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Short Communication

## Navigating Pakistan's immunization landscape: Progress and pitfalls

Muhammad Fawad Ashraf<sup>1,\*</sup>, Safi Ur Rehman Daim<sup>1</sup>, Hafsa Fayyaz<sup>1</sup>,  
Muhammad Aizaz Ashraf<sup>2</sup>, Maham Ashraf<sup>1</sup>

<sup>1</sup> Department of Internal Medicine, King Edward Medical University, Lahore, Pakistan

<sup>2</sup> Department of Internal Medicine, Nishtar Medical University, Multan, Pakistan



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## ABSTRACT

**Objectives:** This study aims to assess the impact of the 2022 floods in Pakistan on the incidence of vaccine-preventable diseases (VPDs) in flood-affected regions, specifically focusing on areas with traditionally low vaccination coverage.

**Design:** Weekly incidence data of VPDs from September to November 2021 and 2022 were collected and analyzed for the provinces of Sindh, Khyber Pakhtunkhwa, and Baluchistan. The study compared year-on-year changes in disease incidence to evaluate the effect of the floods on disease burden.

**Results:** The analysis revealed significant increases in the incidence of various VPDs in the flood-affected regions compared to the previous year. Diseases such as pertussis showed a 171% increase, while mumps exhibited nearly a 1000% increase in reported cases. Other diseases including polio, diphtheria, neonatal tetanus, measles, chickenpox, and rubella also experienced substantial rises in case numbers. Concurrently, cases of lower respiratory tract illnesses and diarrheal diseases in children under five years old surged notably.

**Conclusions:** The findings underscored the failure of relief and healthcare efforts in managing vaccine-preventable diseases in flood-affected areas of Pakistan. The study highlights an urgent need for targeted intervention strategies, including enhanced immunization drives and healthcare infrastructure improvements in vulnerable regions. The post-flood scenario presents a critical opportunity to address existing challenges in vaccination coverage and to mitigate future disease outbreaks through comprehensive public health initiatives.

Vaccines are biological preparations that provide active immunity against a specific infectious disease [1]. A total of 31 diseases can be prevented by vaccines. Deaths that occur due to diseases that can be prevented by vaccines are termed as vaccine-preventable deaths and those diseases are termed as vaccine-preventable diseases [2]. Vaccine development has a long and studied history. Smallpox was the first disease against which immunization efforts through artificial inoculation are on record. Since its early days, various other vaccines have been developed, successfully implemented on a large scale, and led to a decrease in the incidence of major diseases that had caused much morbidity and mortality in the past [3]. According to the World Health Organization (WHO), childhood vaccinations will prevent 4 million deaths each year in 2020. Through concerted vaccination efforts, smallpox has been eradicated from the world and other diseases have seen huge decreases in the number of their victims. An Expanded Program of Immunization (EPI) was established in 1974 by the WHO to initially counter and control six common and deadly diseases, including measles, diphtheria, polio, tetanus, tuberculosis, and whooping cough [4]. As the program developed and further research took place, other vaccines were added to the

roster. The program was a huge success and has been adopted and implemented by almost every country [5].

Since its independence in 1947, Pakistan, as a developing country with a primordial health system, has struggled with infectious diseases. In 1978, Pakistan started its own EPI. Since then, efforts by the health care community and the resolve of successive governments have seen a large decrease in the number of vaccine-preventable diseases [6]. This has also been helped by the improvements in the health care system of Pakistan and by the increase in the living standards of people and the urbanization of the population of the country. Indeed, a greater percentage of the population of Pakistan now lives in the cities and has better access to health care facilities [7].

Although improvement has been made in decreasing the number of vaccine-preventable diseases and Pakistan has come a long way in this regard, problems remain. The rate of improvement does not match that of the rest of the world and there is a significant gap in the expected and planned reduction of disease burden and the observed results. Pakistan has the third highest burden of childhood mortality in the world. For example, the world average for deaths of children aged less than 5 years

\* Corresponding author.

E-mail address: [fawad1110@gmail.com](mailto:fawad1110@gmail.com) (M.F. Ashraf).

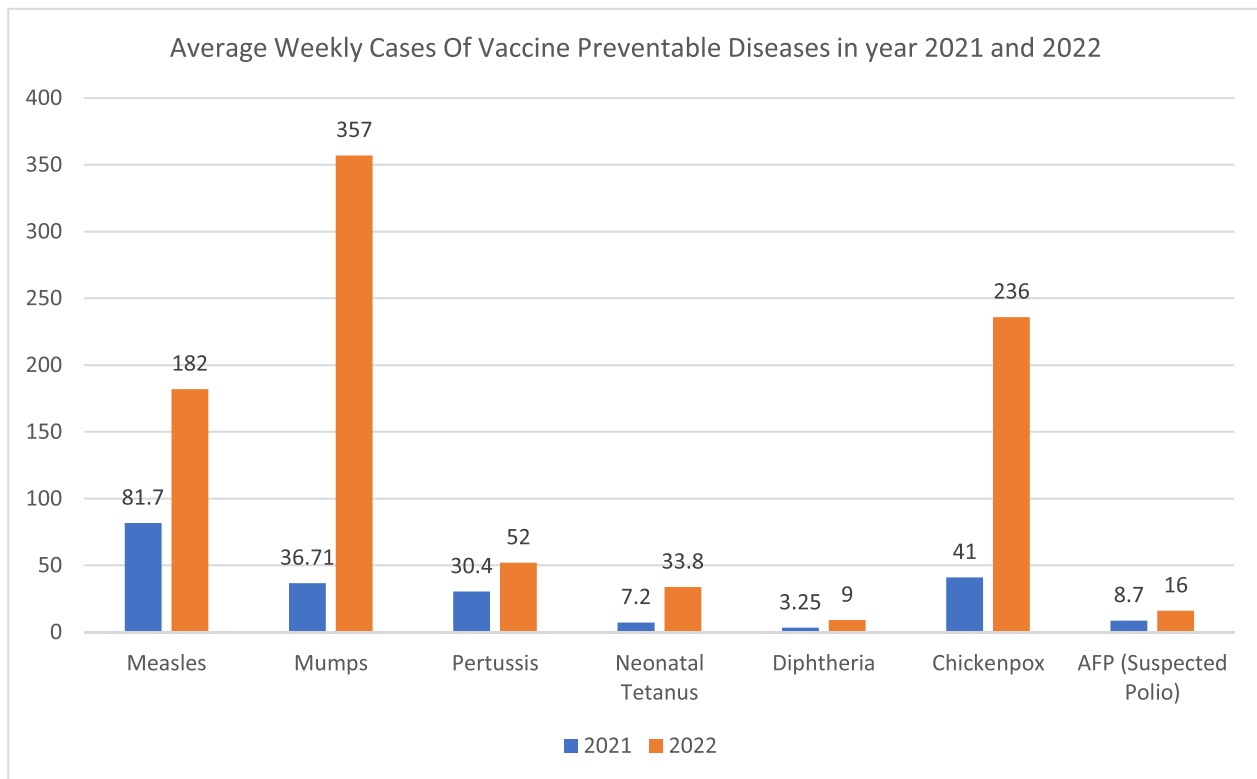
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**Table 1**  
Year-on-year increase in vaccine-preventable diseases.

Number	Vaccine-preventable disease	Weekly average cases in 2021	Weekly average cases in 2022	Percentage increase in cases, %
1	Measles	81.7	182	222
2	Mumps	36.71	357	972
3	Pertussis	30.4	52	171
4	Neonatal tetanus	7.2	33.8	469
5	Diphtheria	3.25	9	276
6	Chickenpox	41	236	575
7	Acute flaccid paralysis (suspected polio)	8.7	16	183



**Figure 1.** Average weekly cases of vaccine-preventable diseases in the years 2021 and 2022. AFP, Acute flaccid paralysis.

as a percentage of overall deaths is 8% [8]. In Pakistan, this number is as high as 81% [9]. Despite the efforts, a large 70% of childhood deaths are due to infectious diseases. Vaccination coverage in Pakistan is also a cause of concern, although the government officially claims to have achieved 80% vaccination coverage, the Pakistan Demographic Household Survey 2012-2013 showed vaccine coverage to be only at 53.8%. Other studies corroborate this and put the number somewhere between 50% and 75%.

Several factors are responsible for Pakistan's inefficient immunization efforts. Pakistan remains a predominantly rural society with the majority of the population living in villages. Health care exposure and reach within these communities are limited. Although urbanization has progressed and generally improved the situation, it also had unwanted consequences. Unplanned urbanization led to the creation of slums, where inadequate health care access has worsened the situation [10]. This can be demonstrated by the polio cases in Pakistan, reported in the rural areas of Baluchistan and Khyber Pakhtunkhwa and in the unplanned slums of Karachi and Peshawar cities [11]. Not having access to health care leads to several issues. This leads to poor surveillance and unreliable data. The lack of diagnostic confirmation leads to underreporting of the diseases. This leads to the misallocation of resources. The absence of these resources means that there is a significant gap in what the im-

munization program requires for the burgeoning population, what is available, and, thus, what can be achieved.

Health care in Pakistan is a constitutional right and, thus, universal health care is available for every individual who seeks it. Resources allocated to it, however, are limited; thus, the care provided is often influenced by this. This same dynamic also plays in the immunization program. The program is funded by the Government of Pakistan, although the WHO and international organizations also provide funds for it. The 18th amendment in the constitution of Pakistan, signed into effect in 2010, made health care a provincial subject. Immunization programs were shifted to the provincial health care departments. The vaccination drives, thus, became non-uniform. Data suggest that a direct link became the change and areas in specific provinces reported an increase in cases of vaccine-preventable disease after 2012, particularly, in Baluchistan and Khyber Pakhtunkhwa [12].

The lack of education, especially maternal education is an important factor. There is a lack of effective health care infrastructure and the integration of an EPI into the existing one has proved a challenge. In addition, vaccine hesitancy and cultural resistance are a major obstacle [13]. Religious clerics have run a concerted campaign against the perceived effects of vaccines and hold considerable influence in several regions within Pakistan, particularly, the rural ones [14]. Rural-predominant

regions of Pakistan, Interior Sindh, Baluchistan province, and districts of Khyber Pakhtunkhwa, particularly, those bordering Afghanistan, are the worst ones in terms of vaccine penetrance and vaccine coverage.

Pakistan faced a large environmental disaster in the summer of 2022 in the form of floods [15]. Regions of Pakistan received up to six times the normal amount of monsoon rain. Pakistan's manipulation of river and canal systems for irrigation purposes and the artificial embankments built for this purpose meant that the rainwater could not find its way back to the natural waterways and flooded a significant proportion of the country. A total of 33 million people and up to 100 thousand km<sup>2</sup> of land area were affected. The flood water stagnated, leading to difficulties in communication with these parts and forcing people to live away from their homes. Areas of interior Sindh, East Baluchistan, northwestern Khyber Pakhtunkhwa, and parts of southern Punjab were affected. Naturally, this also posed health care problems with diarrheal and infectious diseases in particular flourishing [16].

With reports of an increase in vaccine-preventable diseases after the floods, we studied the data. The National Institute of Health, Islamabad, Field Epidemiology and Disease Surveillance Division publishes weekly data on the incidence of infectious diseases in Pakistan [17]. We analyzed these weekly reports, added weekly data on the incidence of vaccine-preventable diseases in the flood-affected provinces of Sindh, Khyber Pakhtunkhwa, and Baluchistan for September, October, and November 2022, and calculated the weekly average of reported cases of individual diseases for these 3 months. We did the same with the data for 2021 for September, October, and November, calculated their weekly average, and compared the year-on-year data. The results we observed were worrying. We collected data for the diseases that are part of the EPI in Pakistan. Each disease saw an increase in its cases. The smallest rise was seen in the cases of pertussis, with a 171% increase, whereas the greatest rise was seen in the cases of mumps, with almost a 1000% increase in its cases year on year. Other vaccine-preventable diseases such as acute flaccid paralysis (incidence), diphtheria, neonatal tetanus, measles, chickenpox, and rubella also saw large increases in their numbers. Cases of lower respiratory tract illness in children aged less than 5 years and diarrhea cases also saw a large jump in their year-on-year comparative analysis. The data conclusively demonstrated the failure of relief and health care efforts in the flood-affected region and the need for immediate intervention (Table 1 and Figure 1).

Although the data reported paints a worrying picture, it also represents a golden opportunity. The regions affected by the flood, i.e. areas of interior Sindh, East Baluchistan, northwestern Khyber Pakhtunkhwa, and parts of southern Punjab, are reportedly those that have traditionally suffered from low vaccine coverage. This presents a unique opportunity for the Government of Pakistan, Pakistan's health care community, and international agencies. A comprehensive and concentrated strategy and campaign at this stage can bring about great results. Government agencies, non-governmental organizations, and international organizations are currently working in these areas to organize humanitarian efforts and have developed positive rapport with the local population. If efforts are made to properly document the flood-affected region, then immunization drives are organized for them. There is a good chance to dispel the negative perception against vaccines, improve vaccination education, increase vaccine penetrance, and bring about a definite change in this regard. Although the fight for a decrease in vaccine-preventable deaths is long, this is one battle can prove to be decisive and turn the tide of the war in our favor. What is important, however, is timely interven-

tion and, for this, awareness needs to be raised. This article is one such effort to direct attention toward the problem and the need for action. Only through timely comprehensive effort could success be achieved.

## Declarations of competing interest

The authors have no competing interest to declare.

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## Author contributions

Study design and illustrations: Muhammad Fawad Ashraf. Data collection, writing: Safi Ur Rehman Daim. Writing: Hafsa Fayyaz. Data analysis: Muhammad Aizaz Ashraf. Supervision and writing: Maham Ashraf.

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