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Article

Economic, social, and administrative barriers to achieving the sustainable development goal of good health and well-being

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Abstract: Good health and well-being are embedded in the 3rd Goal amongst the UN Sustainable Development Goals. The primary objective of this research was to identify the most critical economic, social, and administrative barriers to implementing the Expanded Program on Immunization (EPI) in the Punjab Province of Pakistan. A sequential exploratory design and case study technique were used, employing both qualitative and quantitative methods. In the first stage, in-depth interviews with 50 key officials were conducted to identify the most critical barriers to the EPI program. A quantitative analysis was then performed based on the results obtained from qualitative analysis, and rank orders of barriers were received from the same health department experts. The results indicate that twenty-eight barriers can cause implementation problems for this program. Still, the ten barriers that gained the maximum hits are the most important barriers, which include Shortage of vaccinators, mismanagement of vaccines' cold chain, biometric android application, ice-lined refrigerators, communication gap, inadequate legislation of EPI program, capacity building issues with EPI staff, Misconceptions about EPI program, lack of awareness of the parents and community, refusal cases and inadequate cooperation of lady health workers (LHWs). Coordinated efforts of the government and the public are highly recommended to address these barriers.

Keywords: World Health Organization (WHO); immunization coverage; health care management; cold chain management; community engagement; health education; mobile technology

JEL Classification: I15; I18; I31; O15

1. Introduction

Good health and well-being are the 3rd Goals of the UNDP Global Goals. Good health is a prerequisite for achieving sustainable development. Universal health coverage is important for the socioeconomic development of a country. Research and development of vaccines and their universal coverage is a major target set under this Goal. An Expanded Program on Immunization (EPI) is how a person is made immune or resistant to infectious disease; a Vaccine stimulates the body's immune system and protects the body against contagious diseases (WHO, 2020). According to the World Health Organization (WHO) statistics, delays in the immunization of children contribute to about 2 to 3 million deaths each year in the world.1.5 million deaths can be reduced by improving vaccination programs. Approximately 19.4 million infants

worldwide are not getting the necessary vaccination doses (WHO, 2019d). Vaccines are now useful for immunizing against diseases and maximizing health. It is also considered a very cheap and natural source to prevent the conditions in the community (Rappuoli and Vozza, 2022). It is reported that the immunization program saved about one million lives from measles, neonatal tetanus, and whooping cough in developing countries (Oliwa and Marais, 2017).

In 2018, an estimated 6.2 million children under the age of 15 years died, mostly from preventable causes. Of these deaths, 5.3 million occurred in the first five years. More than half of these early child deaths are preventable with simple, reasonable interventions, including immunization (WHO, 2019c). Measles is the primary cause of death among 9 "EPI" diseases globally, accounting for 114,900 measles deaths in 2014; 314 deaths occurred every day, and 13 deaths occurred every hour (Moura et al., 2018). Pneumonia is the leading infectious cause of death in children worldwide. Pneumonia killed about 808,694 children under five years of age in 2017, which accounts for 15% of all deaths of children under five years of age (WHO, 2019b). In 1998, 125 countries were polio-endemic, but now only two countries, Pakistan and Afghanistan, remain polio-endemic. Polio cases dropped from about 350,000 in 1998 to 33 in 2018, which accounts for a 99% decrease; now, 1 in 200 infections lead to paralysis, among which only 5 to 10% die (WHO, 2019a). Pakistan contributes to the highest rates of deaths among children below five years of age in the world. One child in every 11 (87 per 1000 live births) born in Pakistan dies before five years. Pakistan Millennium Development Goals (MDGs) 2019 target to reduce below five-year deaths to 52/1000 live births (Arif and Bannian, 2022).

In 1974, the World Health Assembly asked the WHO to start the EPI program to give universal vaccine access against a set of diseases (Gupta et al., 2022). Irrespective of the many efforts made by different agencies and government institutions, it is still not achieving 100% coverage. The EPI program started in Pakistan in 1976 and expanded in 1978. The main objective of the EPI program in Pakistan is to reduce morbidity and mortality. The EPI program annually covers 5.8 million children below one year of age and 5.9 million pregnant women and their newborns through routine immunization (WHO, 2022c).

EPI cards of small size (9 × 8.5 cm) are being used in Pakistan which contain all the information of the child e.g., schedule of immunization, complete knowledge of the children (name, father name, date of birth, father Computerized National Identity Card Number, phone number, etc.), date of next visit for vaccination. This card is useless for those mothers who are not educated and cannot read the card information; some mothers misplace this EPI card in their homes.

Vaccination under the EPI program is administered by mobile teams, public hospitals, and dispensaries. The coverage level or EPI results of mobile units are lower than those of hospitals and dispensaries, as there are difficulties covering remote areas. Many children are immunized too late, which creates coverage issues. Expanding this program to remote and hard-to-reach areas could lead to a rapid increase in EPI coverage (WHO, 2022a).

Numerous economic, social, and administrative barriers contribute to low vaccination coverage in Pakistan. Major issues include low maternal (Health) literacy rate, low socioeconomic status, and less access to immunization services. Useful

strategies for improving immunization services may include improving management capacity at the district level, improving service delivery of EPI, integration of other related health programs, progress monitoring and evaluation systems at the district level, increasing vaccine demand concerning the target population, the involvement of civil society and other organizations (Hussain, 2021). Lack of awareness about vaccination and lack of motivation are the main factors for the dropout ratio of immunization in most developing countries (Kumar, 2021). Large family size, low-income level of the parents, lack of awareness and motivation among mothers, and large distance of EPI kit stations from home badly affect the immunization schedule (Anandhi et al., 2000; Lutwick, 2000; Riaz et al., 2018; Ughade et al., 2000).

Parents' education, laziness, illness of the children, non-availability of vaccinators, inconvenient EPI facilities, fear of side effects and rumors about immunization programs, and low-quality services are reasons for low vaccination coverage in Pakistan (Qayyum et al., 2021). Some other factors that may affect vaccination coverage at the district level include workload on vaccinators/health workers and nurse density, female literacy rate, area, socioeconomic status, and delivery at home. EPI infrastructure in Pakistan includes the Federal Health Minister, the Provincial program manager (Head of EPI) under the Director-General of Health, the Secretary of Health, and the Provincial Health Minister. The provincial program manager (PPM) supervises the EPI program through the Executive District Officer, Health (EDO) (H). Each EDO(H) has an EPI Coordinator at the district level who addresses the managerial issues. He supervises the District Superintendent Vaccination (DSV), Assistant Superintendent Vaccination ASV, vaccinators, and all other staff (Larle, 2018).

In the Multan division, Vehari is the most deprived district in terms of the implementation of EPI. Unfortunately, the standards of this program are not being followed by the concerned vaccination staff, so the program faces many implementation problems. According to the Primary and Secondary Healthcare Department (2024), a lot of times, explanations/Personal hearings/Show cause notices were issued to the concerned officers, supervisors/managers, etc. of Vehari for not completing and compiling the records, inadequate and unsatisfactory performance, not achieving the targets, not complying with standards, absence from duty, inefficiency, misconduct, negligence, etc.

All these facts indicate that the implementation of the EPI program in District Vehari has been facing severe issues. Although some consideration was given to identifying the barriers to implementing this EPI program in this rural region of Pakistan, there is a need to identify the barriers to implementation of the EPI program. For this purpose, meetings were held with the WHO Polio Eradication Officer (PEO) District Vehari, EDO (H) Vehari, EPI Coordinator, EPI District Focal Person, School Health and Nutrition supervisors/EPI Supervisors, DSV, ASV tehsil Vehari, Mailsi and Burewala. All these officers assured us of the need to identify barriers to EPI program implementation in District Vehari. In addition to identifying implementation barriers, it is also essential to identify the relative importance of these barriers so that the most critical barriers can be highlighted and discussed (Adnan et al., 2022).

With low resources and insufficient funds, it is crucial to address all the issues simultaneously. The health system in Pakistan is facing not only administrative

problems but also many critical financing challenges (Akram et al., 2021). Identifying each barrier's relative importance may help policymakers allocate resources to the most critical issues. From the above discussion, two questions arise. First, what are the main administrative barriers to implementing essential EPI services at health facilities of District Vehari? Second, what is each barrier's relative importance following the above first question? So, the study's objective was to reveal the administrative barriers to implementing essential EPI services at health facilities of District Vehari and find out the relative importance of each barrier. Practically speaking, without identifying and prioritizing these barriers, initiating necessary changes to implement the EPI and other similar programs is impossible. The findings may facilitate local administration and international organizations (WHO, UNICEF, etc.) to improve the quality of EPI services by addressing the barriers identified in this research.

This research helps achieve the Sustainable Development Goals set by the United Nations and adopted by member states in 2015. These goals are part of the 2030 Agenda for Sustainable Development proposed for the peace and prosperity, of people and the planet. This study is a step towards achieving sustainable development as it focuses on 3rd Goal of this agenda related to health and well-being. The findings of this study provide a way forward toward achieving better health and well-being through the eradication of administrative barriers to the success of vaccination programs.

2. Research methodology

2.1. The study setting

Punjab province is the most crowded province of Pakistan with 621.83 population density per km whereas the national average population density is 303.35 (Pakistan Bureau of Statistics, 2023), and it has been divided into three essential regions: North Punjab, Central Punjab, and South Punjab. South Punjab is considered an underdeveloped area. District Vehari is an integral part of it, located on the right bank of the river Sutluj. District Vehari is divided into three Tehsils: Burewala, Mailsi, and Vehari. Its total population is 3 million with an area of 4360 sq. km (Shahid et al., 2021). This study is conducted in the health department of District Vehari. District health profile consists of Executive District Officer (H), District Officer Health (H), Deputy District Officer (H) (One in every three Tehsils), EPI coordinator, EPI focal person (One in every three Tehsils), School Health and Nutrition supervisors/EPI Supervisors, District superintendent vaccination (DSV), Assistant superintendent vaccination (ASV) (One in every three Tehsils). Healthcare facilities are available in 1 District Headquarters, 2 Tehsil Headquarters, 12 Rural Health Clinics, and 77 Basic Health Units. District Vehari comprises 77 rural and urban union councils with one vaccinator in each union council (NHSR and C, 2020).

2.2. Research design and sample

To explore organizational issues regarding the administration of the "Expanded Program on Immunization (EPI)," we used both qualitative and quantitative techniques on the pattern of previous similar studies e.g., Haider et al. (2019). This

research adopts a mixed method sequential exploratory design as indicated in the Mixed Method Appraisal Tool (MMAT) version 2011 (Pluye et al., 2011). In sequential exploratory designs, "the qualitative findings inform the quantitative data collection, and the quantitative results allow a generalization of the qualitative findings" (Pluye et al., 2011). This sequential mixed method approach is suitable to achieve the objectives of this study as we intend to first identify the barriers and then determine the relative importance of each barrier.

In the first step, a qualitative analysis was conducted. This qualitative research aimed to identify the economic, social, and administrative barriers to the immunization program in District Vehari through expert opinion. In the second step, a quantitative analysis was conducted to have expert advice about the essential administrative barriers from the overall list of barriers obtained during the qualitative analysis. The case study method investigates the grounds of observations and concepts. It enables the analyst to develop a robust empirical basis for ideas and generalizations. The case study method involves a person's natural everyday experiences and the problems they face. The sample was selected by targeting the participants based on professional skills, knowledge, expertise, field experience, and academic search. In other words, all the participants had in-depth knowledge and understanding of administrative barriers to immunization in District Vehari.

2.3. Research instrument and interview process

For the collection of information through interviews, a "Key Informant Interview Guide" was developed as a research instrument. This instrument was developed in consultation with health officials and academic researchers. Before starting the interview process, we identified 50 key informants, out of which forty were health professionals available for the final interview comprising one WHO surveillance officer/(Polio eradication officer (PEO), one EPI coordinator, one district EPI focal person, three Tehsil EPI focal persons; one district superintendent vaccination (DSV); three assistant superintendent vaccination (ASV); twenty-four School Health and Nutrition Supervisors/EPI Supervisors; and six Vaccinators. This sample size included ten people from top/first-line management, twenty-four people from middle-line management, and six people from the low operational management level. Participants' selection criteria were based on professional skills, knowledge, expertise, field experience, and academic search. Before the interviews, all the participants' consent was appropriately obtained. The respondents voluntarily participated in the interview process. All participants were guaranteed that their data would be confidential and that they would never face any negative consequences. Moreover, a documented study approval was obtained from the Ethical Committee for Scientific Research of COMSATS, Vehari Campus.

Based on attribution theory (Tomlinson and Langlinais, 2021) this research suggests that attributions of the district's highly skilled persons toward the issue of administrative barriers can give us useful insight about the subject. The attribution theory states that "humans are not simply observers of events and behaviors. Rather, they are motivated to understand the cause of what they see and experience." This research identifies the administrative barriers to EPI in the District Vehari, which is of

utmost importance in addressing and solving these barriers and improving EPI coverage.

2.4. Rank order survey

It is important to measure the relative importance of the problems in order to focus on the most critical issues for the efficient allocation of resources, especially in low-resource settings. For this purpose, individuals who identified the issues are the most relevant (Haider et al., 2015). Therefore, the same respondents were approached for the quantitative survey who identified the barriers.

3. Data analysis

3.1. Qualitative analysis

The study uses qualitative analysis in which detailed exploration has evolved, which consists of in-depth interviews, where complicated problems are being faced, where a user is required to understand the context and environment for better decisions, where you need to explain the things and where the measurements don't fit the problems. It wasn't easy to approach all the health department professionals and EPI field staff on the same day. Due to this problem, it was decided to contact all the professionals at their workplaces. It was confirmed that all the professionals were present on a specific day, and each discussion time was about 30 min. The main focus was on the question of chief administrative barriers that can affect the performance of the expanded program on immunization (EPI).

During the discussion session, important points were highlighted on the flip chart and shared verbally with the participants for feedback purposes at the end. Initial data (computer-based) from the mentioned professionals in the health department and technical staff were collected over three months. After completing this process, a content analysis was performed. For accuracy purposes, comparing flip chart notes and transcribing these was necessary.

The face-to-face interview technique was used to collect the data from the interviewees. The interviews were conducted from September to November 2017. About 30 min were given for each meeting. Before starting discussions, all the participants were informed about the study's objectives. A well-experienced health official from the health department was present to decide. A research team was also trained to facilitate discussions relating to EPI standards. The main question of the interview was, "What are the main administrative barriers that can cause implementation problems for the expanded program on immunization (EPI) in District Vehari." The conversations were recorded, and critical points were noted and added during the discussion where it was necessary; interviews were summarized on a flip chart by mentioning the most critical administrative barriers, and at the end of the interview, the key points were verbally shared with the interviewee and any final thought from the interviewee was also added. It took about three months to collect data from all the experts, and afterward, content analysis was performed whereby data were transcribed with the help of an independent transcriptionist. Transcribed data were compared with the flip chart notes at the end for accuracy.

It is essential to know the relative importance of each problem so that the most critical issues can be focused on in low-resource settings (Haider et al., 2015). The participants who identified the barriers could better give information about the relative importance of these factors (Dutta et al., 2021). So, after finalizing the barriers, the same respondents were approached and asked to rank the identified barriers based on their relative importance. A list of identified barriers, along with a questionnaire, was presented before the respondents to assign a unique number to each barrier depending on its intensity.

3.2. Results of qualitative analysis

By content analysis, twenty-eight administrative barriers were identified (see **Table 1**). The main question was, "What are the administrative barriers that can cause implementation problems for the expanded program on immunization in District Vehari?" A total of four hundred and eighty 480 hits were observed. **Table 1** shows that the more hits (8%) were given to the barrier, "the vaccinators are in fewer numbers according to their area population." The closest to this was cold chain management of the vaccines (8%). A third number was a barrier, "awareness of the community" (7%) at number four was "Biometric mobile software system problem" (7%), and at number five was "communication gap between field staff and higher authority" (6%). Similarly, at number ten was the "Ice-lined refrigerator problem (ILR)" (4%). The top ten ranking barriers are discussed in this research work.

Figure 1 presents the responses regarding the selected barriers.

Table 1. Frequencies of codes (in number and percentage).

"EPI barriers"	No. of hits	% of total hits per question
Cold chain problem	37	8
Ice-lined refrigerators (ILR) problem	20	4
Supply management system of the vaccine problem	11	2
Vaccinators are fewer in numbers	38	8
No alternate of vaccinator	18	4
Awareness problem	33	7
Biometric mobile software system problem	32	7
Legislation problems	29	6
Misconceptions problem	22	5
Non-availability of incentive program	17	4
Refusal cases problem	21	4
Non-availability of the children's problem	6	1
Capacity building problems	23	5
Less number of lady health workers (LHWs) and lady health visitor (LHV) problem	21	4
Behavior problems of the vaccination staff	6	1
Security issues	4	1
Non-availability of Reward and Punishment system	22	5
Communication gap problem	31	6

Table 2. (*Continued*).

"EPI barriers"	No. of hits	% of total hits per question
Fake entries and self-made reporting problem	18	4
Cooperation with other departments' problem	17	4
W.H.O standards not being followed	9	2
Vaccination points problems	6	1
Political interference problem	5	1
EPI indicators problem	3	0
Behavior of other field staff problem	11	2
Handling problems of the vaccine	11	2
Registration problem of the children	4	1
Duty timing problem of vaccination staff	5	1
Total	**480**	**100**

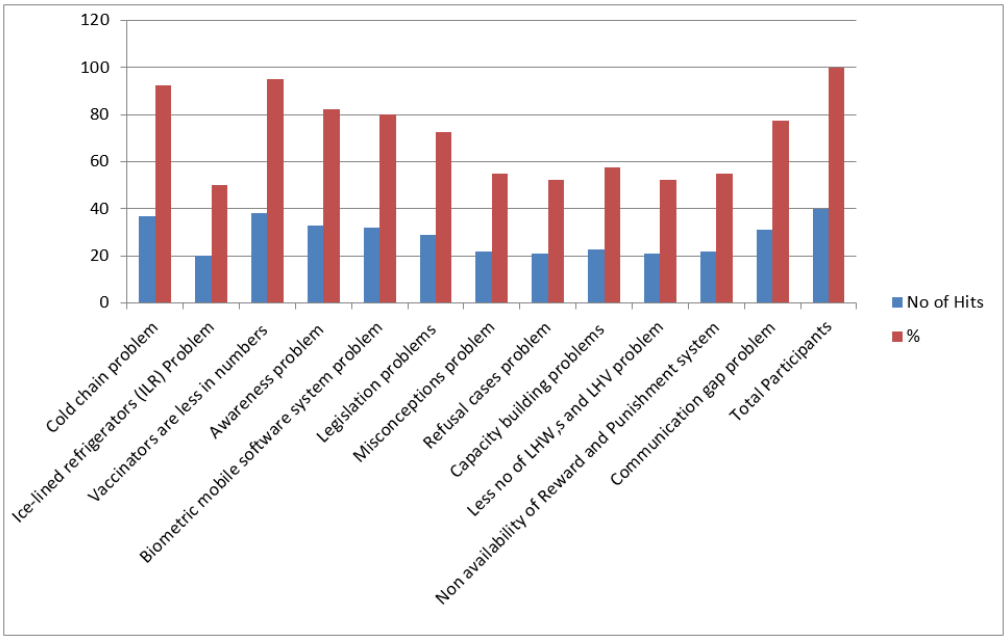

Figure 1. Administrative barriers.

Note: Each hit constitutes one respondent. $N = 40$.

3.3. Quantitative analysis

A quantitative analysis was performed on data obtained from the rank-order survey. We calculated summed-rank orders to determine the relative importance of each barrier. To complete the qualitative study, we returned a questionnaire containing ten restrictions to the same respondents (acquired the maximum number of Hits). Respondents were asked to rank each barrier to the EPI program. The study's respondents were asked to determine the factors that were most critical concerning implementing the expanded immunization program. According to Pullig et al. (2002), the summed-rank order of each barrier is calculated as S (Frequency × Rank). The total lowest score results in the highest ranking, and the highest overall score results in the lowest ranking. The classification of these factors was analyzed using Kendall's *W* or Kendall's coefficient of concordance test, which determined the rank differences

among different elements in a group of 34 variables.

3.4. Results of quantitative analysis

3.4.1. Rank frequencies and descriptive statistics of EPI barriers

Table 2 shows the descriptive statistics and ranking of the barriers to expanded programs on immunization. A graphical version is displayed in **Figure 2**.

Table 2. Summed rank orders.

"EPI Barriers"	Summed rank order	Percent ranked (1)	Percent ranked in top 3	Percent ranked in top 5
1. Vaccinators are fewer in numbers (Qty)	68 (1)	63	93	98
2. Cold chain problems	96 (2)	23	83	98
3. Awareness problems	102 (3)	10	63	98
4. Biometric mobile software system problem	131 (4)	5	30	95
5. Communication gap problem	149 (5)	0	23	78
6. Misconceptions problem, non-availability of reward and punishment system	167 (6)	0	3	13
7. Capacity building problems	168 (7)	0	5	10
8. Ice-lined refrigerators (ILR) Problem	170 (8)	0	3	5
9. Refusal cases problem, less number of LHWs, and LHV problem	177 (9)	0	3	5
10. Legislation problems	231 (10)	0	3	10

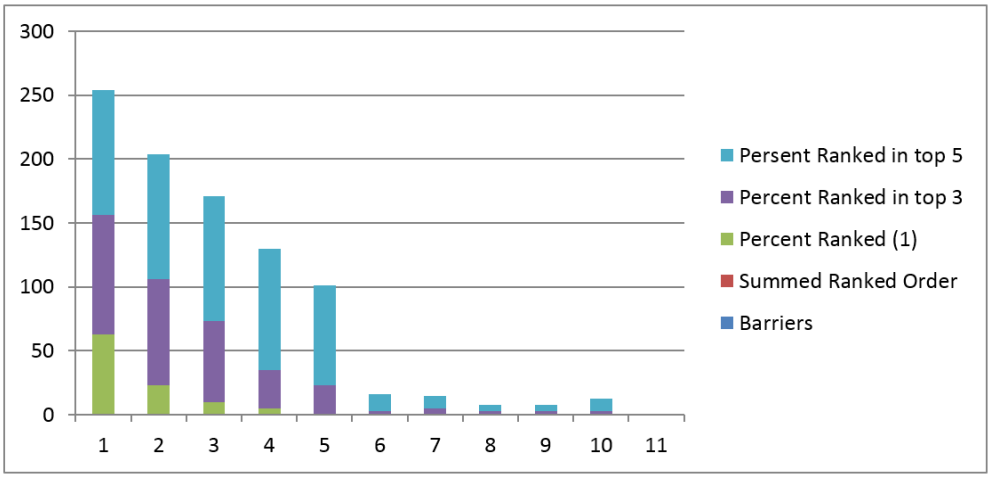

Figure 2. Graphical display of **Table 2**.

The summed rank order of each barrier was calculated by ∑ (Frequency and Rank) following Pulling et al. (2002). The highest value results in the lowest ranking (10), while the lowest value results in the highest ranking (1). **Table 3** shows that the barriers of EPI ranked differently from each other. Kendall's *W* is 0.706, and the chi-square is 282.430. The *P*-value (<0.01) shows that significant difference among the categories of barriers.

Table 3. Kendall's coefficient of concordance.

Kendall's *W*	Chi-square	df	Sig
0.706	282.430	10	0.000

Note: Kendall's coefficient of concordance, a non-parametric test for rank differences among EPI barriers.

The result of the barrier is that "vaccinators are less in number" and "cold chain problem" are (summed rank 68 and 96, respectively) significantly different from each other. **Table 2** shows that "vaccinators are less in numbers" is a barrier that is ranked at the top one among ten barriers and ranked at the top among the three ranking and five ranking columns. **Table 2** also shows that in the top five rankings, "the vaccinators are less in numbers, cold chain management of the vaccines problem and awareness of the community problem" have the same percentage, i.e., 98%. The barrier "legislation problem" is at number ten in the top ten rankings. The barrier "awareness problem" is number three in the top three rankings.

Table 2 shows that people have given almost equal weightage to the top three barriers: "vaccinators are short in numbers, cold chain management problem, and lack of awareness about the non-vaccination issues."

4. Discussion of results

Several economic, social, and administrative barriers were identified in qualitative and quantitative analysis. However, the top five regulatory hurdles have been considered the most important. We discussed these five most critical administrative barriers.

4.1. Vaccinators are fewer in numbers according to their population size (quantity of vaccinators)

The union council's population is increasing daily, but vaccinators remain one. According to the WHO policy, one vaccinator should exist in 20,000 populations. However, in Pakistan, conditions are different; the population of the union councils has doubled or tripled. However, vaccinators are alone till now, due to which population remains uncovered, and children remain defaulters in the non-registered population. Vaccinators must be recruited locally, and their training should be primarily for National Immunization Days (NIDs). There is also a need for female vaccinators as the demand for vaccinators is increasing daily. It is also mandatory that proper recognition and importance should be given to vaccinators in the immunization plan of the government (Jalloh et al., 2019; Samal et al., 2021).

4.2. Cold chain of vaccines

It is mandatory that during transportation, the temperature range of vaccines should be between 2–8 °C (Chandrasekaran et al., 2006; Zaidi, Riaz, et al., 2020). It is necessary to check the vaccine vial monitor (VVM) before opening the vial to see whether it is damaged or intact. VVM is a vaccine vial monitor which tells how much the vaccine is destroyed by heat. VVM contains a heat-sensitive material that responds quickly to anger; it is changed to darken when exposed to heat, and when the

temperature constantly rises, the color of the VVM becomes dark. It depends upon the time and temperature which leads to the darkening point with time (Ross et al., 2020). All these requirements are needed at every step, from the national to the global level. This system prevails throughout the country. Vaccines are usually transferred through air transport from the manufacturer to the cold stores, and the temperature must be between 2–8 °C (Sun et al., 2021). Vaccines are important health tools that have saved about three million lives yearly (Hadjipanayis et al., 2020). Due to this importance, the health community has made it possible for children around the world to receive the vaccine. It has created an additional Burdon on already available old cold chains and other equipment. According to WHO rules and manufacturer guidelines, all vaccines should be kept between 2–8 °C except the oral polio vaccine. However, the cold chain may deviate from this range, which may lead to freezing temperatures, and this could result in the loss of tetanus, pertussis, diphtheria, influenza type B, hepatitis B, and inactivated poliovirus vaccine potency and efficiency (Jean-Jacques and Bauchner, 2021). UNICEF spent a considerable amount, which is almost 38% of the US $638 million, on vaccines. That is being frozen on accidental essential or freeze sensitivity of the vaccines in 2021 (UNICEF, 2006; WHO, 2022b).

4.3. Awareness problem of the parents and community

It is a settled principle among health professionals that the participation of the community is mandatory to resolve any health problem faced by the community (Herman et al., 2019). Participation in the community is necessary to change the attitude of people with health issues and diseases and educate people about any topic in the community. The partnership means giving ownership to the community (Saenz, 2021). A cross-sectional survey level in the northern province of Khyber Pakhtun Khwah (KPK) revealed that there is no motivation among people about vaccination and no information about vaccination, which leads to immunization failure (Shah et al., 2019). Another survey conducted in Karachi shows that deficient immunization coverage is related to less knowledge in the community about vaccination (Kazi et al., 2021). The field staff believes that despite having many vaccines with them, we cannot vaccinate many people due to people's attitudes towards them and the vaccine. They suggest that the television (TV), Radio, and the social media should be used to change the community behavior regarding vaccination. Some religious factors should be discussed on TV and Radio, which can positively affect the attitude of the community (Böhm et al., 2019; Ngonso and Chukwu, 2021). The project can enhance the community's capacity and knowledge to the highest level by maximizing the participation of the population (Wallerstein et al., 2017).

4.4. Biometric Android mobile software system

Globally, vaccination coverage has been increasing daily; however, there is always a need to formulate new procedures and technologies to enhance the coverage of EPI. Among such efforts, mobile technology is one of them (Xie et al., 2021). There has always been a need to develop new technology to cover hard-to-reach areas (Odone et al., 2021). Health department officials widely use mobile technology and smartphones to address health-related issues in developing countries 53. Smartphones

are used for the identification, prevention, reduction, and protection from diseases (Debon et al., 2019). Smartphones are also considered beneficial in hard-to-reach areas. It can lead to in-time information to improve case management and achievement of quality, validity, and reliability targets (Kazi et al., 2021; Odone et al., 2021). To obtain MDGs, WHO and UNICEF have recommended using smartphones to develop countries and improve a central strategy for immunization in hard-to-reach areas at the district level (Olusanya et al., 2022). The e-VACCS works in conjunction with an Android application. Child and infant records are automatically updated on the Smartphone with a single click (Zaidi, Shaikh, et al., 2020).

4.5. The communication gap between higher authority and EPI staff

Due to the lack of proper implementation and monitoring mechanisms, 58% of children remain unimmunized (Yazdani et al., 2021). The EPI report depicts many differences in coverage rates due to the different social conditions of the community. Irrespective of the fact that there are equal services available, the coverage rate is not similar in every society (Peck et al., 2019). Coverage reports created from the health center's evaluation, either from EPI cards or verbal history, are not accurate (Danovaro-Holliday et al., 2021). Vaccination quality and coverage can be increased with the proper monitoring and evaluation of the campaigns and pre-campaign activities (Schumacher et al., 2021). The field staff faces many problems, especially the non-supportive behavior of the supervisory team and facilities in vehicles and other supplies. Close monitoring and solving the problems of field staff are essential factors that can be used to increase immunization coverage (Burlea-Schiopoiu et al., 2022; Cohen, 2019; Palazzo et al., 2022).

5. Conclusion and policy implications

Based on data from health professionals, this study concludes that the implementation of the EPI program is facing many administrative barriers that must be presented to higher authorities to improve the implementation of the EPI program. As the structure and working of this program are identical across the country, following the barriers identified in the District Vehari as a case study, changes in the policy and implementation procedure will bring overall improvement in the vaccination process throughout the country and hence will help in the achievement of sustainable development objectives of health and wellbeing. Based on the research findings it is recommended that:

1) Health service providers, managers, policymakers, and international organizations (i.e., WHO, UNICEF, etc.) take steps towards increasing the number of post of vaccinators to make it easy for every child to vaccinate.
2) More funds should be allocated as the EPI program is facing many economic and financial issues.
3) There is a need to focus on social awareness. The community feels reluctant to get involved in the EPI program. People are mostly unaware of the benefits of the EPI program, but community ownership and involvement are the core elements for the successful implementation of this program.
4) Health education should be included at the primary level so that less educated

persons, especially females, are aware of the importance of vaccination. There are no proper arrangements for the health education of the community.

5) Cold chain maintenance should be improved as it is another main barrier to this program. The leading causes of this barrier are load-shedding and periodic tripping of the electrical cord, which destroys the cold chain and reduces the efficacy of vaccines.
6) Management and administrative styles should be modified. The communication gap between the supervisors and field vaccination staff is the barrier of utmost attention. The management style is autocratic and authoritative, and decisions are imposed without knowing the practical implications. Authority should play an active role in creating harmony with coworkers for the successful execution of this EPI program.
7) Information technology skills of the vaccinators should be developed through training and workshops. Android mobiles are provided to vaccinators, but they don't have the requisite skills to use these mobile applications, and due to their complications, they create many problems. There is no integration between local administration and the health department to facilitate the registration of a newborn child as a red alert in an Android application for a vaccination program. Integrating the NADRA and the EPI program could have produced better results.
8) The community should play its role. The community is unaware of the benefits of vaccination and has a sense of ownership toward vaccine-preventable diseases. Many types of religious beliefs are present in society, and parents are reluctant to vaccinate their children. There are no proper arrangements from the Government or administration to deal with the EPI refusal cases, and children remain unvaccinated. Due to these unvaccinated children, the whole community remains at risk of diseases. So, effective awareness campaigns must be launched to give the community ownership of the EPI program.

Limitations and future research directions

This research has only identified a specific set of interlinked barriers, and coordinated efforts are needed to address these barriers. Like other studies, this research is not free from limitations. The data gathered is wholly and exclusively based on the practical knowledge of health professionals. However, the individuals' practical knowledge and experience may differ in different areas of the country. As this research is directly linked with government EPI officials, it is quite possible that some officials had not provided information with full confidence due to some job-related restrictions and reservations. This study is exploratory, and no hypotheses were made and tested; future researchers may determine whether hypotheses and theories can be developed from this exploratory data (Hullman and Gelman, 2021). Moreover, this study was based on a specific health-related issue in a particular region of Pakistan. Future research may focus on other healthcare issues and the related managerial implications (Burlea-Schiopoiu and Ferhati, 2020). Future research may also examine their impact on the different economic activities in the region, including sustainable tourism. Future studies may use artificial intelligence-based models (e.g., ANN, etc.) for the identification of the critical factors.

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