



## Enactment of System Thinking Framework for Convolution of Immunization Service Governance

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### ABSTRACT

Vaccinations are given to healthy people to prevent specific diseases which are proven tool of public health. Nowadays lot of hesitant movement are active around the globe. Application of system thinking should be adopted to solve this complex phenomenon. The objective is to study the barriers and solutions of Immunization enlisted by Policy makers and administrators at Malappuram district, Kerala, South India. Descriptive qualitative method was the design espoused in this study. Free listing is the technique adopted to enlist barriers and solution at Malappuram district. The data was analysed using Visual Anthropac software. Further barriers and solutions of immunization was enumerated on basis of descending order of Smith S value. Causal loop diagram was used to depict complex phenomenon regarding barriers of immunization. The policy makers and administrators had solicited barriers as Religious belief, antivaccine lobby, negative propaganda by alternative systems and ineffective logistic management. The main solutions set forth to break barriers were strengthening Information Education Communication (IEC), bring in behavioural change communication and adopt policy reforms. The study determined by conscripting community and health system enabled barriers, with solutions for it encompassing global networking, engaging various stakeholders and applying system approach for health system strengthening.



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### INTRODUCTION

In the modern era, health system functioning is complex with newer challenges. To face this complexity into account, efforts need to be generated for accomplishing efficient system. Holistic and dynamic efforts with empanelled network engaging various stakeholder must be systematically furnished (Adam and de Savigny, 2012). Systems thinking enhance our understanding of the characteristics of complex adaptive systems by embracing self-thinking and embedding analytical frame-

work (Stermann, 2006). It encourages to find solutions from practical applications. This approach remains hope for low-and middle-income countries which persist as an untapped method for health domain. No argument is there regarding success of classical approaches which have made great advances in medicine and public health. The sought benefits are, however, hampered by the complexity problem, learning debacles and implementation encounters (Hunter and Rayner, 2004). Systems dynamics modelling is a style that uses set of tools to recognize the behaviour of complex systems over time. They are intended to solve the problem mutual causation by being able to change variables over small periods of time while agreeing for feedback and numerous interactions and delays (Peters, 2014).

Immunization is an intervention which has led to dramatic decline in the cases of Vaccine Preventable Diseases (VPDs) globally. The interventions had almost decreased the cases of VPDs about 62% to 100% in India (Okonko et al., 2013). Children die each year of vaccine preventable diseases (VPDs) with a disproportionate number of these children residing in developing countries (Kadri et al., 2010). Kerala state known as "Gods own Country" is renowned for its finest health indicators. The state has a much-acknowledged health model appreciated and equated to developed countries. But contradictory to above statement, the immunization coverage declined in some districts in Kerala, especially Malappuram district. For the sole reason, Malappuram district was the only district in Kerala which was included under Intensified Mission Indra Dhanush programme at a particular period to restore vaccine coverage. The program was directly reviewed by the Indian Prime Minister through an initiative PRAGATHI-Multipurpose, multi model platform for proactive governance and timely intervention. Malappuram had shown role model in the field of palliative care, Women empowerment (Kudumbasree). The reputation and glory of Kerala health model has been affected by the sad news of the demise of two children at adolescent age group and 5 cases of diphtheria from an orphanage back on September 2015. The immunization coverage of the children aged under 16 years was 64% and found that two lakhs thirty-five thousand children were unimmunised and partially unimmunised in the year 2015. Despite of all valuable efforts to increase the coverage, there was an outbreak on June which slayed two adolescent children and 66 cases exclusively in the district. The scenario at Malappuram transmuted from an outbreak to an epidemic, fetched nostalgic events that took place at

Russia during 1990s, embracing victims of 1,40,000 cases and 4000 deaths. The immunization coverage of Russia those days was the solitary factor for the epidemic (Dushoff et al., 2007). A collectorate march was organized by Antivaccine mob following death of Diphtheria child at Malappuram and the mob claims 'actual' reasons for the death were numerous agents comprising smell of asbestos, talcum powder, tooth paste. This kind of anti-vaccination campaign had affected the routine and special immunization drive (Tafari et al., 2014). Measles Rubella Campaign initiated in the month of October 2017 which targeted 12.6 lakh children from Malappuram District also faced a lot of resistance in carrying out the drive. This study is an attempt to quantify barriers of immunization and finding solution for the same at Malappuram District from the perspective of policy makers and administrators of the district.

## MATERIALS AND METHODS

The study was done in Malappuram District Kerala located at South India, bounded by the Nilgiris hills on the East and the Arabian Sea on the west, the district of Malappuram literally the land atop the hills, is remarkable for its unique natural beauty. Perched among the undulating hills and the meandering rivers that flow to reach the coconut-fringed seacoast, the land conceals a unique and eventful history. In allopathy stream one government medical college with four District headquarters Hospitals are available in the district; also one private medical college with many private hospitals are available in the district for public healthcare needs.

A qualitative research was done by recruiting samples selected exclusively from persons aged above 18 years by purposive sampling. The study included samples of Policy makers, elected leaders, district health administrators from Malappuram district. The duration of sample collection was one year. The subjects were local self-government office bearers, political leaders, District medical officer, Juvenile justice Commission Chairman, Child protection officer, District surveillance officer, Former Reproductive child health Officer, WHO Consultant, UNICEF Consultant, Former District programme manager, National Health Mission evaluator. Free listing techniques with ten members was initiated to study barriers of Immunization and solutions for it. Informed written consent from the participants were taken. Asking group of informants to cite all the factors acting as barrier to immunization and which they can recall and solutions for it was entered to Visual Anthropac software and analysed. And the reasons were listed in descending order of Smith S

Value. Data was expressed using Causal loop diagram. Causal loop diagrams (CLDs) are a system dynamics tool that produces qualitative diagrams of mental models, focused on prominence of causality and feedback loops. Feedback loops can be either reinforcing or balancing. CLDs help to explain the role of such loops within a given system and they are often developed in a participatory approach. The drawings can be further developed by categorizing the types of variables and quantifying the relationships between variables to form a stock and flow diagram.

## RESULTS

The Barriers to Immunization free listed by Policy makers & Administrators are given in Table 1 and Figure 1. Solutions to Immunization barriers free listed by Policy makers & Administrators in Table 2. The barriers free listed by means of highest salient feature was Religious belief 0.440 with frequency 50.0 and rank 2.00. Then it was followed by other factors in descending manner. The next barrier listed was Side effects with frequency of 60.0, ranked 5.17 with Smith value 0.348. The rank was 4.67 for Negative social media with salient factor value 0.238 and frequency 30.0. Then was Naturopathy with frequency 30.0, rank 2.67 and S value 0.201. Negative propaganda by Antivaccine lobby had frequency 20.0, rank 1.50 and Smith S value 0.191. Followed by Chemophobia with frequency 20.0, S value of 0.166 and ranking of 4.50. Grandparents decision makers were repeated by 20.0 with rank of 3.00 and S value 0.143. Lack of perceived threat had frequency of 30.0, rank of 5.33 and saliency factor of 0.138. Followed by Myth with frequency, 20.0, rank of 3.50 and S value 0.129. The tenth listed barrier was Lack of parents awareness with frequency of 20.0, rank of 5.00 and S value of 0.119.

As the barriers were enlisted, the next phase was to enumerate the solutions for intervention. The highest Smith S value was for Amendment of existing Public Health Act 0.342 with frequency of 40.0 and S value of 0.342. The frequency was 40.0 with rank 3.00 and S value of 0.248 for Intensifying IEC activities. It was followed by frequent training on implementation of the program with frequency of 30.0 with rank 2.67 and S value of 0.232. The next solution was to Engage religious leaders in social mobilization which had frequency of 30.0, rank 2.67 and S value 0.225. Involvement of private doctors had frequency 20.0 with Smith S value 0.171 and rank 2.00. Followed by Constant interpersonal communications with S value of 0.154, frequency 30.0 and rank 4.67. Then was Involvement of different stake-

holders for social mobilization with frequency of 20.0, rank 4.00, saliency factor 0.114. Strategies to ensure skill training for health workers had frequency of 30.0 with S value 0.107 and rank 5.67. Followed by Effective implementation of Juvenile Justice Act with frequency 10.0, rank 1.00 and S value 0.100. The salient factor of 0.100 was present for arranging father meetings with frequency 10.0 and rank 1.00. It was followed by Strategies for women empowerment and voice them for decision making with frequency of 10.0, rank 1.00 and Smith S value of 0.100.

### Inputs from Causal loop Diagram one

The reasons for barriers are classified into Community Based and Health related issues.

#### Community based barriers

##### Social Factors

Behaviour of service provider is important for the acceptance of immunization. Persuasion and connect with the community make difference in acceptance of any social product. Lack of strong bond between health workers and family members should be improvised. As the introduction of ASHA into the system, JPHNs have lost the connection with each household. Awareness of local politicians regarding immunization is necessary for smooth delivery of the program. All relevant stakeholder participation should be warranted. Still Immunization is not considered as social norm in some pockets of Malabar.

##### Family and support system

Lack of family support from family to mother who takes out the child in her risk is the sad reality of this region. Gulf father are the decision makers in this part of the country. Grandparents have also prominent role in decision making. As patriarchal society, gender gap is witnessed predominantly. Mothers have no choice to take shots to their children though well informed. The health education classes are not attended by fathers and hence this cohort are unaware of the benefits of vaccines.

##### Cultural and custom factors

Religious belief is the most common reason for not taking vaccines. There is no separate religious leader nor organisation have come out with statement against vaccination. But these people are not favouring the vaccination program due to age old custom they have experienced. Belief in traditional system glues the community to be attracted to the false propaganda easily.

##### Knowledge related

Lack of parent's awareness; especially fathers is

**Table 1: Barriers to Immunization free listed by Policy makers & Administrators**

Item	Frequency (%)	Average Rank	Salience
Religious belief	50.0	2.00	0.440
Side effects	60.0	5.17	0.348
Negative social media	30.0	4.67	0.238
Naturopathy	30.0	2.67	0.201
Negative propaganda by Ant vaccine lobby	20.0	1.50	0.191
Chemophobia	20.0	4.50	0.166
Grandparents decision makers	20.0	3.00	0.143
Lack of perceived threat	30.0	5.33	0.138
Myth	20.0	3.50	0.129
Lack of parent's awareness	20.0	5.00	0.119

**Table 2: Solutions to Immunization barriers free listed by Policy makers & Administrators**

Item	Frequency (%)	Average Rank	Salience
Amendment of existing Public Health Act	40.0	1.50	0.342
Intensify IEC activities	40.0	3.00	0.248
Frequent training on implementation of the program	30.0	2.67	0.232
Engage religious leaders in social mobilization	30.0	2.67	0.225
Involvement of private doctors	20.0	2.00	0.171
Constant interpersonal communications	30.0	4.67	0.154
Involve different stakeholders for social mobilization	20.0	4.00	0.114
Ensure skill training for health workers	30.0	5.67	0.107
Effective implementation of Juvenile Justice Act	10.0	1.00	0.100
Arrange father meetings	10.0	1.00	0.100
Strategies for women empowerment and voice them for decision making	10.0	1.00	0.100

reported. There is lack of perceived threat regarding vaccines due to lack of knowledge. Community are not aware regarding for which disease vaccine is given. Information regarding benefit of Immunization is lacking. Negative propoganda by Anti-vaccine Lobby have paved way for distrust of Modern Medicine. Previous incidence of Post Injection Paralytic Polio had raised concerns among laymen. Rumours about side effects of neighbouring households have added to these tales.

#### **Lack of Scientific Temper**

People carried away by Negative propoganda of Homeopathy, Naturopathy and antivaccine lobby due to lack of scientific temper to evaluate facts based on evidence. Opinion leaders coming against vaccinations added fuel to the existing fire. Negative media especially social media also geared situation with false information. Ineffective Communication of caregivers which is ignored by the system is handicap to the system. Healthcare workers are unable to generate demand by convincing the society. Conspiracy theory on Capitalist Agenda and

myth regarding Chemophobia had impact for hesitant behaviour of the beneficiaries.

#### **Health System based barriers**

##### **System Failure**

Lack of giving quality time for consulting individual patients is considered as lapse of the system. Medical Officers hesitant to work in the afternoon reduces adequate time with just. Involvement and commitment of some medical professionals is seen below expected level. More focus on curative system than preventive care is seen government healthcare institutions. Free Supply of vaccines and more compulsion to take shot make people reluctant.

##### **Administrative Level Failure**

Inadequate awareness programs in the initial phase of introduction to vaccine programme. Immunization card is not considered compulsory document and not valuable.

Lack of timely action legal against mis-informants is the root cause for sustainable negative attitude and propoganda.



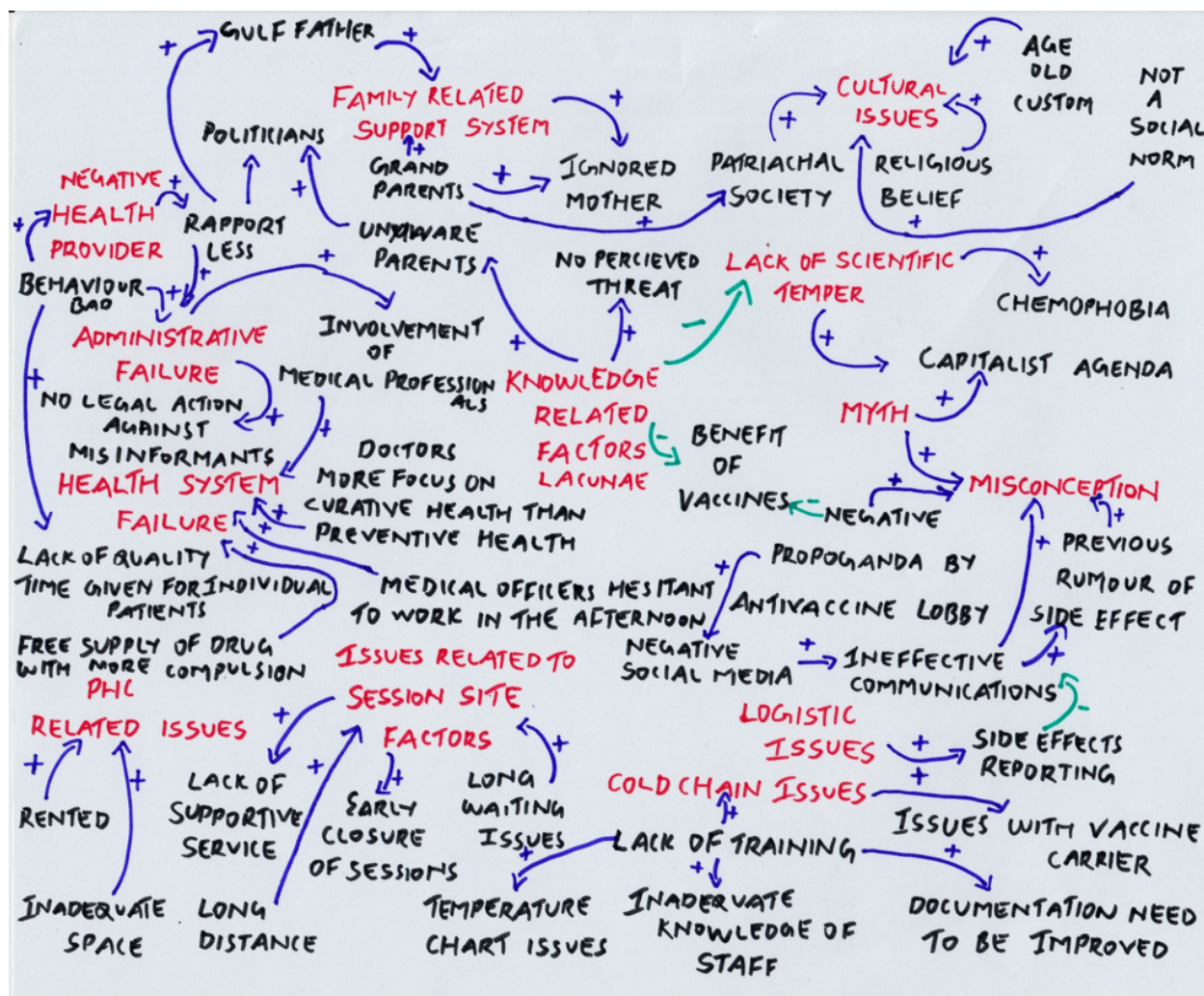


Figure 1: Causal loop Diagram showing barriers of Immunization described by policy makers & administrators

**Issues related to health infrastructure**

Some Primary health centres (PHC) are rented as they don't have their own building. Some PHC have inadequate space for quality delivery of services. Few centres lack supportive supervision and close monitoring. Written contingency plan are not available for some centres. Lack of written documentation or standard operating protocols are not in place. Proper micro plan for outreach sessions are inadequate in some area. People had issues with long distance. Early closer of immunizations sessions were problem for parents. Long waiting time was uncomfortable for parents. Mothers are not able to see their child being pricked due to concern.

**Cold chain Issues**

National Health Mission (NHM) evaluation audits are constructive program organized by the Ministry of health& family welfare, India to improve quality of vaccination program. NHM Evaluator found some deep freezers were not CFC free. Some centres

have no voltage stabilizers for deep freezers. Less number of persons were trained per year for cold chain handling was noticed. Staff had lack of knowledge on weekly and monthly equipment maintenance check list. In some centres no written policy for maintenance and no equipment building plan was available in audits.

**Ineffective Logistic management**

Vaccine related issues found were lack of knowledge of staff on shake test. Buffer level are not calculated scientifically. There are instances where over procurement had happened. Faulty injection techniques were observed during audits. Lack of adequate hub cutters were available on sessions. Healthcare staff were having less knowledge on wastage calculation. Documentation were not systematically and meticulously done. No proper documents of diluents were present. Concern related to vaccine carriers and icepack were there. Many centres had limited supply of new vaccine carriers.

Lack of standard format for stock register intend and issue form were noticed. Availability of standard temperature logbooks were not present.

## **Solutions**

### **Behavioural Change**

More strategies should be focused on behavioural change communication. Modern and innovative techniques need to be encompassed. Immunization should never be given coercively. Few administrators recommend that vaccine should not be given free and should ensure minimum charge.

### **Role Model**

Health Professionals should vaccinate their children mandatory. They should be able to portray themselves as role models for the society. Government servants should also vaccinate their children mandatory. Data analysis and cost-effective strategy of immunization should be illustrated practically to health professionals and government servants.

### **Administrative level Implementation**

Mandating of completion for Immunization schedule in Visa application process should be guaranteed. Effective implementation of juvenile justice act must be safeguarded. Amendment of existing public health Act should be taken seriously. Policy to make Immunization Child right should be initiated. Delegating of completion of Immunization for school admission must be alleged. Strategies for women empowerment and voice them for decision making. Health system should take ownership if some AEFI occurs.

Instructing community for completion of Immunization to avail social security scheme should be legally bound. Ensure mechanism for scrutiny of Immunization certificate to foreign countries as chance for fake. Involvement of private doctors for routine immunization services can be adopted as policy. Mechanism for proper grievance redressal should be present.

### **Integration of all sectors**

Involve different stakeholders for social mobilization. Engage religious leaders in social mobilizations. BCC through proponents of Homeopathy and Ayurveda may be adopted. Ensure political commitment and systematic empowerment of politicians through continuous IEC activities.

### **Strengthening IEC**

Give assurance mild AEFI is not an issue. Address decision making grandparents through sustained programs. Behaviour Care Communication for addressing cultural aspects. Make community feel

vaccine is perceived threat. Give clarity regarding no vested interest. Constant interpersonal communications should be ensured. Arrange father meetings to empower them to take correct decisions. Ensure four key messages by health workers in each session. Relatives of Hesitant parents should try to convince them. Teach public concept of Immunization and how it works.

### **Implementation of effective logistic management system**

Microplanning should be strategic as per beneficiary load. Ensure adequate checklist for surveillance. Formal training on preparing preventive maintenance plan must be ensured. Frequent training should be adopted on implementation of the program effectively. Ensure skill training for health workers to improve competency. Ensure standard protocol for logistic management. Training on effective logistic management. More personnel to be trained for cold chain handling. Ensure proper microplanning to hard and difficult reach area. Follow protocol for AEFI referral from grass root to higher ups. Supportive supervisions should be documented. Ensure adequate staff population ratio to ensure quality of services.

## **DISCUSSION**

Immunization has been widely accepted as one of the most cost-effective public health interventions for disease prevention. In the present study, the highest Smith S value as barrier were enlisted for religious belief. Humans found purpose, solace, values and understanding in religious practices. There are reports that violation against smallpox was initially done by Buddhist nuns over 1000 years ago. Few people were against vaccination even at times when Jenner developed vaccination against smallpox in 1796 citing various religious reasons. Hinduism, Buddhism, Jainism, Judaism, Christianity, and Islam were reviewed to find the place of immunization in the Holy Scriptures. Subjects of concern evaluated against the religious concerns were blood components, pharmaceutical excipients of porcine or bovine origin, rubella strain RA 27/3, and cell-culture media. There should be no conflict between public health and religion. Open discussion with concrete platform should be made available for transaction of idea, views and perceptions. Sometimes information can act as contagion on top. As the modern propagation of messages in media especially social media spreading fast is termed as viral ([Centola and Macy, 2007](#)).

Anti-vaccine sentiment is complex contagion. A superficial information of anti-vaccine propaganda



does not change a person's beliefs. Special kind of social underpinning deliberates integrity to the idea that vaccines could be detrimental. Engendering sufficient credibility for the anti-vaccination perspective to engage the reasoning processes of ambiguity, and distrust is the way to sway parent trapped in the octopus' hands of anti-vaccine lobby. A study conducted in Canada depicts growing controversy about vaccination rates. Science of vaccines is not understood by major share of the inhabitants which lead to insecure herd immunity (Dubé *et al.*, 2013). Hesitancy to vaccinate is a complex phenomenon, but there is little doubt that Complementary and alternative medicine (CAM) providers have played a role in making the present scenario worse. The objective of the study was to examine websites of naturopathic clinics and practitioners in the provinces of British Columbia and Alberta. The study concluded that dwindling legal measures, plummeting CAM practitioners' to self-regulate, and improving enforcement of law standards would limit capability to spread inaccurate vaccine-hesitant perspectives.

Despite high immunization coverage rates and vaccine effectiveness, there are still a number of reported outbreaks, some of which could be prevented by better vaccine management practices. The continuing number of reports of vaccine-preventable disease outbreaks raises concerns about vaccine quality (Salgado *et al.*, 2004). Vaccines are biological products that can be damaged by high temperatures, freezing temperatures, and excessive light. They are generally effective for a limited period of time at room temperature. Inappropriate transportation and improper storage of vaccines might lead to a decrease in vaccine effectiveness (Kumru *et al.*, 2014). Once potency has been lost through exposure to excessive heat or freezing temperatures, returning the vaccine to the correct storage temperature will not cause the vaccine to regain its potency. If potency is lost through heat exposure, the vaccine's appearance will not change. Without performing a laboratory test, it is not possible to know whether a vaccine has lost its potency (Techathawat *et al.*, 2007).

In regard to country's vaccine logistic management, results are motivating and still more to improve as it depicts achievement of (72%) scores in Temperature, (76%) in Building, Equipment, Maintenance (80%) scores in Storage capacity, and (75%) scores in Vaccine Management. The lowest scores have been achieved in Vaccine arrival (60%), Distribution (62%), MIS & Supportive functions (59%), Maintenance (64%), Stock Management (65%). The measures adopted to strengthen the system is to

develop detailed Standard Operating Protocols for building. The states need to establish a linkage between Health and Civil works (PWD) department for maintenance of buildings. Temperature monitoring and mapping study need to be conducted. Detailed SOPs as per WHO recommendation should be followed. Engagement of partner agencies for hands on training may be done.

Side effects from a vaccine are usually rare and exceptional with examples of painful arm or mild fever. More serious side effects can happen with less probability. A vaccine to appear in market needs to jump hurdles which is not so easy. Close surveillance of all steps is initiated by the regulatory authority. The benefit harm ratio weighing simulates us there is high chance for procuring Vaccine preventable disease than be affected by the shots side effects. Many more morbid conditions and mortality would occur without vaccines.

WHO had officially kept access for frequently related queries in their official website. The webpage reiterates information about any drug, vaccines and their mild side effects. Long lasting events are very rare and usually it presents with meagre symptoms like fever, small abscess or similar light presentation. The existing performance of the logistic management is assessed by EVM assessment tool for identifying key strengths, weaknesses and to utilize the findings and recommendations for plan of action. Then there would be a reviewing process against activities monitored with WHO works to ensure positive health in all meaning to everyone round the globe. As part they help countries set up machinery and safe systems for vaccines and apply strict international standards to regulate them. Joining hands with experts worldwide they assure effective monitoring of programs. They also help countries investigate when probable problems of apprehension occur. Global Advisory Committee of WHO take care unexpected adverse side effects.

### Recommendation

The solution put forth were to engage religious leaders and different stakeholders in social mobilization. Strategies for incorporating gender enablement by ornamenting women to voice for decision making and empower fathers by exclusive evening trainings. Constant interpersonal communications ought to be on attention. Strategies to engage and develop inclusive approach to private doctors partnering for the program should be instigated. Further steps to take legal action by effective implementation of Juvenile Justice Act must be considered. Ensure competent skill training for health workers by International stakeholders like UNICEF, WHO, Rotary Club

and Lions Club.

## CONCLUSION

The current research had spotted light on system thinking framework in enlisting barriers and portraying effective solution to break hesitancy. The study had helped to classify barriers based on Community and health system-based barriers. The community-based barriers discussed complex system involving social, cultural, family aspects related to immunization. Lack of awareness, knowledge related barriers and diminished scientific temper of the society were canvassed. Administrative failure, Ineffective cold chain and logistics management were red lettered in the present study. The policy makers should intervene with strategies meeting with socio-political demands of the community addressing each barriers.

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## Conflict of Interest

The authors declare that there is no conflict of interest for this study.

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