India's commitment to the elimination of polio also presented an opportunity to address critical inequalities among certain vulnerable populations by engaging with local stakeholders. This is not a phenomenon isolated to India, and by understanding how to overcome these barriers, future epidemics can be controlled in a more efficient manner. As this paper shows, managerial strategies were necessary to achieve polio elimination among India's hardest to reach. Namely, these strategies were: the bundling of basic healthcare services when marketing the vaccine, engaging stakeholders in vulnerable communities, and implementing accountability mechanisms among healthcare workers. The inclusion of these strategies in future disease eradication programmes may improve the effectiveness of vaccine deployment and expand immunisation coverage, while simultaneously addressing sociopolitical and economic inequalities.

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