ORIGINAL ARTICLE

Safe drinking water and sanitary measures: A cross-sectional study in peri-urban community of Islamabad

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Abstract

Objective: To assess sources of drinking water and its methods of disinfection, sanitary situation and waste disposal methods.

Methods: This cross-sectional study was conducted over a period of 6 months from April 2015 to September 2015 in the village of Nurpur Shahan, a peri-urban slum area of Islamabad, Pakistan. Systemic random sampling method was employed to gather data from an adult household member aged between 18 and 45 years through a structured questionnaire. SPSS 21 was used for data analysis.

Results: A total of 2,078 households were included in the study. The mean age of the participants was 31.5±8.17 years. Moreover, 1,600(77%) residents did not disinfect drinking water. Boiling was the most common 378(18.2) method of disinfection. Majority of the households 1,936(93.2%) had latrine inside their houses. The most common mode of waste disposal was burning 951(45.8%), followed by dumping 601(28.9%) and throwing away in the street 415(20%).

Conclusion: Most participants did not disinfect drinking water.

Keywords: Disinfection, Drinking water, Refuse disposal, Sanitation. (JPMA 67: 220; 2017)

Introduction

Water is imperative for existence of life. Around 748 million people worldwide drink from untreated water sources, with another 1.8 billion people drinking contaminated water.[1,2] As a result, waterborne diseases are prevalent worldwide. Studies done in different parts of the world show that waterborne diseases are a major cause of mortality and morbidity.[3] Moreover, 3.6% of the total disability-adjusted life year (DALY) global burden of disease is due to diarrhoeal diseases, 58% of which results from poor hygienic conditions and unsafe water supplies, resulting in 842,000 deaths each year. Diarrhoeal diseases are the second major cause of deaths in the children below the age of 5 years.[4] Within this age group 361,000 children die due to diarrhoeal diseases each year.[5] From the year 1991 to 2008, 1,428 outbreaks of diarrhoeal diseases were observed globally, of which 70.9% were attributable to waterborne pathogens.[6] Another major cause of waterborne diseases is poor sanitation and hygiene which provide rich grounds for pathogen growth and transmission. A study conducted in 94 countries covering all the Millennium Development Goals (MDG) indicators in 2014 showed that 2.5 billion people had poor sanitation and 1 billion people defecated in open air, emphasising a dire need for measures to be taken to improve the sanitation and general hygiene.[1] The community in our study had inadequate sanitation and water services. Due to poor sanitation system the human waste was going directly into the ravines. There was a paucity of proper waste disposal site in the community and the ones present were not properly maintained. The current study was planned to assess drinking water sources and methods of disinfection, and the sanitation and waste disposal measures in a peri-urban community. This would help to educate such localities with regards to safe drinking water and basics of sanitation.

Subjects and Methods

This cross-sectional study was conducted in the village of Nurpur Shahan, a peri-urban slum area located 15 km from Islamabad, Pakistan, over a period of 6 months from April 2015 to September 2015. The sample size was calculated by the World Health Organisation (WHO) sample size calculator keeping confidence level at 95%, prevalence of drinking water disinfection practiced 33%,[7] and absolute precision required at 3%. The questionnaire comprised 31 variables, out of which 12 were related to demographic variables, 5 were on drinking water practices, 3 were on practice on sewage system and 4 were on waste disposal. Data was collected by a group of 5 researchers who designed the project. Because of the initial poor response by the community, the researches visited more than double the households. All study personnel were trained in interviewing skills, content of

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the questionnaire and the importance of data quality. Systemic random sampling method was used for collecting the data. The first household surveyed was located north of Bari Imam. In each street, the first household was surveyed followed by 3rd, 5th and so on. Data was obtained from one household member who was between 18-45 years of age and permanent resident of Nurpur Shahan. Data was not obtained from visiting guests and residents who had moved into the community in the last one month. Informed consent was taken from all the participants. SPSS 21 was used to analyse data. Descriptive statistics were calculated. Mean and Standard deviation (SD) were calculated for all quantitative variables. Frequency and percentages were calculated for qualitative variables. Ethical approval of the study was taken from the ethics committee of Shifa International Hospital.

Results

A total of 2,078 households were surveyed. The mean age of the participants was 31.5±8.17 years. The mean number of family members was 7.3±3.54. The mean number of earning family members was found to be 1. The mean time taken to reach water source for residents not receiving water supply from the Capital Development Authority (CDA) was 1.51±3.986 minutes. Moreover, 1,588(76.4%) households depended on water supply from the government, 415(20%) on ground water and 75(3.6%) on other sources (Table-1).

Also, 1,600(77 %) residents did not disinfect their drinking water. Besides, 378(18.2%) boiled water for disinfection, 60(2.9%) used solar disinfection whereas 40(1.9%) used aqua tabs for the purpose (Table-2).

Water supplied by the government was the most common 1,719(82.7%) source of water for bathing.

Table-1: Frequency Distribution of Water Sources for the Residents of Nurpur Shahan.

Water Source	Percentage
Government water supply	76.40%
Ground Water	20%
Other sources	3.60%

Table-2: Frequency distribution of methods used to disinfect drinking water.

Methods of Water Disinfection	Percentage
Aqua Tabs	1.9
Solar disinfection	2.9
Boiling	18.2
Did not disinfect water	77

Table-3: Frequency distribution of methods of waste disposal.

Methods of Waste Disposal	Percentage
Burning	45.8
Dumping	28.9
Throwing Away in street	20
Other	5.3

Majority of the households 1,936(93.2%) had latrine inside their house. Flush system 1,458(70.2%) was the most common type of latrine used. Most of the houses 1,457(70.1%) had a proper sewerage system. Solid waste collection and disposal was done on a daily basis by 1,679(80.8%) households, while only 361(17.4%) and 38(1.8%) did solid waste collection and disposal after every 2-3 days and once a week, respectively. Most of the waste disposal 1,873(90.1%) was done by the household members themselves while only in 205(9.9%)cases household waste disposal was done by the government. Solid waste was disposed of at specific sites in the community by 572(27.5%) residents. Methods of waste disposal included burning 951(45.8%), dumping 601(28.9%), throwing away in the street 415(20%) and other methods 111(5.3%) (Table-3).

Discussion

On the occasion of World Water Day 2014, March 22nd (Friday), it was disclosed by the Ministry of Environment that 72 million people in Pakistan, i.e. 44% of the population, did not have access to safe drinking water. Pakistan's water quality ranks 80th out of 122 nations. Studies done on quality of water in Rawalpindi and Islamabad show that the water quality fails to meet the standards described by the WHO for potability, mainly in terms of its microbial characteristics and the fact that the water supply systems do not have reliable protective measures to safeguard public health.[8] Furthermore, the drainage system and water supply lines lie in close proximity increasing the risk of contamination via mixing of the two. This is more likely probable when the water pipes are of poor quality or have rusted creating openings for exchange between the pipelines. The pipe joints are more vulnerable to such deterioration and thus form a common point of mixing. Chances of contamination are further increased when a vacuum forms inside the water pipe due to usage of water pumps.

Provision of clean water is an issue in the rural and peri-urban areas. These areas suffer from multiple deficiencies, which include poor institutional capacity, poor water supply system, lack of proper sanitation and lack of public awareness.[9] Another study conducted in Latin America

and the Caribbean showed that compared to urban areas the rural and peri-urban areas had comparatively less number of households supplied with water. Availability of water-related services in such areas is also limited.[10] According to the current study, water was supplied by the CDA to 76.4% households. The houses which are not provided with water by the government have to look for alternative means. The most common alternative source of water is ground water. According to a study conducted in Bangladesh, tube wells are the main source for water in agricultural/rural areas.[11] A major problem with these alternative sources (especially ground water) is that they are easily contaminated by chemicals (organic and inorganic pollutants), heavy metals (e.g. arsenic),[12] animal waste and microorganisms, especially near industrial cities and agricultural areas which employ large amounts of fertilisers.[13] A number of studies have linked heavy metal and chemical contamination in water to diseases like chronic kidney diseases of unknown aetiology. The prevalence of chronic kidney disease of unknown aetiology is more in people who drink contaminated well water as compared to surface water as the concentration of contaminants is more in ground water.[14]

Water contamination by pathogenic microorganisms is one of the main culprits behind many waterborne diseases. These diseases are flourishing due to poor hygiene and sanitation.[15] Studies conducted in the sub-continent show a high prevalence of waterborne diseases such as diarrhoea, typhoid, hepatitis A and E.[16,17] Another study conducted in Nurpur Shahan concluded that 41.1 per cent children developed diarrhoea at least once a month.[18] There is an urgent need to devise methods for improving water quality, hygienic conditions and sanitation, if we are to curb the number of these diseases. These incidences are further raised by weather conditions like torrential rain, heavy floods and earthquakes.[19] During July-August 2010, Pakistan experienced extreme flooding, after which 130 outbreaks were reported; 88.5% of them were due to waterborne diseases.[20] Therefore, there is a need for a proper protocol to counter such developments.

With the rise in population, there has been an increase in the demand for water. However, due to decreased pure water sources and increased contamination of water sources and public water supply,[21] more and more households are receiving contaminated water. Studies have shown a direct relationship between poor water quality and waterborne diseases[8,16] and that by improving water quality waterborne disease incidence can be greatly reduced. There is a requirement to implement purification methods either at network/supply station or at household level. The implementation of water treatment techniques at household level have proven to be more effective as compared to those implemented at source. However, the reality is that very few household use any form of water purification technique. Our study showed that at household level 77% of the population did not use any form of water purification technique. A similar study conducted worldwide showed that only 33% of the total study group practised household water treatment. The household water treatment was practised in the following descending order among the various studied regions; Western Pacific (66.8%), Southeast Asia (45.4%) regions, Africa (18.2%) and Eastern Mediterranean (13.6%).[22] Boiling was the most common water purification technique used by participants in our study, followed by solar disinfection method and aqua tablets. A number of other studies also concluded that boiling was the most common method employed.[23] A study also concluded that boiling resulted in 99% decrease in faecal contamination.[22] On the other hand, another study concluded that boiling was an ineffective method as it could not prevent contaminants from entering the water after boiling.[24] Apart from water treatment, safe storage of water is also essential as it protects water form contaminants after it has already been treated.[15]

Poor sanitation is another crucial issue faced by many communities. According to our study majority of the population (93.2%) used indoor latrine system, of which the most popular form was the flush system, which was used by 70.2% of the participants. A study conducted in Ethiopia showed that 52.1% were using unhygienic sanitary system and that 35.6% of the population was defecating in the open.[25] Another study done in Uganda showed that even in some urban areas (especially slums) most of the population did not have a proper sewage system.[26] The same study also concluded that lack of water was the principal reason for improper sewage system.[26] The most common form of sanitation used by the household that were using latrine system was the pit latrines. One of the major issues with using pit latrine is that many of the households did not empty the pit latrine as often as was necessary to maintain hygienic conditions.[27] Another study concluded that some households did not use any form of latrine in the house and preferred using the public washrooms.[26]

Improper disposal of solid waste increases the incidence of diseases and contributes to pollution. In our study most of the people (80.8%) disposed off their waste on a daily basis. But due to lack of government involvement waste disposal by 90.1% of the houses was done by the family members themselves. Our study also concluded that

burning and dumping were the main mode of waste disposal adopted by the people. The burning of waste results in release of toxic substances into the air, especially if it is not done properly. Dumping of waste in undesignated areas leads to unhygienic conditions. The lack of public awareness and interest by the government has to be addressed, if this oversight is to be rectified.

Despite the fact that pure water supply and proper sanitation is one of the fundamental requirements for a healthy community, most of the population does not have access to them. There is a need for active government participation in this regard. The government needs to improve the communication between different government offices, for example those dealing with water supply and those dealing with water regulation and laws. A study conducted in Brazil also found that improving the government work efficacy also improves the quality of water supplied to the people.[28] Furthermore, active and prolonged health advertisements are needed so that the people comprehend the dangers of unsafe water and unhygienic condition, and learn how to overcome them. A study showed that the usage of water purifying methods such as aqua tabs decreased by 50% after promotion was stopped.[29] A research done in Bangladesh concluded that financial issue was one of the major hurdles faced by people who had sufficient knowledge about the benefits of water purification and proper sanitation methods.[30,31] Therefore, the cost of any method implemented to either improve sanitation or drinking should be kept to a minimum so that the general people can easily afford it. A research also revealed that improving the financial condition of the community as a whole had a more positive impact as compared to improving financial condition of an individual household. This provides another avenue by which we can counter this problem.[32]

Methods to improve water quality and sanitation were not effective in areas where water availability was scarce.[33] Adequate water supply should be established in these areas, in order for such programmes to be effective.

As stated above, impure water is hazardous for health, and there are multiple ways to address the problem of unsafe drinking water and poor sanitation. In order to have a lasting impact, we need to educate the public about the consequences of drinking unsafe water, and provide methods of water treatment that are cost-effective and easily applicable. In addition, it is imperative that the government show an active interest, in order for the issue to be managed on a grander scale.

Conclusion

The practice of drinking water disinfection was less common, a major determinant of waterborne diseases. Sanitary and waste disposal practices were being followed at community disposal, highlighting the need for educating communities and informing the authorities of the situation.

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