Spatial Analysis of Environmental Health Risks: A Case of Bahawalpur District, Pakistan

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Abstract

Environmental degradation is causing serious health threats to the population worldwide. This condition is becoming worse in the developing countries. Keeping in view various environmental health problems of Pakistan, the main objective of this research article is to analyze the spatial distribution of environmental risk factors in Bahawalpur district. Data has been mainly taken from the last report of Multiple Indicator Cluster Survey (2007-2008) of Bahawalpur district, compiled by the Punjab Bureau of Statistics. First, the study exposes the geographical and demographical setting of the district including all its sub administrative units, Ahmadpur East, Khairpur Tamewali, Yazman, Hasilpur Bahawalpur Sadder, and Bahawalpur City. Second, a number of environmental health indicators have been focused. These include, use of improved water sources, household water treatment, physical access to source of water, sanitation, bacterial concentration in water, disposal of excreta, disposal of waste water, disposal of solid waste and hand washing habits. Results reveal that existing state of these indicators offer a sort of environment that is prone to a number of serious health risks. For planners and policy makers, the study suggests a set of strategies and policies to address the local environmental issues and to minimize the health risks through administrative environmental management and community participation.

Key words: Environment, Health Threats, Water Quality, Air Pollution, Sanitation and Community Participation

1. Introduction

Environment includes all the material and non-material surroundings which influence human life and all his doings. Environment is like a shopping basket as it fulfills all the

human needs. Any harmful change in environment may deteriorate human health. Though, all the environmental issues are directly or indirectly affecting human health, but water quality, sanitation, air pollution and waste disposal have immediate direct effects which cannot be overlooked in any case. Currently, Pakistan is confronting with a range of environmental problems like indoor and outdoor air pollution, lack of safe drinking water and sanitation, poor waste water and solid waste management, and unhealthy housing. All these issues are posing severe environmental health threats to population of the country. Poverty and imbalanced social and economic development are thought to be the prime causes of these environmental problems. According to National Environmental Policy 2005, almost 60 present of the total population in Pakistan have access to safe water sources, but 60 to 90 percent of these sources are contaminated accompanied with the fact that majority of people use it untreated (without filtering). Sanitation facilities are available to only about 42 percent of the total population. Nearly 45 percent of the total households do not have access to latrine while only 51 percent of households are connected to any type of drainage. Likewise, 3 percent of hazardous waste from factories and hospitals is collected while rest of it goes to open dumps or is burned openly. In terms of air pollution, suspended solid materials and gases (SO_2, NO, and CO_2) in air exceed the World Health Organization (WHO) standards by a factor of 4 to 6. Hence, as a result of the prevalence of such circumstances, 60 to 80 percent increased burden of diarrheal diseases can be attributed to poor environmental health conditions, especially to poor water quality and unimproved sanitation. Moreover, from unpublished sources it reveals that approximately 60 percent of infant deaths occur due to infectious and parasitic diseases most of which are water borne (MOE, 2005). On the other hand awareness among the inhabitants of study area about environmental health risks (EHR) is not as much as needed. In view of all these facts it appears useful to point out environmental health risk factors. Therefore, this effort has been made with the objective to illustrate and to highlight the environmental health risk factors that may cause a range of diseases and to develop environmental health risk intensity scale for various tehsils of Bahawalpur District.

2. Literature Review

Environmental health is defined by the WHO as, 'those aspects of the human health and disease that are determined by factors in the environment. It also refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect human health' (Smith et al., 1999). The strict definition of environmental causes of diseases would be all those that are not genetic. The different environmental health threats can be divided into traditional hazards which are associated with lack of development, and the modern hazards which are associated with unsustainable development. A broad definition of environmental health encompass the theory and practice of appraising and managing factors in the environment that can potentially have adverse effects on the health of current and upcoming generations (Albertini, 2001; WHO, 1999; Smith et al., 1999; C. F. Corvalán, Kjellström and Smith, 1999). Environmental health has historically focused on the prevention of contagious diseases that can spread through water, different kinds of waste, foods, insects and rodents. Although such problems still subsist, the focus of environmental health has expanded and has become more complex for several reasons. For example, environmental contaminants put in not only to infectious diseases but also contribute to

numerous persistent diseases. Furthermore, onwards from the middle of last century, historic technological progress has augmented human capability to manipulate, harm and change the environment. Rapid population growth, rising standard of living and increasing demands for environmental resources have extended the impact of humans on the environment. Environmental health, therefore, can be seen as about all the interactions and dealings of people with their environment and the health consequences of these interactions and dealings (Insel, Roth and Price, 2002). Often man is answerable for the pollution of his environment in the course of urbanization, industrialization, and intensification of other activities. Realizing this, in 1972, the United Nations Conference on Human Environment urged the importance of worldwide attention on the environmental hazards that are a constant threat for human beings (Park, 2009). Environmental health indicator can be defined as an expression of the link between environment and health, targeted at an issue of specific policy or management concern and presented in a form which facilitates interpretation for effective decision making (Smith et al., 1999). For environmental health analysis, it is imperative to choose suitable indicators because environmental health priorities vary from one country to another, especially from less developed to developed countries. WHO, under the title of 'Environment Health Indicators: Framework and Methodologies' has arranged all the possible indicators in DPSEEA framework (figure 1), which was basically devised by Corvalan (Corvalan et al., 1999; Smith et al., 1999). This framework consists of an interrelated chain of indicators namely driving forces (D), pressure on the environment (P), state of environment (S), exposure (E), and controlling actions (A) (Briggs, 1999). Driving forces include the factors that motivate and push the environmental processes involved for example, population growth, economic development, technology etc. These forces build pressure on the environment in the form of manufacturing, energy production, transport, waste release and many more. In response to the pressure exerted by these forces, the state of environment is often changed in terms of the frequency of natural hazards, the availability and quality of natural resources, and the level of environmental pollution. The resulting effects of these changes can be wide ranging and could be observed from local to global scales. When people are exposed to such environmental hazards, their health can be at serious risk of wide ranging health effects. The effects may vary in type, intensity and magnitude depending upon the type of hazard to which people are exposed, the level of exposure and the number of people involved (Briggs, 1999). Present study attempts to analyze environmental health risks at local level focusing on to the region of Bahawalpur within DPSEEA framework. The theoretical framework which it follows can be expressed as;

$$HER = f (DPSEEA)$$

That is environmental health risk is the function of interrelated environmental health indicators which mainly include DPSEEA (figure 1).
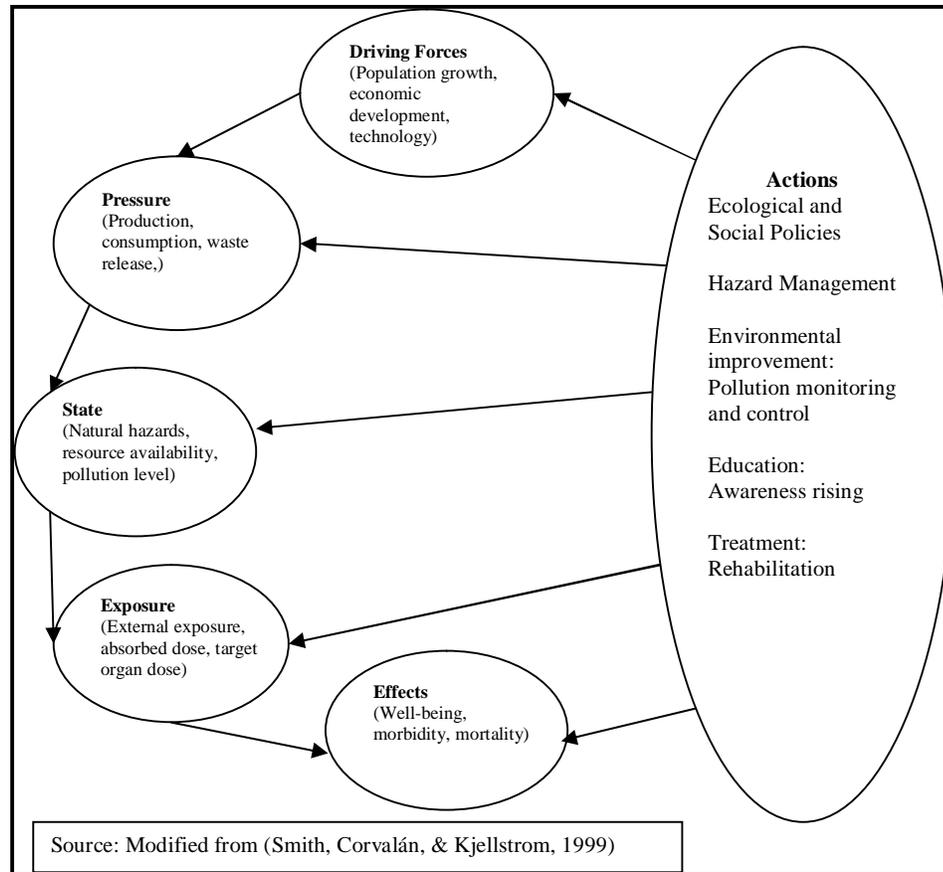
Figure 1 : DPSEEA Framework

3. Methodology

Methodology for this research is based on descriptive study design which is widely used for environmental health research. Environmental health indicator can be defined as an expression of the link between environment and health, targeted at an issue of specific policy or management concern and presented in a form which facilitates interpretation for effective decision making (WHO, 1999; Smith et al., 1999). For environmental health analysis, it is imperative to choose appropriate indicators because environmental health priorities vary from one country to another, especially from less developed to developed countries. Taking into account the appropriateness, environmental health indicators selected for current research include the following;

i. Air: outdoor and indoor air pollution, ambient air quality index and use of biomass fuel

ii. Water: access to safe supplies of drinking water, household water treatment and bacterial contamination in water

iii. Sanitation conditions: use of sanitary means of excreta disposal, disposal of waste water and solid waste, and hand washing before meal and after latrine

Data for these indicators was mainly taken from Punjab Multi Indicator Cluster Survey (MICS 2007-2008) and from the various reports of Environmental Protection Agency (EPA) Punjab. MICS surveys were initiated by the United Nations International Emergency Children's Fund to fill the data gaps. Since the mid 1990's, the MICS has enabled many countries to produce statistically sound and internationally comparable estimates of a range of indicators in the areas of health, education, child protection and HIV/AIDS. MICS findings have been used extensively as a basis for policy decisions and program interventions, and for the purpose of influencing public opinion on the situation.

4. Results and Discussion

This section deals with the investigation of current situation of three major indicators of the environment namely air, water and sanitation conditions prevailing in the study area.

4.1 Air Pollution

Air pollution as an environmental health indicator provides a measure of the state of the environment in terms of air quality and the potential exposure of people to air pollutants of health concern. The health effects of air pollution are both immediate and delayed. The immediate effects are borne by the respiratory system and the resulting state is acute bronchitis, while the delayed effects most commonly linked with air pollution are chronic bronchitis, lung cancer, bronchial asthma and respiratory allergies (Bonita, Beaglehole and Kjellström, 2006; Denny and Loda, 1986; Park, 2009; Willis et al., 2010). This indicator can also be used to design policies for actions to minimize air pollution. Outdoor air pollution was measured at ambient air quality index (AQI) while the indoor air pollution was measured by the percentage of households using biomass as a fuel.

4.1.1 Air Quality Index

AQI is a devise or plan developed for reporting quality of air on daily basis. It explicates that how clean or polluted the air is and what associated health effects may possibly be of concern for local people. Five major air pollutants are calculated for AQI which are ground level ozone, particle pollutants, sulphur dioxide, carbon mono oxide, and nitrogen dioxide (Brunekreef, 2008; Friis, 2011). EPA Punjab monitored the ambient air quality of various districts of Punjab including Bahawalpur during 2009-2010. Different commercial centers, busy roadsides and residential locations were selected to gauge actual level of pollution. The results indicate that AQI levels are quite high in Bahawalpur city consequently showing unhealthy air for population of the city (table 1). At present, Bahawalpur is the fastest growing among the cities of the Punjab and ranks as twelfth biggest city of Pakistan. Rapidly increasing population, accelerated urbanization, and expanding industrial, transport and other activities may aggravate further the prevailing situation of air quality. Thus the problem needs an immediate and serious look otherwise it can turn into a big threat for human health in the years to follow.

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Table 1: Air Quality Index of Selected Sites of Bahawalpur City

Sr. No.	Locations	Type	AQI	Status of Air Quality
1	Fawara Chowk	Busy Road Side/Residential/ Commercial	210	Very Unhealthy
2	Fareed Gate	Busy Road Side/Residential/Commercial	138	Unhealthy for Sensitive People
3	Commissioner Office Chowk	Road Side	110	Moderate
Source: Annual Progress Report 2010, EPA Punjab				

4.1.2Use of Biomass Fuel

Indoor air pollution is another striking factor contributing acute respiratory infections in young children, chronic lung diseases and cancer in adults (Ezzati and Kammen, 2001; Kumar and Varma, 2004). It is usually caused by the use of biomass fuels like wood, kerosene oil, coal or dung cake for cooking and heating. Long duration of exposure may cause serious health problems.

Data shows that in Bahawalpur district 83 % households use wood as fuel for heating and cooking. This percentage is even higher than 90% in the tehsils of Yazman, Khairpur Tamewali, Hasilpur and Bahawalpur Sadder (table 2). Bahawalpur City is the only tehsil where higher proportion (54.2%) of households uses natural gas as a fuel. Electricity, liquid propane gas, biogas, and animal dung are also being used in this area but their proportion is very low. In such state of affairs the people, specifically those who are involved in cooking activities, incessantly remain exposed to the precarious exhaust of biomass fuels and are at serious risk with regard to their health.

Table 2: Percentage of Households by Type of Cooking Fuel Used in Bahawalpur District

Area	Electricity	Liquid propane gas (LPG)	Natural gas	Coal	Wood	Grass	Animal dung	Others
Ahmedpur East	0.0	0.3	9.8	0.7	88.6	0.0	0.6	0.0
Bahawalpur City	0.3	3.7	54.2	0.0	40.6	0.0	0.3	0.5
Bahawalpur Sadder	0.0	0.8	6.7	0.3	92.2	0.0	0.0	0.0
Hasilpur	0.0	5.6	0.3	0.2	93.1	0.0	0.2	0.6
Khairpur Tamewali	0.1	2.3	0.0	1.0	95.9	0.1	0.1	0.5
Yazman	0.0	0.8	0.0	0.0	98.8	0.5	0.0	0.0
District Total	0.1	1.9	13.9	0.4	83.1	0.1	0.2	0.2
Source: MICS- Bahawalpur 2008-2009								

4.2Water Pollution

Pure, safe and high quality drinking water is an essential ingredient for public health. Much of ill health which adversely effects population efficiency, particularly in developing countries like Pakistan, might be associated to the lack of safe and purified drinking water supply. Human health can be badly affected by ingestion of contaminated water either directly or indirectly through food, and by use of contaminated water for purpose of personal hygiene and recreation (Detels, Holland, McEwen and Omenin, 2011; Park, 2009).

4.2.1Access to Safe Drinking Water Sources

Access to safe and sufficient supply of water either within house or within an appropriate distance from the house is a good indicator of environmental health to measure exposure to access of safe drinking water and the efficiency of act to recover the access. The predominant source of drinking water in Bahawalpur district is underground aquifers. However, different methods are used to pump the ground water which includes electric pumps, hand pumps, tube-wells, and turbines etc. Data reveals that hand pump is the main method of water supply in Ahmadpur East and Khairpur Tamewali, while electric pump is the chief method in Bahawalpur City (table 3). Proportion of households having piped water supply within dwelling or courtyard is extremely low in most of the tehsils, except Hasilpur and Yazman where its proportion is 22.1% and 32.2% of total households respectively. Despite this, well above 90% of the households in each tehsil have been found using some sort of improved method for water supply. Even if, table 3 depicts acceptable picture telling that collectively 98.3% households of the district have access to improved source of water supply but geographically the district belongs to water scarce and salt sink region. Ground water at most of the locations contains high amount of dissolved salts. Therefore, regardless of having access to improved method of water supply the quality of water has always been a serious issue for a vast majority of households in the district.

Table 3: Percentage of Households by Use of Method of Water Supply in Bahawalpur District

Area	PD	PC	PS	HP	EP	TW	PW	BC	% households having improved source of drinking water
Ahmadpur East	2	0	3.2	65.5	28.3	0	0	0.5	99.5
Bahawalpur City	2.6	0.3	1.5	10.9	79	1.2	0	3	98.4
Bahawalpur Sadar	7	0.2	6.3	46.1	37.4	0.7	0	1.4	99.1
Hasilpur	22.1	0.3	3.3	33.5	31.1	1.8	0.3	0.7	93.2
Khairpur Tamewali	1.9	0	0.5	63.5	33.3	0.5	0	0	99.8
Yazman	32.3	0.9	15.9	22.2	25.7	0	1.5	0.4	98.7
District Total	10.1	0.3	5.1	42	39	0.6	0.3	1	98.3

Source: MICS- Bahawalpur 2008-2009.

PD = Pipe into dwelling, PC = Pipe into court yard, PS = Public supply/stand pipe, HP = Hand pump,

EP = Electric pump, TW = Tube well/turbine, PW = Protected well outside dwelling/spring/rain water,

BC = Bottled/Can

4.2.2 Water Treatment Methods

Purification of drinking water has great meaning for the health of a community. Though the percentage of households having access to safe drinking water source seems to be satisfactory, but the overall water treatment practices are alarming throughout the entire district (figure 2). Among various water treatment methods, only 0.8% of total households boil their drinking water, 0.3% strain through cloth, 1.2% use filter, 1.4% households use stand and settle method whereas 96.1% of households make use of untreated water for drinking purpose offering themselves highly vulnerable to water borne diseases (table 4). Therefore, water borne diseases like diarrhea, abdominal cramps and dysentery are very common in the region. Awareness about the importance of the use of treated water among the people and installation of water filtration plants at proper locations can reduce the risk of water born diseases.

Table 4: Water Treatment Methods Used in Bahawalpur District

| Area	None	Boil	Strain through a cloth	Use water filter	Let it stand and settle	Add bleach/ chlorine or solar disinfection	Other
Ahmedpur East	98.2	0.9	0	0.1	0.8	0	0
Bahawalpur City	90	2.2	0	4.9	1.8	0	1.1
Bahawalpur Sadar	97.3	0.3	0.1	0.2	2.5	0	0
Hasilpur	93.9	0.7	1.8	1	2.5	0	0
Khairpur Tamewali	98.7	0.3	0.2	0.2	0.5	0	0
Yazman	98.3	0.1	0	0.5	1	0	0
District Total	96.1	0.8	0.3	1.2	1.4	0	0.2
Source: MICS- Bahawalpur 2008-2009.							
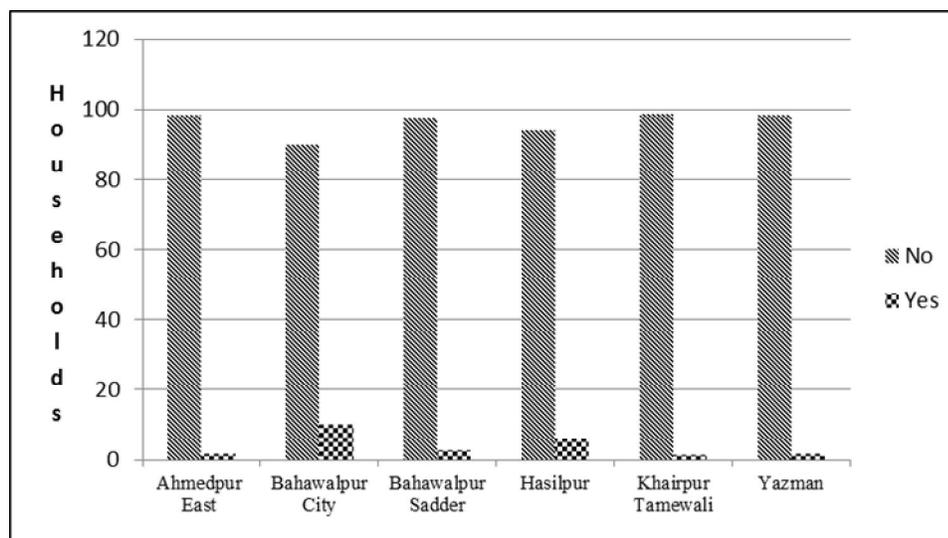
Figure 2: Percentage of Households Using Treated Water for Drinking in Bahawalpur District

4.2.3 Bacterial Contamination

Ideally drinking water should not contain any pathogenic microorganism which can cause diseases. It must be completely free from bacteria indicative of pollution with excreta. Microbial contamination, such as presence of bacteria, in drinking water is a big threat to human health. Failure to provide adequate protection, effective treatment and disinfection of drinking water may cause outbreaks of intestinal and other infectious diseases in the community (Cairncross et al., 2010; Park, 2009). Results of the study point out that almost all tehsils show bacterial contamination in drinking water, whilst highest percentage has been found in Yazman (Figure 3) making it the most vulnerable tehsil in the district toward water borne diseases. Furthermore, during the course of several previous years authors observed commonly that people living in the areas of Bahawalpur associated with unhygienic conditions remained susceptible to water born intestinal and other infectious diseases. Almost every year, specifically during rainy and humid summer period, several deaths occur just because of drinking contaminated water. This problem can be controlled effectively simply by using boiled or treated water.
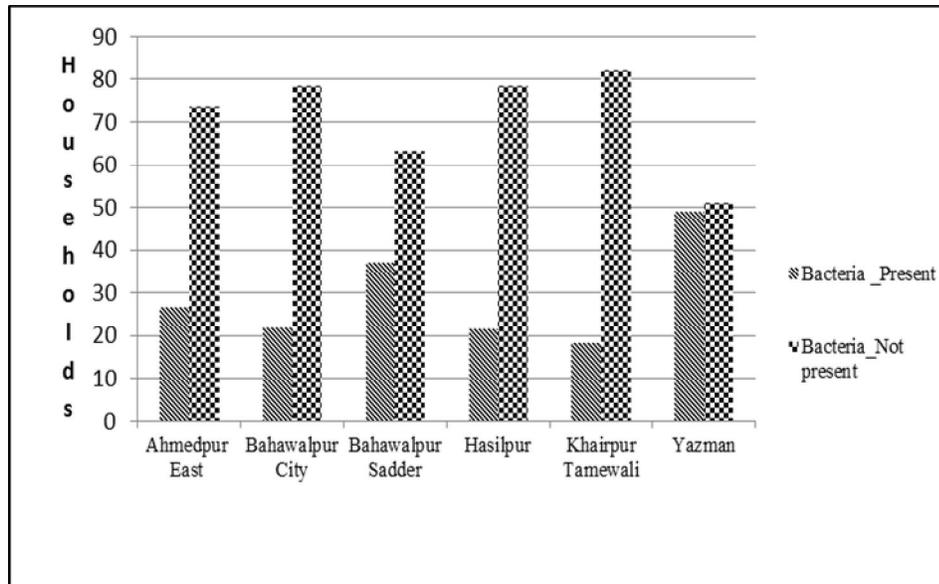
Figure 3: Percentage of Households Using Bacterial Contaminated Water in District Bahawalpur

4.3 Sanitation Conditions

Sanitation, which is one of the basic human requirements, means the promotion of health by safe disposal of all kinds of waste using safe disposal techniques. Provision of sanitation services associated with privacy, dignity, cleanliness as well as healthy environment through safe disposal techniques can improve sanitation conditions. Main components of sanitation are safe disposal of liquid and solid wastes and promotion of health and hygiene in the community (MOE, 2006). Following are the main sanitation and health risk factors considered for the study in point.

4.3.1 Excreta Disposal

Human excreta are the major source of infection and an important cause of environmental pollution. Safe removal of excreta disposal is indispensable for community health (Cairncross et al., 2010; Storti, Callier, Fry, Kleinau and McGahey, 2004; Yassi, 2001). Improper excreta disposal may cause numerous diseases including typhoid, viral hepatitis, dysentery, diarrhea, cholera and other intestinal diseases. Availability of latrine facility is used as an indicator of sanitation in Bahawalpur district, which is further divided in to improved sanitation (proper latrine) and unimproved sanitation (without latrine). Results show that, among improved sanitation, most of the households use pit latrine (26.6%) and sever pipe (18.6%), some have septic tank (9.5%) while few use public latrine (0.2%) in the district. On the other hand, almost 44.2% households do not have any latrine facility rather they use bush or fields for defecation (table 5). This condition was poor in tehsil Ahmadpur East (63.3%), Khairpur Tamewali (56.7%) and Bahawalpur Sadder (52.1%). Overall results show that Bahawalpur city, Yazman and Hasilpur do have satisfactory means of excreta disposal compared to rest of the tehsils (figure 4). However, the facilities for safe disposal of excreta are completely not up to the mark and further improvement is certainly required that may reduce health risks.

Table 5: Sanitation Conditions According to Type of Toilet Facility in Bahawalpur District

Toilet Facility		Ahmedpur East	Bahawalpur City	Bahawalpur Sadder	Hasilpur	Khairpur Tamewali	Yazman	District Total
Improved sanitation	Piped sever	8.3	56.6	5.9	16.6	7.7	13.3	18.6
	Septic tank	10.8	10.6	9.7	9.8	10.1	5.3	9.5
	Pit latrine	17.6	19.9	31.4	27	23.1	48.6	26.4
	Public latrine	0.0	0.1	0.3	0.2	0.0	0.9	0.2
Unimproved sanitation	Uncovered pit	0.3	0.2	0.4	0.8	2.0	0.0	0.5
	No facility/ Bush	62.3	10.7	52.1	45.7	56.7	31.4	44.2
	Others	0.6	10.1	0.1	0.0	0.5	0.4	0.7
Source: MICS Bahawalpur 2008-2009								
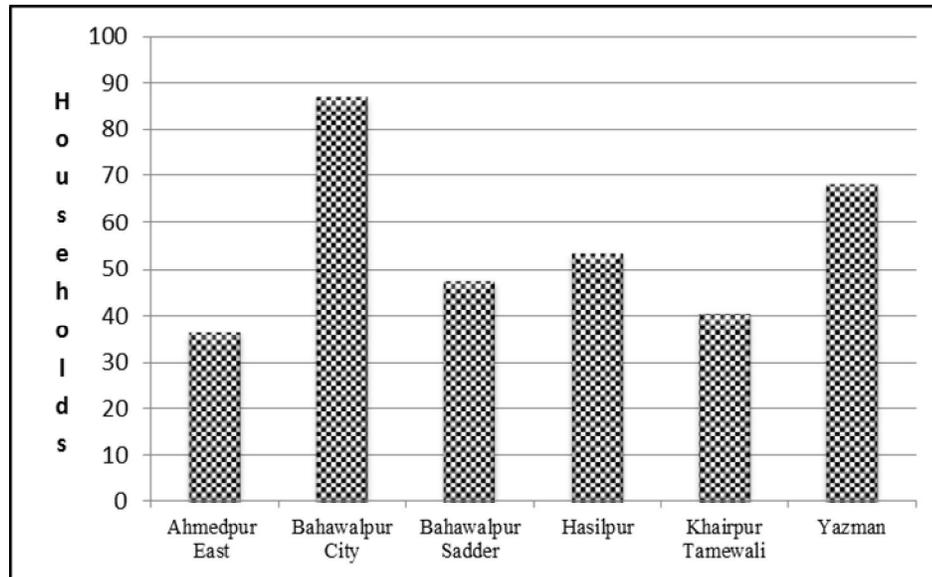
Figure 4: Percentage of Households Using Sanitary Means of Excreta Disposal in Bahawalpur District

4.3.2Solid Waste Disposal

Solid waste disposal is one of the basic indicators of environmental health. There is a deep relation between improper disposal of solid waste and incidence of vector borne diseases. Hence, efficient system of solid waste disposal is a crucial requirement of the community to minimize the health risks caused by such kind of waste. Current situation of solid waste disposal in Bahawalpur District is more alarming compared to other indicators of environmental health risk. Almost 74% of households dump their waste in open fields which is a threat to local environment in terms of heath as it encourages fly breeding; attract rodents and vermin, cause water and soil pollution, and continually troubles the people from bad odors. Percentage of municipal waste collection is very low in all the tehsils except for Bahawalpur City where it is acceptable to some extent (table 6). However, municipal waste collection and disposal in the entire district is also not reasonably up to the mark. The collected waste is dumped in open spaces more often along road sides and becomes highly troublesome for passengers and for inhabitants of nearby localities. This practice is another serious cause of environmental health risks rather than their reduction and control.

Table 6: Solid Waste Disposal Conditions in Bahawalpur District

Area	In open fields	In open streets	Collected by municipality	Disposed off by solid waste management department	Others	No response
Ahmedpur East	85.9	9.5	4.2	0.2	0.1	0.1
Bahawalpur City	48.9	22	25.3	2.9	0.8	o
Bahawalpur Sadar	81	17.2	1.3	0.4	0	0
Hasilpur	69.9	20.3	9.4	0.3	0.1	0
Khairpur Tamewali	78.3	19.4	2.3	0	0	0
Yazman	75.3	22.1	2.5	0	0.1	0
District Total	74.2	17	7.9	0.7	0.2	0
Source: MICS- Bahawalpur 2008-2009						

4.3.3 Sewage Disposal

Sewage is waste water discharged from community, containing solid and liquid excreta, derived from houses, street and yard washing, factories and industries. Breeding of flies, water and soil pollution, contamination of food, creation of nuisance, and incidence of diseases especially enteric and helminthic diseases are some of the major environmental health consequences of poor and improper sewage disposal (Park, 2009). Most of the households in Bahawalpur district dispose off their sewage into open fields (48.4%) or the pit inside or outside the house (20.6%). Only 30.7% of total households have proper disposal of waste water but it is also below satisfactory level. Ahmadpur East, Bahawalpur Sadder and Khairpur Tamewali are the tehsils that are associated with worse conditions of waste water disposal (table 7). As a whole, current sewage disposal methods practiced in the study area are not up to the mark and may favor atrocious environmental health risks. Therefore, for the avoidance of health harms, these practices need scientific based improvements.

Table 7: Methods of Waste Water Disposal in Bahawalpur District

Area	Sewerage main line	Open drain	Septic tank	Pit in or out house	Open street or open field	No response	Proper disposal of waste water
Ahmedpur East	3.1	13.2	3.7	17.7	62.2	0.1	19.9
Bahawalpur City	56.8	7.8	3.7	11.3	20.5	0	67.3
Bahawalpur Sadar	4.5	7.7	4.1	25.2	58.1	0.4	16.2
Hasilpur	17	2.9	9	26.1	44.9	0.1	28.7
Khairpur Tamewali	8.4	2.2	7.7	21.1	60.1	0.5	18.4
Yazman	10.1	17	3.3	28.4	41.2	0	30.4
District Total	16.3	9.8	4.7	20.6	48.4	0.2	30.7
Source: MICS- Bahawalpur 2008-2009							

4.3.4 Hand washing before Meal and after Latrine

The organisms causing diarrhea can be transmitted easily from infected feces to people through food and water, person-to-person contact, or direct contact. Hand washing is very effective in reducing the morbidity from diarrhea and dysentery (Han and Hlaing, 1989). Hand washing after defecation and handling feces, and preparing and eating food can reduce the risk of diarrhea. It has been already documented by several researchers that hand washing can reduce diarrhea episodes by about 30% (Cairncross et al., 2010; Ejemot-Nwadiaro, Ehiri, Meremikwu and Critchley, 2008). Some studies demonstrate further that interventions which promote hand washing can reduce diarrhea episodes by about one-third (Ejemot-Nwadiaro et al., 2008).

Behavior of the people towards hand washing practice in study area is somehow normal, but not sufficiently satisfactory. This indicator has been divided into different categories according to its practice among the persons of single household, i.e. hand washing with soap, without soap, some with soap, some without soap, no one and do not know. Furthermore, these classes are divided into two categories such as before meal and after latrine according to their relation with the possible chance of intestinal diseases and other infections.

Variations in the attitude of people toward hand washing have been noted throughout the district. Bahawalpur city is the only area where hand washing practice can be said satisfactory and where 71.8% and 78.3% households wash their hands all with soap before meal and after latrine respectively, whereas this proportion in Bahawalpur Sadder, Yazman and Ahmadpur East is below 50% making the people prone to serious health risks (table 8 and 9) .

Table 8: Hand Washing Practice before Meal in Bahawalpur District

Area	All with soap	All without soap	Some with soap	Some without soap	No one	Do' nt know
Ahmedpur East	30.2	30.2	28.6	6.5	4.5	0
Bahawalpur City	71.8	5.3	18.7	3.2	0.7	0.3
Bahawalpur Sadar	34.7	14.4	40.8	7.3	2.5	0.3
Hasilpur	48.9	12.1	30.7	6.9	1.4	0
Khairpur Tamewali	45.2	23.4	23.9	2.5	4.1	1
Yazman	28.8	2.9	52.4	13.4	2.5	0
District Total	41.7	16.4	32	6.8	2.8	0.2
Source: MICS- Bahawalpur 2008-2009						

Table 9: Hand Washing Practice after Toilet in Bahawalpur District

Area	All with soap	All without soap	Some with soap	Some without soap	No one	No response/ Do not know
Ahmedpur East	37.7	22.2	29.1	7.3	3.7	0
Bahawalpur City	75.3	4.3	17.3	2.4	0.4	0.3
Bahawalpur Sadar	41.3	12.7	39.1	6	0.6	0.3
Hasilpur	68	3.1	25.1	2.7	1.1	0
Khairpur Tamewali	64.1	10.2	19.5	1.4	3.8	1
Yazman	33.6	3	52.2	9.6	1.6	0
District Total	50.5	11.2	30.5	5.5	2	0.2
Source: MICS- Bahawalpur 2008-2009						

5. Major Findings and Suggestions

After studying the chosen environmental health factors, 'Health Risk Intensity Scale' has been developed to present the clear and more generalized picture of health risks in the study area. For this purpose, five categories have been made on the basis of increasing percentages of each indicator (table 10).

Table 10: Health Risk Intensity Scale

Category No.	Percentage of Environmental Health Indicators	Health Risk Intensity	
1	0-20	Very Low	
2	21-40	Low	
3	41-60	Medium	
4	61-80	High	
5	81-100	Very High	

On the basis of analysis using the intensity scale following main results have been extracted;

i. Indoor air pollution is very high throughout the district except Bahawalpur City where it was moderate (table 10). Hence these areas are prone to acute respiratory infection, chronic obstructive pulmonary disease, lung cancer, asthma etc.

ii. It is obvious that drinking water treatment practice is very alarming in all the tehsils of district Bahawalpur, making this region vulnerable to gastrointestinal diseases, while bacterial contamination has been found at medium to low levels in this area which can be attributed to the dominance of arid climatic conditions also (table 10).

iii. Variations are found among all the tehsils in terms of unimproved excreta disposal. With regard to this environmental health risk indicator Ahmadpur East is the high risk area, Bahawalpur Sadder, Hasilpur and Khairpur Tamewali are moderate risk areas, while Yazman and Bahawalpur City are low and very low risk areas respectively (table 10). Cholera, typhoid, hepatitis, polio, cryptosporidiosis, ascariasis and schistosomiasis etc. are the substantial resultant health threats to the population of these areas.

iv. Correspondingly, solid waste disposal and sewage disposal intensity has been found to be very high in all the tehsils with the exception of Bahawalpur City where it is low as it is an urban area and waste disposal is carried out efficiently by Tehsil Municipal Authority (table 10). The mal-disposal of solid waste and sewage can cause outbreaks of vector borne diseases along with the blood-spattered diarrhea, cramping, abdominal pain, nausea, vomiting and fever, etc.

v. On the behavioral side, hand washing practice before and after latrine is to some extent acceptable with the exception of Yazman (table 10) where it may cause nausea, vomiting, diarrhea, stomach cramps and hepatitis- A etc.

Table 11: Health Risk Intensity Scale for Tehsils of Bahawalpur District

Environmental Health Indicators	Health Risk Intensity in Tehsils of Bahawalpur						Possible Health Threats
	Ahmed Pur East	Bahawal Pur City	Bahawal Pur Sadar	Hasilpur	Khairpur Tamewali	Yazman	
Indoor air pollution/use of biomass fuel	Very High	Medium	Very High	Very High	Very High	Very High	Acute respiratory infection, chronic obstructive pulmonary disease, lung cancer, asthma etc.
Drinking water treatment	Very High	Very High	Very High	Very High	Very High	Very High	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps) , etc.
Bacterial contamination in drinking water	Low	Low	Low	Low	Low	Medium	Intestinal infections, cholera, diarrhea, dysentery, etc.
Un improved excreta disposal	High	Very Low	Medium	Medium	Medium	Low	Cholera, typhoid, hepatitis, polio, cryptosporidiosis ascariasis and schistosomiasis, etc.
Solid waste disposal	Very High	Low	Very High	Very High	Very High	Very High	Vector borne diseases (malaria, dengue etc.)
Sewage disposal	High	Low	Very High	Very High	Very High	High	Bloody diarrhea, cramping, abdominal pain, nausea, vomiting and fever , etc.
Hand washing before meal	Low	Low	Medium	Low	Low	High	Nausea, vomiting, diarrhea and stomach cramps, hepatitis- A, etc.
Hand washing after latrine	Low	Low	Medium	Low	Low	High	

Though it is intrinsically difficult to remove all these environmental health threats completely, but certainly they can be minimized through the adoption of effective precautionary measures as well as through adaptation and constructive modification of environment. For effective communication with the public about risks, the media in fact has an essential role within the public health system (Fitzpatrick-Lewis, Yost, Ciliska and Krishnaratne, 2010). All in all, multidimensional approach indeed can be highly effective and useful. Thus, following basic strategies (figure 5) can be suggested on the basis of results;

1. Environmental health management is direly needed in Bahawalpur District and government should pay special attention to this issue.

2. Instigation of campaigns and programs about environmental health education, especially about sanitation and personal hygiene, throughout the district is important need of the time.

3. Assurance of the supply of clean water to each household is obligatory.

4. Implementation of existing environmental policies ought to be maintained.

5. Community participation practice is another important need of the time that must be introduced for better adaptation of local environment.
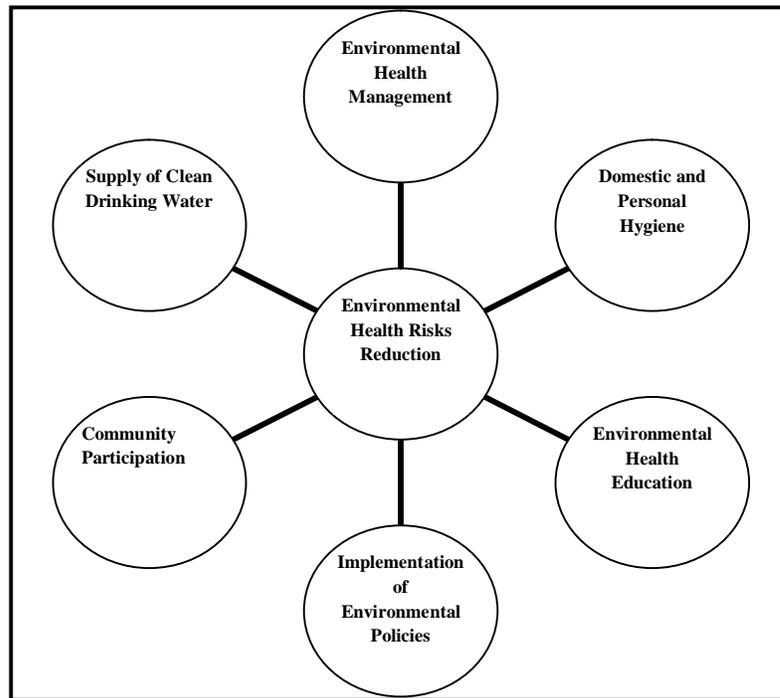
Figure 5: Strategies to Minimize Environmental Health Risks

6. Conclusion

From the study of environmental health risks in Bahawalpur it can be concluded that the condition of three major indicators of environment, air, water and sanitation analyzed in

the foregoing discussion is not up to the required standards. Based on the analysis of these indicators, health risk intensity scale has been developed which divulges that indoor air pollution, poor practice of drinking water treatment, incongruous and improper solid waste disposal and sewage disposal are the main causes of high risk to the health of the inhabitants of Bahawalpur District. These risks can come out in the form of various air born, water born and vector borne diseases. Adjustment and management of environment through designing and implementing effective policies and environmental education can help to deal with these issues proficiently in future.

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