

Determinant Factors for Implementing Polio Eradication Activities under Security Compromised Settings of Pakistan

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Abstract

Background: Today, the world is nearer than it has ever been to polio eradication. However, ongoing Wild Polio Virus 1 (WPV1) transmission in parts of Pakistan remains a substantial threat to the Global Polio Eradication Initiative goal of a polio-free world. In Pakistan, the security environment puts polio workers in danger and makes some areas inaccessible. This research made experts on polio program reach a consensus on key determinant factors for the successful implementation of polio eradication activities while considering the context of the security compromised setting of Pakistan.

Method: The Delphi expert panel discussion method was applied. Experts in the field of polio eradication who worked in Baluchistan province of Pakistan were invited. Two rounds of expert panel discussion were conducted. Key challenges and recommendations from the first round were assessed and incorporated to the second round Likert scale questionnaire to arrive at a consensus. The Expert's consensus was defined to be obtained if 75% or more of the experts agreed on an issue.

Result: During the first round, 16 experts responded, out of the 18 invited (88% response rate). The second round questionnaire was sent to the 16 experts, of which 15 experts responded (93% response rate). The majority of experts (93%) agreed that the health department did not take part actively in pre-campaign activities. All experts (100%) agreed that teams and Area in Charges (AIC), who supervise vaccinator teams, were not incorporating the required changes that were happening on the ground to their micro-plan. All experts (100%) agreed that the AICs had no accountability attached to their roles. Most (86%) experts agreed that teams who attended training didn't participate during campaign days. The majority (86%) of experts agreed that the campaign compilation data was not genuine. There was a lack of contingency and smart planning for the evolving security situation (80% of experts). The majority of experts (86%) agreed that the polio campaign was highly linked with making money. The majority of experts (93%) agreed that sweeping method was prone to miss houses and children.

Conclusion: It was deemed that the major factors affecting the polio eradication program in a security compromised setting were found to be poor preparation during the pre-campaign phase, low skilled polio teams involvement, and poor campaign monitoring and reporting. It was indicated that proper micro-planning and security planning, increasing the number of campaign monitors and the receipt of timely feed-back of intra and post-campaign monitoring results improves polio campaign achievements.

Keywords: Delphi panel discussion; Acute flaccid paralysis; Wild polio virus type 1; Supplementary immunization activities

Abbreviations: A/C: Area in Charges; AFP: Acute Flaccid Paralysis; AFP: Acute Flaccid Paralysis; CNIC: Computerized National Identity Card; cVDPV2: Circulating Vaccine Derived Polio Vaccine Virus type 2; DDM: Direct Dis-imbursement Method; DEWS: Disease Early Warning System; DHMT: District Health Management Team; DHMT: District Health Management Team; DHOs: District Health Offices; DPT: Diphtheria, Pertussis and Tetanus vaccine; DSCs: District Surveillance Coordinators; EPI: Expanded Program of Immunization; GPEI: Global Polio Eradication Initiative; HMIS: Health Management Information System; LHWs: Lady Health Workers; LQAS: Lots Quality Assurance Sampling; NEAP: National Emergency Action Plan; NGO: Non-Governmental Organization; NIDs: National Immunization Days; OPV: Oral Polio Vaccine; PEI: Polio Eradication Initiative Program; RED: Reach Every District; RI: Routine Immunization; SIAs: Supplementary Immunization Activities; SIAs: Supplementary Immunization Activities; SPSS: Statistical Package for Social Science; STOP: Stop Transmission of Polio; UCMO: Union Council Medical Officers; UCMOs: Union Council Medical Officers; UCPW: Union council Polio workers; UCs: Union Councils; UPEC Union Council Polio Eradication Committee; VDPV: Vaccine Derived Polio Virus; VPD: Vaccine Preventable Diseases; WHO: World Health Organization; WPV1: Wild Polio Virus type 1

Background

Today, the world is nearer than it has ever been to polio eradication. The vaccination efforts have brought polio case reduction by 99.8% since the GPEI (Global Polio Eradication Initiative) began in 1988. Because of the polio eradication initiative, an estimated 250,000 children are now alive and another 5 million children are walking who otherwise would have been paralyzed [1]. To interrupt polio transmission in many countries, it has taken 25 years and a cost exceeding \$10 billion from external sources; exclusive of polio funds from countries' and bilateral sources. Moreover, it is predicted that, every additional year will cost close to \$1 billion from external sources [2]. If the polio eradication program falls short, it is estimated over 250,000 children will be paralyzed every single year with possible serious counterattacks

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Received November 18, 2013; Accepted December 29, 2013; Published December 31, 2013

Citation: Fetene NW, Sherani A (2013) Determinant Factors for Implementing Polio Eradication Activities under Security Compromised Settings of Pakistan. J Trop Dis 2: 127. doi: 10.4172/2329-891X.1000127

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in places that have long been polio-free and a greater number of adult lives will be in jeopardy [3].

Pakistan reported more poliomyelitis cases in 2011 than any other country globally [4]. During the same year, the Wild poliovirus type 1 (WPV1) which is genetically linked to the virus circulating in Pakistan was identified in China implying a potential threat of the WPV exportation to the rest of the world [5]. In 2013, Europe has become under threat of polio transmission after WHO confirmed WPV1 outbreak in Syria and polio virus isolation from sewage and faeces of asymptomatic carriers in Israel [6]. The progressive WPV1 transmission in Pakistan caused a considerable threat to the Global Polio Eradication Initiative goal of uprooting the polio virus from the surface of the globe [7]. The global polio laboratory network, the agency that provides a genomic sequencing of the polio virus, revealed that only one genotype (SOAS, South Asian) had been endemic in previous years in Pakistan and Afghanistan, unlike in African countries, where multiple genotypes have been reported [8].

In spite of a number of supplementary immunization rounds conducted in Pakistan, poorly secured and hard to reach communities have complicated the polio eradication efforts [9]. As a result, engaging and convincing caregivers in hard-to-reach areas of the benefits of vaccinating their children and ensuring that caregivers whose children have received OPV (Oral Polio Vaccine) are motivated to continue vaccinating their children remains a strategic communication challenge in these areas [10].

In Pakistan, the security environment puts polio workers in danger and makes some areas difficult to access. Polio front line workers fear of kidnappings, beatings, harassments, and even sometimes assassinations in such zones [11]; which is a fact supported by instances of assassinations of polio workers in different parts of the country [12]. As the result of the ban imposed by the militants, approximately 200,000 children missed polio vaccination in the tribal agencies of North and South Waziristan of Pakistan during 2011-2012 polio campaigns [7]. In Pakistan, it is feared that some militant groups may turn polio immunization into a bargaining chip. As a result, the use of polio immunization for political leverage may occur in the future [3].

The Experts Committee recommended that Pakistan should conduct a minimum of 6–10 high-quality Supplementary Immunization Activities (SIAs) each year in infected areas and in high-risk areas until WPV transmission is interrupted [13]. However, “failure to vaccinate” during Supplementary Immunization Activities has become the most important reason for the delay in interrupting poliovirus transmission in Pakistan [14]. Successful rounds of supplementary immunization leads to sustained achievements of polio circulation interruption if the background routine immunization coverage is sufficiently high [15].

In Pakistan, the routine immunization coverage is still not high enough to augment the impact of anti-polio strides aimed at achieving the Polio eradication goal. Despite the high coverage administrative report for fully immunized children, surveys conducted from 1995 to 2007 for immunization in Pakistan, indicated that only about half of the targeted children were fully immunized [16]. Because of the high dropout rate, a very low proportion of children fully complete DPT3 (Diphtheria, Pertussis and Tetanus 3rd Vaccine) [17]. In such areas of low OPV coverage, Vaccine-derived polioviruses (VDPVs) can emerge to cause polio outbreaks and can replicate for years [18,19].

Therefore, despite formidable challenges, Pakistan needs to improve upon the stagnantly low rates of routine immunization coverage while achieving and maintaining high rates of coverage in the Polio campaigns

[20]. The process through which polio SIA campaigns are conducted in such insecure areas should be well structured and planned to achieve the maximum result from the sacrifices made by front-line health workers. To the contrary, it was indicated that Polio workers have had poor quality and irregular trainings [21].

The STOP (Stop Transmission of Polio) program has made an important contribution to the mission of GPEI by providing countries with critical technical support to strengthen polio eradication activities. From January 1999 through June 2013, a total of 1,563 volunteers were trained and deployed to 69 countries. The majority of STOP assignments (25%) were to polio endemic countries (Afghanistan, Nigeria and Pakistan) [22]. This study was conducted by one of these STOP members (STOP 41 and 42) and by WHO staff working on the ground.

The aim of the study was to gather expert opinion on the challenges that considerably affect the polio eradication activities in the study area. The research also aimed at making the experts provide recommendations and reach a consensus using the Delphi consensus seeking technique. Key experts in the polio eradication and immunization program with considerable experience in security compromised settings were requested to participate. Accordingly, the experts included in the study reached a consensus on key determinant factors of polio eradication program and made recommendations that are expected to significantly contribute to the polio eradication efforts.

Methods

The Delphi expert panel discussion method was applied in this study. The starting point for the application of the Delphi method was to identify the problem area in polio eradication activities and then to select experts (Delphi panel) based on the expertise required for the problem defined. A questionnaire was developed and distributed to the panel members. The data were collected and analyzed for consensus in responses (consensus is defined beforehand). This process was repeated until a consensus was reached based on which a final report was developed. The goal of the study was to investigate the determinant factors of polio eradication activities in security compromised settings like Baluchistan province of Pakistan and the Delphi method was selected to achieve this goal. This study consisted of two Delphi rounds.

Selection of Delphi panel

For this study, it was determined to have experts in the field of polio eradication program in the Baluchistan province of Pakistan at least for two years before the onset of the study. The selection of experts was done in cooperation with the WHO staffs working at Baluchistan province. Field Polio workers, Health facility medical officers, District polio program managers, NGO polio program managers, Provincial EPI and Polio program managers were also involved in the study.

All participants were pre-informed that filling and submitting the online first and second round response would be taken as consent to participate in the study. For panel members who were willing to participate in the study, the discussion report was shared only using the codes of the discussant to keep the confidentiality of the respondents. As the aim of the study was to investigate the challenges and exhaust the recommendations that experts provided over the area, an initial open-ended questionnaire was distributed to experts via e-mail and in print out. The questionnaire was sent to three experts (not belonging to the written Delphi panel) for pilot testing. Changes were made based on the comments and suggestions received. The questionnaire consisted of a total of 19 questions. All questions were open-ended questions focusing

on the experts' view of the challenges they encounter while implementing polio eradication activities. The challenges and recommendations they suggested to overcome the problems were categorized in themes which are very important for the polio eradication program. Eleven open-ended questions were under the theme of polio campaign related questions and 5 questions were from the theme of AFP surveillance related areas while 3 questions were from the Routine Immunization. Feed back to the respondents was provided as a summary report from the first round.

Key challenges and recommendations from the first round were put forward as a second round of the Delphi questionnaire to ensure that the experts reached a consensus. The second round questionnaire consisted of a total of 51 questions; 43 were agreement statements while 8 questions were comprised of multiple check boxes. The second questionnaire was made using Google Drive online questionnaire submission. Expert's views consensus was defined if 75% or more of the responses fell in one of the 3 groups of Likert scale (Strongly Agree and Agree, Disagree and strongly disagree, Not sure/other).

The analysis of the replies to round one was done by looking at the qualitative data provided by the respondents using ATLAS.ti version 5 Software. The software assisted in easy coding and generating themes to develop first round report and second round questionnaire. The replies were coded and grouped into 9 thematic areas (Campaign preparation, Polio campaign teams, Polio campaign monitoring and reporting, Refusal and missed children, Security problem, Polio campaign operation, Permanent sites for Polio vaccination, Coordination and Integration and the Experts' recommendation). For second round questionnaire, analysis was conducted using statistical software SPSS version 21.

Results

A total of 20 infectious disease experts were invited to participate over the study area and 18 accepted the invitation. During the first Delphi round, 16 experts responded out of the 18 to whom the first questionnaire was sent (88% response rate). The second round questionnaire was sent to the 16 experts who had responded to the first round, out of which 15 experts responded (93% response rate). The Delphi rounds result were categorized in to nine themes; the theme of campaign preparation, polio campaign teams, polio campaign monitoring and reporting, refusal and missed children, security problem, polio campaign operation, permanent sites for polio vaccination, coordination and integration and the theme of experts' recommendations.

The theme of campaign preparation

In relation to the observed problems linked to the polio campaign preparation phase, the majority of experts (93%) agreed that health department did not take part actively in pre-campaign activities, UPEC (Union Council Polio Eradication Committee) meetings were not being held but reported, and teams training were not being conducted effectively and health department could not involve their staffs fully, such as LHWs (Lady Health Workers) in polio campaigns. Moreover, all experts (100%) reached in to consensus that there was low participation of Area in Charges (AICs) and polio teams during pre-campaign training. Same number of experts also agreed that the poor coordination between teams, Area in charges and Medical officers was the main problem during the pre-campaign preparation phase. 'There was a general lack of interest from DHMT (District Health Management Team) and supervisors to actively get involved in pre-

campaign preparation phases like micro-planning and training' Expert WQG7.

Experts (80%) agreed that the micro-planning documents developed by teams for polio campaign were not being used to conduct effective campaigns. All experts (100%) agreed that teams and AICs were not regularly updating the micro-plans and they didn't incorporate the required changes that were happening on the ground. Micro-plans were considered as pages of paper and only to fulfill the formality; DHMT, supervisors and teams did not consider micro-plans as important documents to reach targeted children (93% of experts agreed). 'There was also no proper target assigned for each team and maps at team level usually did not exist' Expert WQF1. 'Polio field staffs still have not yet perceived the importance of micro-planning. Only the date of old micro plan was being changed and submitted' Expert GQC3. The majority (86%) of experts agreed that there was also low commitment from the implementing agencies in enforcing the use of micro-planning in the field. The majority (60%) of experts supported the reasons that teams were not currently using and not following micro-plan was attributed to the security situation and shortage of teams.

The theme of teams involved in Polio Campaign

All experts (100%) agreed that the Area in Charges, who supervise vaccinator teams, had no accountability attached to their roles. The majority (86%) agreed that Area in Charges mostly not used monitoring checklists while monitoring teams and most (53%) agreed they were not capable to support teams. Their major role was to verify whether teams were working or not. The majority (73%) of experts also believed that the Area in charges didn't compile data from tally sheets and UCMOs (Union Council Medical Officers) didn't conduct evening meetings at the UCs (Union Councils) level to obtain timely feedback on achievement and data quality of teams.

All experts (100%) agreed that the community level Lady Health workers (LHW) and government health workers at health facilities were not committed and involved enough in the eradication of polio program. 'Polio teams don't show interest without paid money. Teams are not committed because they are like daily wage workers. They are also not accountable' Expert UCB2. Most (86%) experts agreed that teams who attended trainings didn't show up during campaign days making the shortage of teams to be compensated by untrained teams. 'Teams and Area in Charges are not being trained properly, if at all. Trainings conducted were of low quality and considered as time passing' Expert GQC3. 'The vaccination team members were not known by the people to the area where they were required to work' Expert UQA1.

Some experts stated that the key problems related to the intra-campaign phase of polio campaign were late daily deployment and early return of teams (73%), inappropriate deployment of teams to areas (60%), over or under issuance of vaccines and logistics (7%) and weak monitoring system in the field (66%).

The theme of Polio campaign monitoring and reporting

The majority (86%) of experts agreed that the campaign compilation data was commonly counterfeit, i.e., compilation data was not what was collected from tally sheets. Some experts (60%) agreed that campaign data reported usually don't match the vaccine used. The majority (86%) of experts believed the reason for having counterfeit filling of tally sheets was to meet the increased daily target plan which in turn usually was planned to get more resources. 'There is late arrival of data from some Union Councils and providing not genuine data without considering actual tally sheets data' Expert WQA6. 'The monitors should sign or

cross the empty cells of tally sheets after teams completed the daily work so that it can't be further filled' Expert UCA1 advised.

Most (73%) experts agreed that teams did not record the full information that was located at the back of the tally sheet which include; record of missed and refusal children, children routine immunization status, AFP (Acute Flaccid Paralysis) cases observed during the house to house visit and the report on the vaccine consumption. 'Teams were not properly trained in all segments of tally sheets use making them unable to fill and compile the data on tally sheets' Expert WQB5. 'Polio workers consider data entry and compilation less important and there was weak documentation system in polio activities at facility level as well' Expert WQG7.

Most (73%) experts concurred that intra campaign monitoring reports were not being used for improvement; rather they were either not relayed timely or simply not followed for action.

The majority (60%) of experts agreed that there was lack of timely flow of action orientated information and feedback to the teams and concerned bodies. 'There is poor follow up on what is conveyed to the district by the authorities for rectification measures' Expert WQD3.

The theme of Polio vaccine refusal and Missed Children

The majority (73%) of experts believed that there was ever increasing community resistance for polio vaccination due to the repeated campaigns. Most (60%) experts also suggested involving religious, community and political leaders in to the polio eradication program whom community trusts most was essential. The majority of experts (86%) believed that more work has to be done in changing religious leaders and refusal families mind to conduct effective and quality campaigns in Baluchistan.

The majority of experts (60%) agreed campaigners and teams regrettably miss those children and areas which are always missed. 'After multiple LQAS (Lots Quality Assurance Sampling) were done by the third party, the result was not shared to the union councils so that missed areas and missed children could have been covered' Expert GQC3. The majority (93%) of experts agreed that post campaign monitoring results should be shared immediately so that the missed areas can be covered.

The theme of security problem

There was lack of contingent and smart planning for evolving security situation (80% of experts agreed). 'Campaign schedules and security plans were not aligned and integrated. When campaign deferment criteria were met at large due to poor preparation and security condition but still the campaigns were decided to be conducted, it usually ended-up with low performance' Expert WQD3.

The majority (80%) of experts agreed that the security problem affected the polio program by causing difficulty for supervisors to conduct proper monitoring during campaigns. 'The poor security arrangements caused inadequate team deployment during campaign days making major challenges' Expert WQA6. 'The government is required to give proper security to the teams while they are working in the field in order to fully implement the micro-planning prepared' Expert WQG7.

The majority (80%) of experts believed that there was shortage of security personnel during the polio campaigns conducted. 'Few years back, the government staffs used to be fully involved in polio campaigns and there were no imminent security threats' Expert UQA1. 'Mainly as

the result of the security related effect, when I compare the 2008, 2009 and 2010 campaigns quality with the current year, the polio campaigns quality and achievements are very low now' expert WQD3 commented. The majority (73%) of experts agreed that having proper security arrangement in place contributes toward the quality of polio campaign.

The theme of Polio campaign operation

The majority of experts (86%) agreed that the polio campaign is highly linked with making money. Most experts (73%) believed that Direct Dis-imbursement Method (DDM) had become one of the biggest issues which caused delayed payments to the front line workers. 'The introduction of the new payment approach (DDM) at this end phase of polio eradication has posed challenges on the program' Expert WQG7. 'None of the staff at UC level and area level was briefed about the process of DDM which caused huge rejection of DDM payment approach' Expert WQB5. DDM applies financial settlement directly to the polio workers Bank account or official Agents unlike the previous settlement approach of via health office. Polio teams were required to have CNIC (Computerized National Identity Card), which was a challenge for most at the time, and DDM cards were to be completed by district health offices and sent centrally that also caused delay in field team payments.

Most experts (73%) agreed that the most important concern in polio campaign at the time of interview was the date payment was being settled. 'If we want to perform well in polio eradication activities in Baluchistan, we should facilitate the team payment on time' Expert UCA1. 'Delayed payment process through DDM has directly reduced the number of teams to be involved in the campaign thus the work of all mobile teams is made to be done by the few available teams' Expert WQG7. However, 73% of experts agree that DDM was being blamed by those who do not care for transparency. 'There are some problems with bank system which made DDM difficult. Banks are under control of government. Government should facilitate the provision of CNIC to teams and make DDM more useful expert WQH7. Some experts (53%) suggested that the release of fund to hire cars, to purchase markers and buy ice from ice factories should be released in advance, at least in a certain percentage. An expert cited the sequence of fund release as "Cart before the horse".

Most experts (73%) alleged the lack of ownership of the polio program by health department at provincial and district level. All experts (100%) agreed that there was failure in trickling down the level of commitment from higher government circles to district administration and to the implementing health departments. 'Steps and measures to translate commitment at service delivery level and decentralize planning, making the local authorities plan as per local security situation, are very important for the success of polio program' Expert WQD3.

The theme of having permanent sites for Polio vaccination

The majority (73%) of experts agreed that the permanent polio sites contributed a lot in polio eradication program. 'Patients from Afghanistan are coming directly to the hospitals where we have these sites. However, some experts (33%) mentioned that the quality of permanent sites was not reliable as it was difficult for teams to work all through the days of the month effectively. Some experts (60%) agreed if some transit polio vaccination points are gradually transform in to permanent sites. 'We should start vaccination on some more sites where there are fast movements of nomadic population' expert WQA6. But an expert showed his concern stating 'Hospital administrators at busy

hospitals not cooperate with polio permanent teams to allow them choose an appropriate place and vaccinate children' Expert UCB2.

The theme of SIA and AFP Surveillance Integration

Most experts (80%) pointed out that there should be clear integration between AFP (Acute Flaccid Paralysis) surveillance, VPD (Vaccine Preventable Diseases) surveillance, DEWS (Disease Early Warning System) and HMIS (Health Management Information System) reporting systems which was lacking in the province at the moment. 'Currently, WHO is conducting all the AFP surveillance activities. But WHO doesn't have staff in 70% of the areas of Baluchistan where nobody from the government side is ready to conduct these activities. When a WHO staff member (PEO) leaves the area (quits the job), no government body takes over the job which creates gaps' Expert WQA6. The government had never owned AFP surveillance activities in Baluchistan and it had been WHO's responsibility since long, 80% of expert panelists agreed.

Some experts (53%) agreed that the increased frequency of Polio campaign rounds had affected the AFP Surveillance activities negatively. Some experts (53%) agreed that by involving the Union council Polio workers (UCPW) only in polio campaigns activities, there was underutilization of this task force in surveillance activities. They believed UCPW should actively have been involved in active surveillance activities after proper training was provided to them over the area. 'Every Lady Health Worker in her community should be responsible and accountable to provide awareness to the community on polio campaign and report on any AFP cases that occurs in the community she works' Expert UCB2.

Most (80%) experts agreed that the AFP surveillance in Baluchistan was not sensitive enough to detect circulation of polio virus. But, 'Government officials are satisfied by looking at no polio case report and think that they have controlled the virus circulation without having very strong and alert surveillance system in place' Expert WQE2. The majority of experts (93%) disagreed with 'Surveillance system in Baluchistan had strong power to detect virus circulation and one of the proof was that it was detecting cVDPV2 (Circulating Vaccine Derived Polio Virus Type 2)' expert WQE2.

Most experts (86%) agreed that AFP surveillance activities should also be incorporated in to NEAP (National Emergency Action Plan); lack of it had caused government officials to give less attention to the program. Experts agreed (80%) that surveillance reports were not submitted in time because there was no focal person in facilities and district level that collects weekly zero surveillance reports and relays on time. 'More focus on AFP surveillance activities by government health officials and workers should be given than what is happening right now' Expert WQB5. Experts (93%) advised that there should be integration in the whole surveillance reporting system and District Health Offices (DHOs). Particularly, District Surveillance Coordinators (DSCs) should be technically and financially supported so that they can conduct active surveillance activities.

The theme of SIA and EPI integration

There was lack of coordination between routine EPI and SIAs which the majority (86%) of experts believed had become the primary reasons in making polio eradication program difficult. 'The attention polio campaign program was enjoying should be given to routine immunization as well' Expert UQA1. Most experts (93%) believed that coordination between Polio Eradication Initiative Program (PEI) and EPI should be improved in a way that resources like human and

physical resources of PEI should be used to enhance the coverage on routine EPI.

The majority of experts (80%) agreed micro-planning for routine immunization was almost did not exist in the district and at facility level. The experts (86%) coincided that there was no strong EPI supervision and monitoring system put in place. Experts (80%) spotted that there was no accountability for program underperformance and financial problems related to EPI. The majority agreed that there was no community demand creation being done (86% experts) and there was shortage and inappropriate utilization of resources (93%). Some experts (43%) figured out that the outreach coverage was low as vaccinators had no fuel to go for the outreach activities and trace defaulters. 'Circulating Vaccine Derived Polio Vaccine Virus type 2 (cVDPV2) is showing up in Baluchistan proved by a fragile barrier of poor routine EPI coverage that failed to interrupt cVDPV2' expert WQE2.

The theme of expert's recommendation

The majority of experts (73%) recommended that there was no need of implementing a new strategy trial for polio eradication, instead it was suggested that the existing strategy should be strengthened in order for it to work more effectively. "The Polio virus eradication initiative is doable and there are four major strategies for the program; none of these have become blunt" Expert WQE2. However, most experts (66%) still suggested that it could be advisable if special campaigns to address refusal children were conducted. The majority of experts (93%) agreed that the sweeping method which was being used in areas of security compromised situations was prone to miss houses and children as micro-planning were less likely to be used in this approach.

Experts (66%) suggested that campaign quality could have been improved if training on supervision was emphasized; proper micro-planning was prepared (80%), the number of monitors increased to cover all Union Councils (73%) and feed-back during intra-campaign and post-campaign monitoring were provided timely and appropriate actions were taken (86%). Most experts (86%) believed that if LHWs were actively and fully involved, the quality of the campaigns would have been improved. "Few successful campaign rounds with strong planning, monitoring and remedial actions are better than piecemeal multiple campaigns" expert WQD3. The majority (86%) agreed in addressing primarily the absence of a true accountability framework for defaulters and non-compliant staffs. Experts (73%) recommended that follow-up on what was conveyed to the districts by the authorities for rectification measures should be conducted.

The majority of experts (73%) advised that the involvement of vaccinators in the polio campaigns should be discouraged as their role was more important in working at health facilities than involving in campaigns. Experts (86%) recommended that it would be good to involve college and university students in the polio campaigns and provide them certification of participation. The experts also agreed (80%) that it would be good if boys scout and Shahri Dafa workers (organized youths) involve in polio campaign as well. Experts reached a consensus (86%) that government should involve education departments in the polio campaign, as teachers have a vital role in the society, and they can convince and raise awareness about the polio program at the community level.

Most experts (86%) also advised for the introduction of the Reach Every District (RED) Approach to improve routine immunization uptake in Baluchistan. 'EPI centres should provide outreach services to trace defaulters and meet the need of the rural areas where there is difficulty of access. EPI centres should always be kept open and work

all through the week' Expert GQC3. The majority of experts (93%) suggested that the recruitment of more staffs to involve in the routine immunization program was necessary so that EPI coverage significantly improves.

Experts agreed (86%) that WHO staffs should not conduct surveillance activities which entirely replaced government responsibilities but should focus on how to capacitate DHMT on active surveillance activities. "WHO should review program implementation strategies at all levels and restrict its staffs to abide by the rules and policies to provide technical support only not to replace the government staffs roles" Expert WQB5. Most experts (93%) agreed that WHO should hire more Polio Eradication Officers to cover 100% of the province districts in order to effectively support the surveillance activities in each district (Table 1).

Discussion

The independent evaluation that was conducted in 2009 clearly indicated that Pakistan's polio eradication program required further improvements in campaign quality and continued innovation to

interrupt transmission. It was pointed out that the polio program had disparities in campaign quality, and that there had been deterioration in security in a key transmission zone [13]. Four years after the independent evaluation team recommendation, this study showed that there were still basic issues not addressed in the quality of polio campaigns being conducted in security compromised areas of Pakistan. This was evidenced when the health department did not take part actively in pre-campaign activities, Union Council Polio Eradication Committee meetings were not being held but reported, and team trainings were not being conducted effectively and that the health department could not involve their staffs fully, such as LHWs in polio campaigns.

The success of each SIA round depends upon the quality of the pre-campaign phase with major components being the micro planning and trainings for the supervisors and teams. The National Emergency Action Plan reviewed for 2013, clearly demarcates the tools and indicators to grasp the level of ownership and commitment exhibited by the district administration and the health department [23]. Our study panellists have reached consensus over the fact that the health department has been unable to mobilize and engage its staff, not only to participate, but

	Panelists discussion Themes	Findings reached consensus at 75% cut-off
1.	Campaign preparation	<ul style="list-style-type: none"> - Health department participation in micro-planning and training was low - UPEC did not involve skilled staffs(LHWs) in campaign preparation - There was poor coordination among polio teams - Micro-plans were not updated and appropriately utilized - Implementing agencies were not enforcing the use of micro-plans enough
2.	Polio Campaign teams	<ul style="list-style-type: none"> - Field polio team supervisors(Area In Charges) had no accountability attached to their work - Area In Charges did not commonly use supervision check list while monitoring polio teams - Lady Health Workers and government health workers were not committed and involved enough in the polio eradication effort - There was frequent trained team absenteeism and their replacement by untrained team during polio campaigns
3.	Polio campaign monitoring and reporting	<ul style="list-style-type: none"> - Campaign compilation data was commonly counterfeit - Reason for having counterfeit filling of tally sheets was to get more resources
4.	Polio vaccine refusal and Missed Children	<ul style="list-style-type: none"> - More effort has to be done to change religious leaders and refusal families - Post-campaign monitoring result should be shared immediately so that missed area and children are covered
5.	Security problem	<ul style="list-style-type: none"> - Security personnel assigned for polio teams were not adequate - Contingent planning for evolving security situation were not sufficient - Security problem affected the polio program by causing difficulty for supervisors to conduct proper monitoring during campaigns
6.	Polio campaign operation	<ul style="list-style-type: none"> - Polio campaign is highly linked with making money - There was failure in trickling down the level of commitment from higher government circles to lower level
7.	Permanent sites for Polio vaccination	<ul style="list-style-type: none"> - No agreement reached
8.	SIA and AFP Surveillance Integration	<ul style="list-style-type: none"> - There should be integration between AFP surveillance with other disease surveillance and HMIS - Government health department had never owned AFP surveillance activities - AFP surveillance in Baluchistan was not sensitive enough to detect circulation of polio virus - AFP surveillance activities should also be incorporated in to NEAP (National Emergency Action Plan) - Surveillance reports were not submitted in time because there was no focal person in facilities and district level
9.	SIA and EPI integration	<ul style="list-style-type: none"> - There was a lack of coordination between routine EPI and SIAs(Supplementary Immunization Activities) - Planning for routine immunization was almost did not exist in the district and at facility level - There was no strong EPI supervision and monitoring system - There was no accountability for program underperformance and financial problems related to EPI - No community demand creation activities on routine immunization was done - There was shortage and inappropriate utilization of EPI resources
10.	Experts' recommendation	<ul style="list-style-type: none"> - Sweeping method miss houses and children; its use need to be limited - Preparing a good micro planning and involving LHW improves polio campaign quality - Post-campaign monitoring should be provided timely and appropriate actions need to be taken based on this report - Accountability framework for defaulters and non-compliant staffs should be strengthen - Involving college and university students, scout and Shahri Dafa workers (organized youths),and teachers in the polio campaigns is important - WHO staffs should not conduct surveillance activities which replaces government responsibilities - Much more health staffs deployment are necessary for SIA, routine immunization and AFP surveillance program

Table 1: Delphi panelists' discussion themes and the key findings reached consensus, Pakistan, Baluchistan, 2013.

also to effectively supervise and monitor the preparatory activities. That is evident from consistently low turnouts of Area-in-charges and teams in trainings and low participation of LHWs. Contrary to the NEAP that warrants the essential role of Union Council Medical Officers (UC supervisor from DHMT) to ensure the effective implementation of the pre-campaign phase entailing upon effective UPEC meetings, updating and validation of micro plans, team recruitment, and trainings; the UCMOs remained less active and most of the activities were still taken up by the paramedic staffs, formerly responsible for campaigns prior to the promulgation of NEAP.

The most important documents for an effective polio campaign, micro-planning documents, were poorly planned and utilized for polio campaigns. Therefore, the micro-planning documents developed by teams for the polio campaign were not being used to conduct effective campaigns as teams and AICs were not regularly updating the micro-plans incorporating changes that were happening on the ground. It is of great concern on the quality of campaign being conducted when micro-plans were being considered as pages of paper and only to fulfil a formality. From the study conducted in Punjab province of Pakistan, the district managers highlighted that there was a deficiency of training on campaign planning and management for the staffs responsible to make micro-planning [21]. In this study, it was indicated by the majority of experts that there was low commitment from the implementing agencies in enforcing the use of micro-planning that flags an areas of focus for implementers. Of all factors affecting polio campaigns, improving the quality of micro-planning and ensuring its utilization during campaign looks the easiest and cost effective approach.

The quality of data collected during the campaign was seriously doubted by the majority of experts and some labelled the data as a counterfeit. There were indications that compilation data was not what was collected from tally sheets. The underlining reason for the overstated reports was to meet the increased daily target plan which in turn usually was planned to get more resources. This finding agreed with the study conducted at Punjab province of Pakistan which showed the unreliability of campaign reporting and poor monitoring systems. This study showed that the reporting and information system was considered unreliable by the managers [23]. Low participation of Area in Charges (AICs) and teams during pre-campaign training and poor coordination between teams, Area in charges and Medical officers were the major inconvenience to a successful polio campaign. The problem was more complicated when the teams who attended the training didn't show up during campaign days making the shortage of teams to be compensated by untrained team. In order to tackle with shortage of trained human resources, involving college and university students, boys scout and organized youths, educations department can improve the quality of polio campaign and its acceptability by the community.

The majority of experts believed that more work has to be done in changing religious leaders and refusal families' mindset to conduct effective campaigns in Baluchistan. This recommendation is consistent with the study conducted in Karachi, Pakistan, which showed the conventional communication efforts surrounding polio were largely conducted by female workers or mobilizers who primarily target adult females in the households. Male family decision-makers or community and religious leaders were insufficiently engaged and were usually absent during the day time when vaccinators visited households. In Pashtu, certain populations, particularly males, are the primary decision-makers. They have strong religious beliefs and are key to polio eradication efforts [24]. However, the work on social mobilization on SIA, in security compromised areas like Baluchistan, was further

complicated when most of the campaigns were conducted without mobilization to avoid the targeted killing of polio workers. Studies have shown that by conducting 'influencers meetings' for polio vaccination and getting the cooperation of influential persons helps in such conditions. Having influencers meetings with the community leaders and religious leaders are very important to decrease the fears of families who are reluctant to vaccinate their children for various reasons [25].

There was ever increasing community resistance for polio vaccination due to the repeated campaigns. This coupled with the religious predisposition and inaccessibility due to insecurity could have led to a large number of missed children. At the local level, community and health staff fatigue may be worsened by the often high frequency of supplemental immunization activities. Fatigue often leads to poor campaigns and then to a vicious circle of lack of progress and waning confidence [26]. It was cited in previous studies that the obstacles to polio eradication lie in the endemicity of social and/or cultural resistance in some pockets, leading to clustering of perpetually unimmunized children - in spite of good coverage of SIAs at the macro level [27]. The quality of campaigns needs to be focused as the campaigners and teams regrettably missed those children and areas which were always missed. A study conducted in India pointed out that the overall vaccination coverage at the district level offers a false sense of security as long as less visible clusters of perpetually unimmunized children persist. The study stressed, such clusters however minuscule, may sustain low levels of WPV circulation, particularly among densely populated settlements with poor environmental hygiene, and low routine immunization coverage [15].

In a post campaign assessment study conducted in the Punjab region of Pakistan, it was shown that 15 out of 20 lots were rejected for unacceptably low NIDs coverage by finger-mark. All of the 20 lots were rejected for poor NIDs service delivery [28]. Similarly, in Baluchistan province, post-campaign monitoring results, showed repeated large numbers of missed children. However, missed children were not immediately covered due to delayed or no response, to post campaign monitoring results. It was agreed that the post campaign monitoring results should be shared immediately so that the missed areas can be covered. This finding was also consistent with the previous study which found very low SIA coverage among non-users of routine immunization services. This study further recommended that SIA monitoring in the GPEI should include an assessment of the vaccination history of children "missed" by vaccination teams during SIAs [29]. Our study also pointed out that the sweeping method which was being used in the areas of highly security compromised situations was prone to miss houses and children as micro-planning was less likely to be used in the approach. Thus, use of sweeping method needs to be discouraged unless mandatory.

Our study found that there was a shortage of security personnel for polio teams indicating that the teams who participated in the polio campaigns did not have adequate security personnel which put them at risk for targeted killings. Moreover, when security problems occurred, it was indicated that there was a lack of contingent and smart planning for the evolving security situation. Such problems resulted in the polio program underperforming during the polio campaigns. Moreover, it was difficult to ensure the quality of the campaign in the areas where the security situation was tenuous. Moreover, security problem affected the polio program by causing difficulty for supervisors to conduct proper monitoring during campaign. The security effect on polio program seems the most difficult to solve and requires multi-sectoral involvement.

It was indicated that the polio campaign was highly linked with making money. This was coupled with an absence of a true accountability framework for defaulters and non-compliant staffs. Particularly, Area in Charges, who supervise vaccinator teams, had no accountability attached to their roles. These key members of polio field team were also not accustomed to using monitoring checklists while monitoring teams. As a result of security concern and lack of proper accountability to their roles, Lady Health workers (LHW) and government health workers at health facilities were also not committed and sufficiently involved in the eradication of polio program. EPI supervision and monitoring system was grossly deficient predisposing to lack of accountability for program underperformance and financial related problems. These observations of experts were mostly consistent with the statement indicating that the immunization program was consistently observed as a system that provides opportunities in many areas for institutionalized malpractice, primarily geared towards pilfering resources from the system. Staff misconduct was often ignored due to collusion between staffs and inspectors. As a consequence, staff remain absent from duty and do not run field operations [14].

Experts agreed that there was lack of coordination between routine EPI and SIAs and believed that this had become the primary reasons in making polio eradication program difficult. The vertical programs such as AFP (Acute Flaccid Paralysis) surveillance, VPD (Vaccine Preventable Diseases) surveillance, DEWS (Disease Early Warning System) and HMIS (Health Management Information System) reporting systems need integration and collaboration. By exploiting all of the opportunities for collaboration between the GPEI and the Expanded Programme on Immunization, it should be possible to improve the performance of both initiatives. Such collaboration will be essential in the polio “endgame strategy” and also in the post-eradication era, when reliance on inactivated polio vaccine will make house-to-house supplementary immunization activities more difficult [26]. Such integration is important because if there is a weak RI coverage, added with no or downscaled SIAs, introduction and establishment of transmission of WPV would not be outside the realm of possibility [19].

AFP surveillance in Baluchistan was not sensitive enough to detect circulation of polio cases.

The fact that cVDPV2 (Circulating Vaccine Derived Polio Virus Type 2) was commonly reported from the province did not indicate the strength of the surveillance system. Rather, it was consistent with low coverage of routine immunization in the province. Thus putting the province at risk of Vaccine derived polioviruses (VDPVs) that can emerge to cause polio outbreaks in areas with low OPV coverage and can replicate for years in persons who are immuno-deficient [18]. AFP surveillance activities should also be incorporated into the NEAP (National Emergency Action Plan) [23]; lack of which had caused government officials to give less attention to the program. In addition, District Health Offices (DHOs) should be technically and financially supported so that they can conduct active surveillance activities. To encourage the ownership of the program, WHO staffs should not conduct surveillance activities which entirely replace government responsibilities, but should focus on how to capacitate DHMT on active surveillance activities.

Routine immunization programs remain a low priority for provincial and many district governments in the Pakistan [4]. This was evident when most experts agreed that planning for routine immunization did not exist in the district and at the facility level. Lack of community demand creation and inappropriate utilization of EPI resources further contribute for underperformance and low immunization coverage. This

finding supports the study conducted in Peshawar which indicated the reasons for low vaccination coverage were mainly due to low awareness among people, poor economic conditions and poor salaries, insecurity and transport problems faced by the immunization staffs [30]. In a study conducted at two hospitals located at Karachi, the most common primary reason for non-vaccination was identified as lack of knowledge, while the most common secondary reason for non-vaccination was religious taboos followed by security conditions [31]. Providing an inexpensive reminder type immunization card or a short centre-based education to mothers was found to be an effective intervention for increasing subsequent immunization visits to the EPI centres [32]. Immunization system issues can be also addressed through improving outreach services, vaccine supply, and health worker training; however, under-vaccination and non-vaccination linked to parental attitudes and knowledge are more difficult to address and likely require local interventions [33].

The introduction of Reach Every District (RED) approach to improve the routine immunization uptake in Baluchistan should be stressed in order to reach the difficult areas of the province. Shortage of skilled staffs at health facilities need to be addressed by recruiting more staffs to involve in the routine immunization program so that EPI coverage significantly improves. This recommendation was in line with the problem identified previously as the inadequate service delivery, lack of information about immunization and inadequate number of vaccinators were found to be one of the main reasons for the poor performance and large number of polio cases reported each year [16]. Similarly, it was pointed out that WHO need to hire more Polio Eradication Officers to the uncovered districts of the province in order to effectively support SIAs and surveillance activities.

This study provides the result of a Delphi-style expert elicitation in Baluchistan province of Pakistan involving experts who have direct experience in the set-up. However, the results of the study will hopefully contribute to better quality of the programs in both specific security-compromised areas and the GPEI activities in general. The limitation of the study, as the study approach used a Delphi method, is that it could have pushed discussion panellists for consensus. It also need to be noted that while the role of underserved and hard-to-reach groups, emphasised in this study, is certainly critical in order to interrupt WPV transmission in the last reservoir, it is important to continue intense vaccination in polio-free areas given the devastating consequences of outbreaks in these places. Successful eradication requires that we achieve high enough population immunity in the whole world to prevent transmission.

Conclusion

The major factors affecting the polio eradication program, in security compromised settings, were found to be poor preparation during the pre-campaign phase, inappropriate planning and under utilization of micro-planning, low skilled polio teams involvement, poor campaign monitoring and reporting, inapt addressing of refusal and missed children, lack of planning for evolving security situation, inefficient payment modalities for frontline workers and poor integration of AFP campaign with surveillance and EPI services.

It was indicated that proper micro-planning and security planning, increasing the number of campaign monitors and the receipt of timely feed-back of intra and post-campaign monitoring results, the establishment of a true accountability framework for campaign underperformance, addressing polio campaign operational bottle necks, integrating the polio eradication initiative with the EPI and

surveillance programs can improve the polio eradication effort in setting where the security situation is precarious.

Acknowledgement

Our sincere thanks go to all Delphi panel discussants who participated in this study. Our deep gratitude is to the WHO Quetta staffs for assisting the selection process of the panel discussants and for providing consistent administrative support. We are indebted to Mr. Michael Wagner for his assistance in editing the manuscript English. We are highly grateful for reviewers of our manuscript for their invaluable comments that make our study fit to be published.

References

1. WHO (2012) Action to stop polio now in Nigeria, Pakistan and Afghanistan, in Global Polio Emergency Action Plan 2012-13, Developed by the Governments of Nigeria, WHO 3-4.
2. Maurice J (2013) Ending polio—if at first you don't succeed... *Lancet* 381: 1261-1262.
3. Mohammadi D (2012) The final push for polio eradication? *The Lancet* 380: 491.
4. Owais A, Khawaja AR, Ali SA, Zaidi AK (2013) Pakistan's expanded programme on immunization: an overview in the context of polio eradication and strategies for improving coverage. *Vaccine* 31: 3313-3319.
5. [No authors listed] (2011) Outbreak news. Confirmed international spread of wild poliovirus from Pakistan. *Wkly Epidemiol Rec* 86: 437-438.
6. Eichner M, Brockmann SO (2013) Polio emergence in Syria and Israel endangers Europe. *Lancet* 382: 1777.
7. Centers for Disease Control and Prevention (CDC) (2012) Progress toward poliomyelitis eradication - Afghanistan and Pakistan, January 2011-August 2012. *MMWR Morb Mortal Wkly Rep* 61: 790-795.
8. Centers for Disease Control and Prevention (CDC) (2009) Wild poliovirus type 1 and type 3 importations--15 countries, Africa, 2008-2009. *MMWR Morb Mortal Wkly Rep* 58: 357-362.
9. Angez M, Shaukat S, Alam MM, Sharif S, Khurshid A, Zaidi SS (2012) Genetic relationships and epidemiological links between wild type 1 poliovirus isolates in Pakistan and Afghanistan. *Virol J* 9: 51.
10. Rafael Obregón, Ketan Chitnis, Chris Morry, Warren Feek, Jeffrey Bates, et al. (2009) Achieving polio eradication: a review of health communication evidence and lessons learned in India and Pakistan. *Bull World Health Organ* 87: 624-630.
11. April C, Sadika H, Rober D, Kathryn M (2012) Eradicating Polio in Afghanistan and Pakistan, in A Report of the Center for Strategic and International Studies. CSIS (Center for Strategic and International Studies).
12. Bhootrani ML, Tahir SM (2012) Polio Free Pakistan: Reality or Dream? *JLUMHS* 11: 122-123.
13. [No authors listed] (2009) Conclusions and recommendations of the Advisory Committee on Poliomyelitis Eradication, November 2008. *Wkly Epidemiol Rec* 84: 17-28.
14. Nishtar S (2010) Pakistan, politics and polio. *Bull World Health Organ* 88: 159-160.
15. Arora NK, Chaturvedi S, Dasgupta R (2010) Global lessons from India's poliomyelitis elimination campaign. *Bull World Health Organ* 88: 232-234.
16. Shah M, Khan MK, Shakeel S, Mahmood F, Sher Z, et al. (2011) Resistance of polio to its eradication in Pakistan. *Virol J* 8: 457.
17. Usman HR, Kristensen S, Rahbar MH, Vermund SH, Habib F, Chamot E (2010) Determinants of third dose of diphtheria-tetanus-pertussis (DTP) completion among children who received DTP1 at rural immunization centres in Pakistan: a cohort study. *Trop Med Int Health* 15: 140-147.
18. WHO, Update on Vaccine-Derived polioviruses - Worldwide, April 2011-June 2012. *Morbidity and Mortality Weekly Report* 61: 741-746.
19. Chaturvedi S (2013) Vaccines, Social Mobilization, or any Other Game changer: Polio Eradication is an Unfinished Narrative. *Indian J Community Med* 38: 67-69.
20. Tayyeb Masud KVN (2012) The Expanded Program on Immunization in Pakistan Recommendations for improving performance, in Health, Nutrition and Population (HNP), Health, Nutrition, and Population (HNP) Family of the World Bank's Human Development Network.
21. Muhammad Umair Mushtaq, Ubeera Shahid, Muhammad Ashraf Majrooh, Mushtaq Ahmad Shad, Arif Mahmood Siddiqui, et al. (2010) From their own perspective - constraints in the Polio Eradication Initiative: perceptions of health workers and managers in a district of Pakistan's Punjab province. *BMC International Health and Human Rights* 10: 22.
22. Centers for Disease Control and Prevention (CDC) (2013) The global polio eradication initiative Stop Transmission of Polio (STOP) program - 1999-2013. *MMWR Morb Mortal Wkly Rep* 62: 501-503.
23. Pakistan (2013) National Emergency Action Plan 2013 for Polio Eradication (NEAP).
24. Asif Raza Khawaja, Sher Ali Khan, Naveeda Nizam, Saad Bin Omerb Anita Zaidia (2012) Parental perceptions surrounding polio and self-reported non-participation in polio supplementary immunization activities in Karachi, Pakistan: a mixed methods study. *Bull World Health Organ* 90: 822-830.
25. William Weiss, Md Hafizur Rahman, Roma Solomon, Dora Ward (2013) Determinants of performance of supplemental immunization activities for polio eradication in Uttar Pradesh, India: social mobilization activities of the Social mobilization Network (SM Net) and Core Group Polio Project (CGPP). *BMC Infectious Diseases* 13: 17.
26. Maher D (2013) The human qualities needed to complete the global eradication of polio. *Bull World Health Organ* 91: 283-289.
27. Chaturvedi S, Dasgupta R, Adhish V, Ganguly KK, Rai S (2009) Deconstructing Social Resistance to Pulse Polio Campaign in Two North Indian Districts. *Indian Pediatr* 46: 963-974.
28. Mushtaq MU, Majrooh MA, Ullah MZ, Akram J, Siddiqui AM, et al. (2010) Are we doing enough? Evaluation of the Polio Eradication Initiative in a district of Pakistan's Punjab province: a LQAS study. *BMC Public Health* 10: 60.
29. Stephane HELLERINGER, Jemima A Frimpong, Jalaa Abdelwahab, Patrick Asuming, Hamadassalia Touré, et al. (2012) Supplementary polio immunization activities and prior use of routine immunization services in non-polio-endemic sub-Saharan Africa. *Bull World Health Organ* 90: 495-503.
30. Naeem M, Adil M, Abbas SH, Khan MZ, Naz SM, et al. (2011) Coverage and causes of missed oral polio vaccine in urban and rural areas of Peshawar. *J Ayub Med Coll Abbottabad* 23: 98-102.
31. Sheikh A, Iqbal B, Ehtamam A, Rahim M, Shaikh HA, et al. (2013) Reasons for non-vaccination in pediatric patients visiting tertiary care centers in a polio-prone country. *Archives of Public Health* 71: 19.
32. Usman HR, Rahbar MH, Kristensen S, Vermund SH, Kirby RS, et al. (2011) Randomized controlled trial to improve childhood immunization adherence in rural Pakistan: redesigned immunization card and maternal education. *Trop Med Int Health* 16: 334-342.
33. Rainey JJ, Watkins M, Ryman TK, Sandhu P, Bo A, et al. (2011) Reasons related to non-vaccination and under-vaccination of children in low and middle income countries: findings from a systematic review of the published literature, 1999-2009. *Vaccine* 29: 8215-8221.