Pakistan: country report on children's environmental health

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Review

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Pakistan: country report on children's environmental health

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Abstract: Pakistan is a developing country with an estimated population of 220 million, and among them 34% are children. Due to the lack of a proper health care system, particularly in rural areas, children are prone to many environmental hazards. This paper reports about the different environmental health issues faced by children in Pakistan and was presented at the Regional Meeting on Children's Environmental Health at the Chulabhorn Research Institute, Bangkok, Thailand in May 2019. Pakistan is among those countries where polio is still present due to misconceptions, hard-to-reach areas, war zones, political uncertainty, etc. Extensively drug-resistant typhoid is broadly spreading in Pakistan, and this is a very serious concern over antibiotic failure around the world. Pakistan was long considered a region with a low prevalence of human immunodeficiency virus, but now the disease is spreading at an alarming rate. Globally, Pakistan has the third highest burden of maternal, fetal and child mortality. In the last 10 years or so, around 10,000 cases of dengue have been reported with around 800 deaths, including children. Other issues related to children's environmental health in Pakistan include cholera because of poor sanitation and hygiene, respiratory disease due to pollution, exposure to pesticides, diarrhea, occupational hazards as a result of child labor, etc.

Keywords: Asia Pacific; children; environmental health; Pakistan.

Introduction

Pakistan is a country spread around 800,000 km^2, sharing its land border with India to the east, China to the northeast, Afghanistan to the west and Iran to the southwest. Pakistan also has a 650-mile marine border along the Arabian Sea and Gulf of Oman to the south. It has a population of over 200 million. Pakistan has three main geographic areas: Indus plain, Baluchistan Plateau and the northern highlands.

The climate of Pakistan is particularly diverse, with four seasons: a cool winter season from December through February; a hot, dry spring from March to May; a monsoon season from June through September; and the retreating monsoon period of October and November. Pakistan is a sub-tropical country and a hotspot for many vector-borne diseases.

Children's environmental health issues

Human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS)

Pakistan was long considered a region with a low prevalence of HIV, but now the disease is spreading at an alarming rate. In 2017, more than 20,000 new cases of HIV-positive were reported and now Pakistan is the second country in terms of incidence of HIV-positive cases (1).

Initially, only drug abusers and sex workers were infected but since April 2019, an outbreak occurred in the province of Sindh. Initially, few cases of HIV-positive were reported, but now it is endemic. Up until 16th May, 2019, screening of 14,810 individuals has been done and 534 turned out to be positive for HIV. This brings the total to about 3.6% of the population. What is most alarming is that more than 70% of the infected population are children. The most affected group is children 2–5 years of age, followed by those 6–15 years of age. In this outbreak, the youngest infected individual was even less than a month old, while a 70-year-old was the oldest one. Fifty-five percent of HIV-positive individuals are between 2 and 5 years of age, and 18.7% are 6–15 years old (2, 3). Recent reports have shown a further increase in the number of HIV-positive individuals (4, 5).

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In Larkana district of Sindh province, the Government has set up screening camps in different hospitals, and a treatment facility has been set up at the Shaikh Zayed Children Hospital Larkana. The exact cause of this issue is not yet identified but it is believed that it could be the use of a single needle and syringe on multiple patients by non-qualified health care practitioners or quacks (2). As per UNAIDS data from 2018 and before this outbreak, the number of HIV-positive children was negligible and only 3500 children (0–14 years of age) were reported to be HIV-positive throughout Pakistan, while in previous years new incidences of HIV have also not been significant.

Extensively drug-resistant typhoid (XDR)

For the last few months, extensively drug-resistant (XDR) typhoid has been broadly spreading in Pakistan, and this is a very serious concern over antibiotic failure around the world (6). Earlier cases were reported in late 2016 in Hyderabad, Sindh. Those who visited Pakistan were also found to be positive for the disease in the USA and UK (7). In 2019, it spread to multiple cities in Pakistan but mainly the largest metropolitan city, Karachi, was affected. Over 96% of the cases were reported in Karachi and Hyderabad. Most of the untreated health issues from different parts of Sindh province come to Karachi or Hyderabad, as these cities have better health care facilities and laboratories. Other cities where laboratories are not up to the mark may fail to diagnose this strain.

From November 1, 2016 to May 05, 2019, a total of 10,799 typhoid fever cases were reported from different districts of Sindh province. Out of these, 7187 were found to be XDR typhoid cases. The drug-resistant cases are mostly reported from Karachi and Hyderabad district (6). Around 70% of the cases were reported in Karachi (n = 5051), 24.65% (n = 1772) in Hyderabad district and 5% in other districts in the province (n = 364). The circulating XDR strain of *Salmonella typhi* haplotype 58 was resistant to first- and second-line antibiotics, as well as third-generation cephalosporin. Informal reports of XDR typhoid cases occurring in other parts of Pakistan were made and required further verification.

In Karachi, the XDR typhoid cases were reported mostly among children and the greatest number (1055 = 21%) of the XDR cases were reported in the 3- to 4-year age group. Children of ages 1–2 years, 5–6 years and 7–8 years were the second, third and fourth most effected age groups, respectively. The overall attack rate was 25/100,000 population. The highest attack rate was found in the 3- to 4-year age group (78/100,000), followed by the 1- to 2-year age group (67/100,000). Males had a higher attack rate (30/100,000) as compared to females (6).

In another metropolitan city, Hyderabad, Sindh, molecular analysis using polymerase chain reaction (PCR) on extracted DNA from 55 water samples collected from community taps showed that *S. typhi* DNA was detected in 12 (21.8%) samples (6). The bacterium is frequently transmitted by contaminated water and food and tends to spread in areas with poor sanitation. The World Health Organization (WHO) says the risk of acquiring XDR typhoid in Pakistan is high because of insufficient access to clean water, and poor sanitation and hygiene. Inappropriate use of antibiotics prescribed by non-qualified doctors or quacks, self-medication, and easy availability of medicine from medical stores without any prescription are the main causes of developing resistance. The condition in Sindh province is alarming. A senior microbiologist reported that the XDR strain is reported in one in three blood samples from typhoid fever patients.

The risk of XDR *S. typhi* at the national level is considered high in Pakistan due to insufficient water, poor sanitation and hygiene (WASH) practices, low vaccination coverage and limited surveillance for typhoid fever. The fact that antimicrobial-resistant (AMR) *S. typhi* confirmatory testing and antimicrobial susceptibility testing are only conducted by major laboratories and tertiary-care hospitals is another priority consideration in terms of risk (8). Pakistan began a vaccination campaign in February using a recently approved formulation that, for the first time, works in young children and triggers longer-lasting immunity than older versions. The Bill & Melinda Gates Foundation in Seattle, Washington, is funding the campaign, which aims to administer 200,000 doses of the new vaccine (9).

Polio

Pakistan is one of the countries in the world where polio is still present despite implementation of heavy measures to combat it. From 1988, when the global polio eradication program was begun, the polio virus was present in 125 countries resulting in paralysis of 350,000 people a year. Due to the campaign against polio, the number of polio cases decreased by <99% and today only Afghanistan and Pakistan are the countries where wild-type polio is found (10). Conflict, war zones, political uncertainty, security reasons, killing of the polio workers in the field, populations in hard-to-reach areas, improper health care systems, myths, rumors, poor infrastructure, etc. are the main hurdles in complete eradication of the disease. There

are different misconceptions about the polio vaccine in Pakistan. Some people think that the polio vaccine is not Islamic (haram), it produces impotency or it is sub-standard (11). So far in 2019, a total of 15 polio cases have been reported, including one from Karachi, five polio cases from Bannu, one from Hangu, one from Waziristan, three from Lahore, one from Bajour and three from Khyber Tribal district (12). According to results shared by the National Emergency Operations Centre (NEOC), the presence of the virus was confirmed in sewage samples collected in March 2019 from the cities of Peshawar, Lahore, Karachi, Rawalpindi, Mardan, Bannu, Waziristan, Hyderabad, Kambar and Sukkur.

Five years back in 2014, the total number of polio cases was found to be 307, which eventually reduced to 54 in 2015, and then 20, 8, 12 and 15 in 2016, 2017, 2018 and 2019, respectively (12). The security condition in Pakistan was much improved by the army operation Zarb-e-Azab in North Waziristan Agency, starting in April 2014. The operation demolished the hideouts and safe havens of terrorists in the area. Presently, there is no area banned for the access of polio workers. There are certain sleeper cells of terrorists involved in the killing of polio workers. More than 100 people have been killed in such attacks since December 2012. Despite the attacks, Pakistan is determined to eradicate polio from the country. The government of Pakistan is working hard to eradicate polio from the country. The newly elected Prime minister, Mr. Imran Khan, in his message on world polio day said, "Our government is fully committed to ending polio in Pakistan. On World Polio Day, I am confident, together with our people, we will achieve a safer, healthier and polio-free Pakistan for our children".

Mortality

Pakistan is among those countries where health care facilities are worse and the health care status of children needs a closer look. Globally, Pakistan has the third highest burden of maternal, fetal and child mortality (13). The under-five rate of child mortality as per the United Nations Children's Fund (UNICEF) is 74.9 per 1000 births, which is one of the highest in the world (13, 14); but in the last few years it has been decreased from more than 120 in the 1990s and approximately 100 per 1000 births in the first decade of the new millennium. The infant mortality rate is 61 per 1000 births and the neonatal mortality rate is 44 (15). The most common causes of neonatal death are prematurity, birth asphyxia or birth trauma, neonatal sepsis/meningitis, congenital abnormalities, neonatal pneumonia tetanus, etc. For post-natal deaths, sepsis, diarrheal disease, pneumonia and meningitis are the main causes (16, 17).

Early marriages and teenage mothers are one of the main reasons of neonatal mortality. It is reported that the neonatal mortality rates for younger mothers is 79 per 1000 live births and that is one and a half-fold greater for mothers in their 20s (52 per 1000 live births) (18). Moreover, lack of education, post-natal coverage, trained staff, and environmental and socio-economic conditions could be the other factors for the high mortality rates of children in Pakistan.

Malnutrition

One of the major problems of under-developed or developing countries is malnutrition (19). One of the major causes of morbidity and mortality among children is malnutrition (20). The prevalence of child malnutrition among children in Pakistan is very high as compared to other developing nations (21). In a national survey, it was reported that in Pakistan, approximately 44% of children are stunted (chronic malnutrition), 33% are underweight (acute malnutrition), 15% are wasted (the combination of acute and chronic malnutrition) and half of them are anemic (iron deficiency) (22). Every third stunted child of the world lives in Pakistan and in some parts of Pakistan, 70% of children are stunted (23). Numerous factors are in consideration that are responsible for this problem and the most common one is malnutrition, with other factors including mother's illiteracy, younger mothers and multiple parities (24). Socioeconomic status is another factor as more than 40% of the Pakistani population lives below the poverty line. Less time between the births of babies is also an important factor (25, 26). Pakistan is among the countries in the world with the highest rates of child malnutrition, and its progress in child nutrition and health remains slower than in other South Asian countries (23). The current government is very serious about resolving this issue. In the first speech by the Prime Minister of Pakistan, Mr. Imran Khan focused on the issue of stunted growth in Pakistan along with other major problems.

Use of smokeless tobacco (SLT)

The consumption of tobacco can be in the form of cigarettes, Beeri, pipe, Sheesha, cigar and in form of smokeless tobacco products that could be Gutkha, Pan, Naswar

supari, etc. (27, 28). In South Asia, it is estimated that around 250 million people use SLT, and in Pakistan more than 13% of the population is consuming SLT products, including children (29, 30). SLT is associated with a number of oral and systemic problems and one them is oropharyngeal cancer. Oropharyngeal cancers are the most common cancers in Pakistan (31–34).

The sale of SLT to minors is prohibited in Pakistan; however, despite the law and prohibition, it can be easily available, and its consumption is not considered a taboo in some communities of Pakistan. The use of SLT results in oral sub-mucosal fibrosis, limited mouth opening, anemia, malnutrition, etc. (35). Studies show that large numbers of school-going children in Pakistan are involved in the consumption of SLT (36–39). A study in a sub-urban area of Karachi reported that 60.35% of children between 4 and 8 years of age were involved in Gutkha chewing (40). Another study reported similar results (41). Moreover, the consumption of SLT by pregnant mothers not only affects the women but also the developing fetus, as well as the baby of the nursing mothers. It is proven that use of any tobacco-related product may result in low-term birth weight, stunting, abortions, cleft lip and palate, etc. (38).

Water pollution

Like other developing countries of the world, Pakistan is facing critical water shortage and pollution. The country has fundamentally exhausted its obtainable water resources and it is considered as water-stressed and is likely to suffer water scarcity in the near future (42–44). As per international standards, around 25% of the people have access to safe and drinkable water (45). Bacterial presence is one of the main causes of water pollution in Pakistan and most of the water sources are contaminated with *Escherichia coli*, coliform, fecal coliform, etc. (46, 47). Mixing of sewage water with drinking water lines, leaked pipes and septic tanks could be the reasons for bacterial contamination (47).

Toxic metals are also present in the ground and surface water, and their concentration often exceeds the recommendation by WHO. In Pakistan, iron is one of the major pollutants of water sources. Studies revealed concentrations of iron that range from 0 to 9 mg/L, which is higher than the WHO guideline of 0.3 mg/L (48, 49). Other metals such as cadmium, chromium, nickel, lead and arsenic are present in high levels with few exceptions in the surface and ground water of Pakistan (50).

Fluorosis (dental and skeletal)

The most important source of fluoride is water. Its concentration may vary in sea water, river water, ground water, etc. Fluoride is a natural and important constituent of drinking water, but elevated concentrations in drinking water of >1.5 mg/L may badly affect human health. Long-term exposure to excessive fluoride, i.e. 1.5–4 mg/L, results in dental fluorosis, and concentrations >4 mg/L may lead to dental and skeletal fluorosis. Crippling fluorosis may occur if the levels are >10 mg/L (51). Moreover, excess levels of fluoride have an effect on the kidneys, muscular system and nervous system. Studies have shown the relationship between erythrocyte abnormalities and serum fluoride levels with excessive fluoride intake, in some cases leading to death after prolonged illness. Prolonged exposure to 10–20 mg fluoride/person/day for 10–20 years can lead to crippling skeletal fluorosis, leading to osteosclerosis, ligamentous and tendinous calcification, and extreme bone deformities (52). In Pakistan, especially in rural areas, people drink ground water from wells, and in the mountainous region spring water is widely used. The levels of fluoride are higher than the recommended levels for daily use in most parts of the country. Elevated fluoride levels result not only in dental and skeletal deformities but also have impacts on the overall health, socioeconomic status, intelligence, self-esteem, etc. (53, 54).

School-going children in Pakistan are more prone to fluorosis. Most of the schools have the availability of ground water from nearby-wells, hand pumps, streams, etc. A town called Gadap and the largest metropolitan city of Karachi reported that 53.33% of children between age group 6 and 15 years suffered dental fluorosis (55). In the northern region of the country, the rate of dental fluorosis is drastically high. In Mardan, Khyber Pakhtunkhwa Province (KPK), it was found to be 98% (56). In Mianwali, it was found that 85% of the people are affected by high levels of fluoride in ground water (56). Other parts of Pakistan show almost the same percentage of fluorosis, e.g. in Quetta. In the Thar region of Sindh Province, the levels of fluoride in water are beyond the normal limits (57), and fluorosis due to the high intake of fluoride in water is endemic where almost 30% of the population is suffering and where people have developed severe bone deformities along with dental and skeletal fluorosis. In this part of Pakistan, the underground levels of fluoride range between 13.8 and 49.3mg/L (58). Eighty-four percent of samples exceeded 1.5 mg/L (recommended WHO limit for fluoride) (59). Because of severe drought-like situation, the level of water in the wells has decreased and the concentrations of different salts, including fluoride,

have increased. Excess fluoride levels not only affect the adults and children but also the developing embryos. It is reported that exposure of pregnant women to high concentrations of fluoride have adverse effects on fetal cerebral function and neurotransmitters (60). Both dental and skeletal fluorosis not only affect the body of a person but also render them socially and culturally crippled.

Air pollution

As is the case for other countries in South Asia, air pollution is a great problem in Pakistan. Pakistan experienced the sharpest rise in air pollution levels since 2010 and now presents the highest sustained $PM_{2.5}$ concentrations (61–63). It is reported that air pollution is the cause of approximately 22% of deaths annually (63). Over a 5-year period, a study was performed in Lahore to compare the levels of fine particles with the WHO guidelines, and reported that the average annual $PM_{2.5}$ of the areas studied was 14 times higher than the WHO guidelines. The smog that covers the entire Punjab and KPK province in winters has resulted in severe respiratory issues among children and adults (64). Moreover, reports of eye, skin and other health problems are commonly reported due to the air pollution and smog (65–67).

Burning of crops, combustion of coal in brick kilns and coal power plants, and industrial emissions are some of the sources of air pollution. The sources of air pollution in Lahore are diesel emissions, burning of biomass (crop burning), coal combustion (brick kilns and coal power plants), two-stroke vehicles (motorcycles and rickshaws) and industrial emissions. The Pakistani government has taken some steps in order to manage air quality, e.g. the Clean Air Program, and has also established continuous monitoring stations.

Measles

Pakistan is among the top five countries with poor coverage against measles, and every year hundreds of children lose their lives to the disease in the country. The vaccine coverage is very poor (56–80%) against vaccine-preventable diseases (VPDs) in different parts of the country (68). It is unfortunate that despite being a part of WHO's new Global Measles & Rubella Strategic Plan 2012–2020, Pakistan still reported a large number of outbreaks and high case casualty rates due to measles (69). Only in Punjab province, around 12,000 cases of measles were reported in 2018 (6).

Dengue

Dengue is an important vector-borne viral disease of the 21st century and is regarded as a threat to public health, resulting in heavy socio-economic encumbrance on a large number of tropical, subtropical and temperate regions of the world (70, 71). Since 2005, dengue is an issue of concern. In the last 10 years or so, around 10,000 cases of dengue have been reported with around 800 deaths, including children (72). In 2018, a total of 3204 dengue cases were reported, from Sindh (2088), Baluchistan (69), Punjab (539), KP (332) and Tribal Districts KP (175), and Azad Jammu and Kashmir (AJK) (1). In 2019, a total of 1471 cases have been reported so far (6).

Other

Other issues related to children's environmental health in Pakistan include cholera because of poor sanitation and hygiene, respiratory diseases due to pollution, exposure to pesticides, diarrhea, occupational hazards as a result of child labor, and chikungunya.

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