

**Impact of Socio-Ecological Environment in Slum on Children's
Physical Health and Cognitive Abilities:
A Case Study of Islamabad**



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ABSTRACT

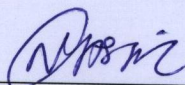
CERTIFICATE

Slum characterized of unhygienic, contaminated water, open sewerage and inadequate solid waste management. Consequently, they are experienced to have negative impact on

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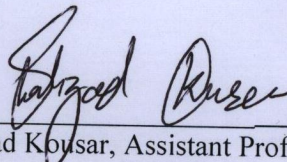
and children’s cognitive ability decrease. One of the main reasons for these characteristics, especially parents education.

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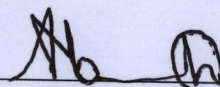
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ABSTRACT

Slum comprised of unhygienic sanitation, contaminated water, open sewerage, and inadequate solid waste management. Consequently, they are experienced to have negative impact on children's physical health and cognitive abilities. The current is an attempted to examine the impact of slums on children's health by comparing than with the children living in non-slum (but otherwise similar) area. For this purpose, data was collected from two areas Muslim colony (slum or treated group) and Bari imam (the controlled group). The results Show that exposure inadequate conditions in slum have adversely affected the height for age Z (HAZ) score of children. The main channel for this impact is diarrhea. Interestingly, the link between slum environment and children's cognitive ability variables. Once we control for parents characteristics, especially parents education.

CONTENTS

Abstract.....	i
Chapter 1	1
Introduction.....	1
1.1 Problem Statement	3
1.2 Research Question.....	4
1.3 Objectives of the Study	4
1.4 Significance of the Study	4
Chapter 2	5
Literature Review	5
Chapter 3	9
Theoretical Framework.....	9
3.1 Water Pollution	9
3.1.1 How Water Pollution Affects Physical Health?	9
3.1.2 Water Contamination through Human Feces, Disposal, and Veterinary Feces	10
3.1.3 Common Diseases Transferred to the Humans through Unclean Water.....	11
3.1.4 How Water Pollution Affects the Brain Function?	11
3.2 Air Pollution.....	12
3.2.1 Air Pollution and Children’s Brain Development	12
3.3 Socio- Ecological Environment Lead to Diseases	14
3.4 ECONOMICS PATHWAY	14
3.4.1 Long-Term Significances of a Slum in Primary Life of Children’s.....	16
Data Collection and Methodology	17
4.1 Study Area.....	17
4.2 Sample Size and Data Collection.....	17
4.3 Econometric Specification of the Model.....	18
4.3.1 Description of Variables.....	19

Chapter 5	21
Results and Discussion.....	21
5.1 Descriptive Statistics of the Study	21
5.2 Impact of Slum on Physical Health of Children’s.....	22
5.3 Channel_ Diarrhea.....	23
5.4 Impact of HAZ on Cognitive Ability	24
5.5 Impact of Slum Area on Cognitive Ability	25
Chapter 6	27
Conclusion and Recommendations	27
References.....	30
Appendix.....	35

Chapter 1

INTRODUCTION

Social ecology describes the complex interaction of private, social, and environmental elements with the assist of theoretical principles (Machlis, Force et al. 1997). The notable factors of socio-ecology include social, cultural, human health, economic and educational factors. The socio-ecological aspect is very important in its own right because the social and environmental factors vastly affect health and well-being of individuals. This socio-ecological perspective enables the individuals to be aware of the interdependence between them and the society. Moreover, individuals can grasp and understand the complex and broad physical, social, economic, and cultural context. These influences and reshapes their well-being and experiences.

In this complex backdrop, it can be inferred that the adult and children in a society are severely vulnerable and prone to health and social-emotional issues due to social-ecological imbalances. Some of the most common diseases prevalent in the children include diarrhea, typhoid, intestinal worms and hepatitis due to imbalances in their socio-ecological environment. The implications of the inconsistent socio-ecological environment are not confined to the physical health consequences of children. They can also affect their cognitive abilities.

These imbalances in socio-economic environment are caused by many factors e.g., increased population growth, industrialization; rapid urbanization etc. for instance urbanization creates an interaction between the environment and the population thereby affecting the atmosphere of the earth. This leads to serious problems such as affecting the long run sustainability of the Ecosystem. Similarly, high population inflow to urban centers degrades the environment in terms of deforestation. It also affects food security, industrialization, water quality and level of air and noise pollution (Ghanem, 2016). One of the outcomes of unplanned urbanization is the creation of slums.

According to R. Hunter (1968) who thought that “Slum is more than a crowded building, it is more than dirty streets, the lackluster people sitting on the stems, the shrieking children running up and down, the sullen boys having at the corners, the stupefied addicts leaning against. It is a way of life and it runs on a way of looking at the future or is perhaps looking away from it.”

A leading organization UN-Habitat and sustainable urban development has refined its definition of slums over time to improve measurability, but it is still generic. Without insisting upon any minimum number of households it defines a variety of desirable living conditions that households in slums usually lack:

- I. Non-Availability of permanent houses
- II. Scarce living condition.
- III. Access of safe water is not easy.
- IV. Access to proper and adequate sanitation facilities with respect to sharing of private or public toilets.
- V. Protecting rights of tenants of property that prevents forced expulsion.

Many diseases including diarrhea, typhoid, intestinal worms and hepatitis are related to the physical health of the children that has three standard indicators. These indicators include "height for age" (stunting), "weight for age" (underweighting) and "weight for height" (wasting). The cognitive abilities of children are also severely affected by reasons like environmental stress, war, nutrition genetics, poverty and family structure.

Across the world, it is a proven fact that those communities which perform better on socioeconomic indicators they have improved social and economic well-being. While the situation in developing world is different like Pakistan, if we talk about Islamabad, The city of Islamabad was the first planned city in Pakistan. The rapid urbanization in Islamabad led to creation of slums. Workers all across the country came for the job opportunities especially in the construction sector settled in Islamabad. People of different communities that are residing in slums consist of a majority who jumped for the opportunity to live in the capital city even as street cleaners. Afterwards, when the people from these communities started to progress economically it prompted most of their relatives, friends, and family members to migrate. The

purpose of migration was to escape poverty and to avail the benefits of extended work opportunities. Later on due to such practices people living in slum started to face the health hazards specially children are most vulnerable (Akhtar).

1.1 Problem Statement

Slum contains large heaps garbage spread near the residential places. People who are living in slums are exposed to severe unhygienic conditions. The main problem faced by the slum residents is access to safe and clean drinking water. Unhygienic and polluted water is the main source that carries viruses, bacteria which is the cause of typhoid, diarrhea, cholera, and hepatitis etc. The adverse impact of the poor sewerage system and the sanitation can be seen through poor health condition of slum inhabitants.

Especially Children of the slum are facing long-lasting diseases such as lung diseases, acidity, mental and psychosomatic disorder. The slum children also face social challenges in form of vulnerability to social instability. Social instability means anxiety that arises from lack of ideals and personal unrest due to degradation of social values. The children also face the problems of lack of social affiliation and mental ill effects of degrading living condition. Open stand water and non-availability of toilet facilities are spreading a different kind of diseases. The analysis of previous studies shows how slum condition affect the physical health of the children that have a direct cost. According to the UNICEF report (Stop Stunting 2013-2015), stop stunting prevalence Pakistan is facing stunting ration at 44%. This makes it around 9.5 million children in Pakistan have to some extent experienced the stunting. This makes Pakistan third highest in terms of stunted children in the world. While these issues not only affect the physical health it also affects the cognitive abilities of the children which have indirect cost on health. The research on the effect of stunting on cognitive abilities of the children in primarily under studied and unexplored. The direct financial burden faced by the people is in form of expenditure on their physical health and medical treatment. The indirect cost faced by the people is in form of loss of productivity in the future, which ultimately results in lower wages & adverse labor market outcomes.

1.2 Research Question

Does degradation in socio-ecological environment adversely affect the physical health and cognitive abilities of the children?

1.3 Objectives of the Study

The objectives of the research are:

- I. To examine the impact of residing in a slum on physical health and cognitive abilities of children by comparing those with children living in non-slum areas.
- II. To examine the effect of deterioration in physical health and cognitive abilities on the long-term welfare of the affected children.

1.4 Significance of the Study

The study contributes to the literature because the previous studies show the impact on the physical health only. Currently, there is no study that examines the effect of residing in slum on the cognitive performance of children in Pakistan. From the perspective of policy making, this study is important in sense that it showing the overall effect of slums on the physical health and cognitive abilities of the children. The results showed guiding the policy makers to set their priorities accordingly.

Moreover, this study is of great significance for the government of Pakistan and also for the administration of the city because by protecting the children they could reduce the burden of health cost. In addition, this study may also prompt the city administrators to reduce the number of slums or upgrade them to settled areas. In Islamabad, most of the slums are located in the center of the city or in main commercial and residential areas. Due to the bad environment, it not only affects that particular area but it also affects the surrounding areas. This reduces the air quality and dirty smell spread everywhere which ultimately increase the health hazards for non-slum residents as well.

Chapter 2

LITERATURE REVIEW

Urbanization refers to the general increase in the population of the cities or expansion of the cities either through migration from rural to urban areas or because of the increase in the population of urban areas. In 1800 A.D a very small segment of the world population were living in urban areas which are approximately (2%) and it reached 50% in 1995. The United Nation have analyzed in 1995, there were 22 large cities and 14 megacities globally. In 2015, both categories had doubled. Moreover, it is predicted that by 2030, population in urban centers will increased it may double and area required to cover the population three time more.(Habitat 2016).

Urbanization creates an interaction between the environment and the population of the globe that affects the atmosphere of the earth. This problem leads to serious problems and cast to maintain the long run sustainability of the ecosystem will double. High population influx to urban centers degrades the environment in terms of deforestation, unplanned industry development, contaminated water, food shortage, non-availability of land for residency, noise, air pollution and problem of solid waste material (Ghanem 2018).

The irregular process of urbanization also leads to generate a particular type of area where people have no access to drink clean water, electricity, and facility of the toilet. Such areas are referred to as Slums or the areas that lack the basic facilities. The phenomenon is very closely related to the unpredictable urbanization that yields a most evident impact of urbanization on the environment as well. “UN-HABITAT explains the characteristics of slum Lack of necessities of life 1. Mud houses 2. Very small house. 3. No access to clean drinking water 4 inadequate sanitation.

The slum is not environment-friendly space in the urban sector in under developed countries. Most of the health hazards are linked with presence of poverty, lack of access to water and sanitation and below average housing cause change in living condition and lifestyle. Children

in developing countries are subject to more and more frequent adverse conditions receiving a low level of investments compared to the children from the wealthier environment (Duque 2015). Family investments are important determinants of human capital. The large percentage of the variations in later life education attainment and wages can be explained by physical health and different cognitive as well as non-cognitive indicators (Meghir, Attanasio et al. 2015). Children and youth are significantly growing up in an urban world. Around 90 % of the urban population growth occurs in least developed countries. (Unger 2013).

According to a UNICEF flagship report of 2012 on state of world's children, the major proportion of urban population is made up by children and young people in the least developing countries. A major indicator to assess the development of nation is the child health. It also tells about the demographic factors of any country that explains the future of human resource capital potential of the nation (Chauhan and Navodaya 2015). Around 219 million (39 %) children age below five fail to reach their developmental potential in the middle and low-income countries. This is due to exposure to risk factors that includes nutritional deficiencies, illness and less responsive parents all of which are linked with poverty (Grantham-McGregor, Cheung et al. 2007). The cognitive abilities are affected by these factors beyond the effect of genetics (Hackman and Farah 2009) and general development delays that are difficult to compensate later on in life given the plasticity of the brain in early childhood (Davies 2010).

The long term effects due to exposure to these factors include lower employability rate, lower school performance and worse adult health and well-being (Rubio-Codina, Attanasio et al. 2015). Hence the expected social and economic benefits of public (government) and private (parental) investments in children's health and education may not be determined by early childhood development. The quality of the human resources available in the labor market and aggregate economy is also reduced in later life. (Rubio-Codina, Attanasio et al. 2015)

Cognitive Abilities referred to as a "subset of goal-directed, self-regulatory operations involved in the selection, scheduling, and coordination of computational processes underlying perception, memory, and action" (Hillman, Pontifex et al. 2009). Cognitive is the brain-based skills we need to carry out any task from simpler to complex. Cognitive skills include the core

skills that our brain uses to think about things, reading, and learning. Several reasons that affect the children's cognitive abilities like environmental stress, war, Nutrition, Genetics, poverty, and family structure. Marital conflicts are the reason of stress in the children. Such conflicts harm their stress response system that affects their mental and intellectual development and it also affects their cognitive abilities. According to the (Society for research in child Development March 28, 2013) Poverty, low standard of living, and family unsteadiness are connected to each other. Poverty affects the families economically and socially which increase the risk of relationship breakups.

Children with the better family system have better cognitive abilities as compared to the children facing persistent poverty(Dickerson and Popli 2016). Slums are the outcomes of imbalances in growth of urban areas over the last 15 years. The slum is mainly considered as a bad and dirty environment access to water and sanitation. Presence of these aspects due to the open defecation, mud houses, open gutters and drinking dirty water are the causes of under nutrition and sickness. Most of the people used polythene bags and throw them due to lack of the facility of the toilet in a slum. Children's are playing in mud touching the urine germs of others which enters in their body. This leads to different diseases. Diarrhea dishes are also common in the children because of insufficient water and poor sanitation. Almost 12 million children under the age of 5 die due to the bad environment every year (WHO 1995). In 1992, 80% of the children died due to the diarrheal disease (Bartlett 1999). Environment at home not only effect the children's emotional it bring change in behavior and mental abilities (Paul 2015). Quality of housing and community space not only affect the physical health, but it also affects the children's emotional, social well-being and cognitive abilities (Coley, Leventhal et al. 2013).

According to Pakistan Council of Research in Water Resources (PCRWR) the number is high of the population drinking unsafe and polluted water both from the surface and underground sources in Pakistan. Around 62% of urban and 84% of the rural population don't treat their drinking water that's why millions of the cases of diarrhea are registered in hospitals. According to the (UNESCO), 40% of all the reported disease in Pakistan is aspects of unsafe

and polluted water that is the main source of many diseases like diarrhea, typhoid, intestinal worms and hepatitis. All research is related to the physical health and mental health of children.

It is estimated approximately 165 million stunted children's reside in just 14 countries, including Pakistan. Its mean that globally about one in four children under 5 years are stunted. In Pakistan the chronic nutrition deprivation in utero and/or during early childhood is experienced by around 44 percent which makes around 9.6 million children. Furthermore, the under-5 stunting rates are much higher in Pakistan than the global rate (Khalid and Martin, 2017). The growth and optimal health of a child are hindered by the stunting and other forms of under-nutrition. Stunting is partially linked to brain growth which effect the mental health in long run. A decrease in school achievement leads low earnings in future.

Over 40 million people don't have access to basic toilet facilities which leaves them no choice but to defecate in the open. As a result, the lack of toilet facilities in Pakistan leads to stunted. Stunting basically means children will not grow as tall as they would. The child's brain development is also affected. Children with stunted growth are more vulnerable to diseases. In some case, stunted mothers give birth to stunted children (UNICEF 2015). Amenities in urban slum-like Pucca house, electricity supply, clean and safe drinking water, sanitation facilities and better education are not available that adversely affects the physical health of the children (Chauhan, at al 2015)

Poor housing condition is also the problem of slum mud houses. In winter, such houses became the cold house that is most vulnerable to the serious illness in children under five like cold and flue (National Children's Bureau 2011)

Chapter 3

THEORETICAL FRAMEWORK

Numerous epidemiological research has demonstrated that slum negatively affects human well-being that reasons different ailments as raised to ahead of time, yet its impact on mind advancement isn't tended to in detail. Studies have linked those slums with poor health addressing different symptoms like diarrhea diseases and stunting problems in children. However more noteworthy research is required to manage the effect of a slum on brain development, primarily of children.

To start with, it clarifies the biological linkages, water quality and health and by air quality and health in children.

3.1 Water Pollution

The water features include the sewerage water, sanitation, and stained water. While air satisfactory is divided into indoor air pollution, sewerage scent, and solid waste/ garbage odor, a lot of these factors have an effect on the fitness of children.

More than 80% of polluted water is launched to the environment without an adequate cure (Oller, Malato et al. 2011). Extended discharges of inadequately dealt with wastewater are contributing to the similarly degradation of water satisfactory in floor and groundwater. Water pollution seriously impacts water availability. Organic pollutants (measured in phrases of biochemical oxygen call for – bod) has extreme effects on inland fisheries, meals safety and exquisite livelihoods of negative rural communities. Poor wastewater management directly affect the ecosystem (Capps, Bentsen et al. 2016).

3.1.1 How Water Pollution Affects Physical Health?

All over the world disease due to water pollution are the most dangerous disease that kill the children under age 5 (Rajgire 2013). Diarrhea kill the Children frequently every day, it is expected that approximately 1,000 children die due to dirty water and inadequate sanitation

(Joys and Prayer, 2016). In developing countries waste water management is one of the biggest issue that link to the slum settlement (Un-habitat, 2012).

Pakistan has been blessed by the enough Natural Resources including surface and underground water. Industrialization, urbanization, and a mega inflow to the cities leads to the urbanization, industrialization that place stress on water resources. First source of water pollution is mixing of sewerage water to the drinking water and secondly industrial waste like disposal of toxic chemicals and fertilizers from agriculture sources. (Mihelcic, Naughton et al. 2017).

Further the diseases like malaria, yellow fever, filariasis, dengue, hepatitis A and hepatitis E, typhoid fever are due to contaminated water which again place huge burden at worldwide (Harris, Alzua et al. 2017; MacPepple, Okereke et al. 2017)

3.1.2 Water Contamination through Human Feces, Disposal, and Veterinary Feces

Human and veterinary feces excrete into the sewerage thus figure 3.1 shows how this sewerage water mixed to the surface and underground drinking water. On the other hand dumping of waste and chemicals in land affect the water quality. Through these channels the figure express humans, animal feces and disposal are the main sources of contamination of drinking water.

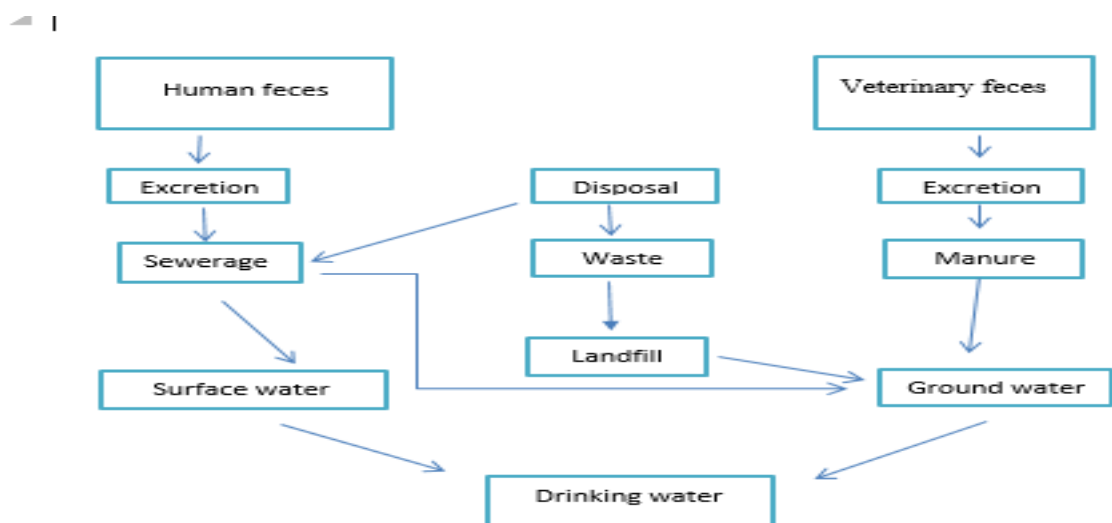


Figure 3.1: Channels_ water contamination

Sources and pathways for PPCPs entering groundwater

3.1.3 Common Diseases Transferred to the Humans through Unclean Water

Life is not possible without water because Water is the necessity of life but now a day's contaminated water became more dangerous. The table 3.1 shows there are main three living organisms in water bacteria, viruses and protozoa that promote different kinds of diseases. Diseases due to bacteria are typhoid fever, cholera and Bacteriological Dysentery have some adverse effect on human health.

Table 3.1 Connection of Living Organisms to the Diseases

Organisms	Diseases	Effect
Bacteria	Typhoid fever	Diarrhea, severe vomiting Swelling of the spleen.
	Cholera	Diarrhea, vomiting Shortage of water in body
	Bacteriological Dysentery	Diarrhea, rarely fatal except in infants without proper treatment
Viruses	Hepatitis	Temperature and Headache
Protozoa	Giardiasis	Diarrhea

3.1.4 How Water Pollution Affects the Brain Function?

Contaminated water not only affect the physical health of the children, it also affects the mental health (cognitive ability). Table 3.1 shows physical health related impacts. Children under the age 5 consumed 44% of the body's metabolic resources for the brain development while these metabolic resource in the body also fighting against the infection(Ijaz and Rubino 2012). Diarrhea is an Enteric infection that not only negatively affect the physical health (stunting) in child, it also affect the cognitive abilities. Figure 3.2 "Note here we can see the impacts of enteric infections, how these infection leads the stunting and injured the cognitive ability in children (Nataro and Guerrant 2017)"

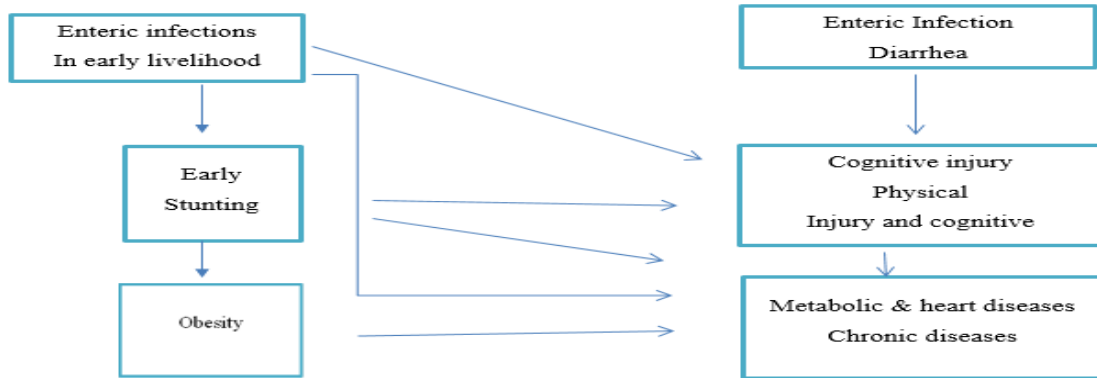


Figure 3.2 Diseases and Health

Source: Pediatric Infectious Disease Journal

3.2 Air Pollution

After discussion of water quality and its impacts on children's health, this study explains how these factors pollute the air and affect the quality and how this air pollution leads to different diseases in the children at the age of five.

This study divided the air pollution in three ways.

- I. Ambient air pollutants
- II. Sewerage smell and air pollution
- III. Solid waste/garbage smell and air pollution

3.2.1 Air Pollution and Children's Brain Development

Where the children are vulnerable to health due to water pollution, the air pollution is also playing its role degrading the health of children. Children are in their early growing stage, all body parts are growing including lungs, at this stage they take more breath as compare to young guys. When they take the breath, the lungs caught more polluted in the body. During this process when the children sick they missed the school and weak learning negatively affect the long term well-being (Vanos 2015).

For child health development it is necessary the blood is properly flowing to brain. Guts, lungs and nasal are working properly. A child's healthy development outcome is dependent on the healthy growth of natural barriers such as the blood-brain barrier, nasal, gut, and lung

epitheliums (Calderón and Vojdani et al., 2015). As a result, the brain’s ability to protect itself against potentially dangerous toxicants/ particles is reduced. the body size of children consume more water and air as comparison to adults (Sampson, 2012). A young child’s brain is especially vulnerable because it can be damaged by a smaller dosage of toxic chemicals, compared to an adult’s brain. Children are severely vulnerable to air pollution because they breathe more rapidly and protection system is not fully established (Fund, 2017).

Air pollution affects the children’s brain through several ways, very small substances can create a barrier on the way of blood flow to the brain that cause of neuroinflammation (Garciduenas, Sanchez et al., 2015). Air pollution particles are very small, they have less than 2.5 microns in size, they can easily travel through blood to the brain cause serious issue for example memory loss, low IQ grade and also thinking potential.

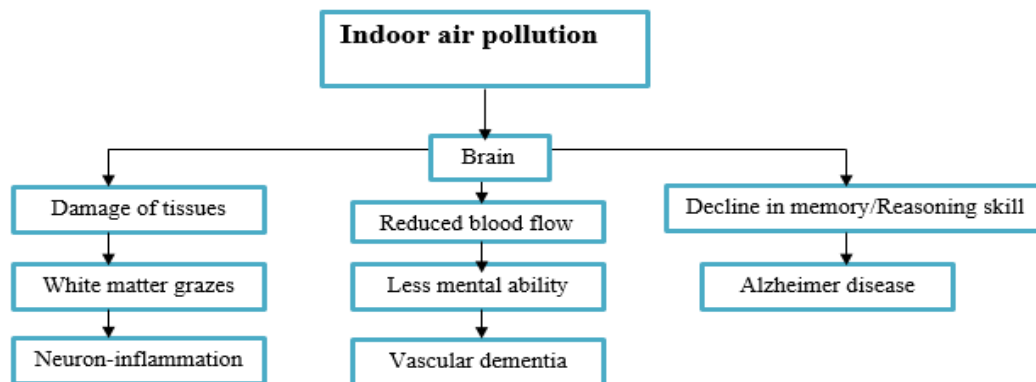


Figure 3.3 Air Pollution and Brain

Figure 3.3 shows the channels and movement of small partials in mind. These particles slow the blood flow in vessels that affect the brain development and reduce the thinking level like decline in memory.

According to the Environment Protection Agency (EPA), express in a study average of 7 million individual’s ill every year due to sewerage smell, so out of which 7% are children. Destruction in starting 1,000 days of children’s life effecting their brain development in long terms(Siddique, Banerjee et al. 2011). One study reports that due to air pollution under the age 5 drop by IQ 4 points.

3.3 Socio- Ecological Environment Lead to Diseases

The environment have significant effects on human being. The positive and negative consequences depends on the environment conditions, if the environment is not good it leads the different diseases in the children's and adults.

Table 3.2: Relationship between Environmental Conditions and Diseases

Respiratory Infections	Traditional fuels	Smoking	unhygienic condition	Open excretion
Cough & cold/ Throat & eye infection	Water from roadside	Open water container	unhygienic condition	Open excretion
Diarrhea & dysentery/ Cholera & Jaundice	Water from roadside	Open water container	unhygienic condition	Open excretion
Malaria	Garbage	strain out	unhygienic condition	Open excretion

Table 3.2 explaining the links between environmental conditions and diseases occurred. Respiratory infection influenced by the traditional fuels like usage of wood and waste of crops for cooking and their dangerous smoke. Diarrhea is a water borne diseases and in slum people carry water from public tabs or from road side well that are highly contaminated. Spreading of solid waste in slum is common because there is not a specific place for this waste and stain water near these place increase the production of mosquitoes which leads to malaria diseases.

3.4 ECONOMICS PATHWAY

Early-life conditions play their role in shaping adult outcomes (Duque, Rueda et al., 2017). Children development affects through a number of mechanisms first supply side limited amount and quality of resources in local communities. It can reduce household economic resources, lack of infrastructure, hospital, and school reduces the quality of public services. All these

factors affect the human capital. Previously showed how the health of children is affected by the bad environmental consequences. Here, study has some evidence about bad health conditions of the children that affect the human capital. The physical health like stunting and lack of cognitive abilities has an adverse impact on future productivity.

The concept of the stunting is if the Z score height for age is below then -2 SD its mean the child is stunted (WHO Multicenter Growth Reference Study Group, 2006). Stunting also indicates a child fail to achieve required height to the age (Dewey and Begum 2011). Bad environmental consequences not only affect the children's skills in that period, but it will also reduce future accumulation of skills. The productivity of future investment depends upon past skills so, that negative shocks on past skills decrease the productivity of future investment (Leight and Glewwe et al. 2015). Evidence from literature suggests that the experience during early childhood can have long-lasting effects on later outcomes. Around half of the children population in developing countries are stunting due to high poverty rate and diseases prevail in (Dewey and Begum, 2011).

According to Vogl , 2012 founded that an extra centimeter of height in Mexico is related with an hourly gain of 2.3% in wages. Using back of envelope calculation, we conclude that Pakistani children living in slum are likely to face a reduction of approximately 12% in their future wages due to their exposure to adverse socio-ecological conditions of slum decreasing their childhood.

That is the back of the envelop studies available that show, In Colombia, 7-9% expend the earning by increasing 1-standard deviation increase in cognitive ability (Ross and Horton et al. 1998). According to the Alderman et al. (1996) 1-standard deviation increase in cognitive scores (using Raven-test score) increased in wages ranging from 10% and in Ghana a one-standard deviation increase CA wages rate jumped 22% increase in the public and 33% in non-public sector (Glewwe, 1996).

3.4.1 Long-Term Significances of a Slum in Primary Life of Children's

The long term loss due to the adverse affect of living in inadequate socio-ecological environment of slums. This is done by examining the loss in future wages, of the affected children. Vogl (2012) founded that an extra centimeter of height in Mexico is related with an hourly gain of 2.3% in wages. Using back of envelope calculation, we conclude that Pakistani children living in slum are likely to face a reduction of approximately 12% in their future wages due to their exposure to adverse socio-ecological conditions of slum decreasing their childhood. Table 3.4 shows the vicious circle of slum. Due to non-availability of necessities of life how this circle is moving around the peoples. Lack of sanitation, dirty water and poor health facilities leads to children's nutritional deficiency. When child is weak body the immune system will unable to fight against the attack of different diseases. In unhygienic socio- ecological system children are under nutrient that lead stunting. Weak body stature and poor mental health reduce the school achievement.

Figure showing these chorionic diseases is one of reason of the fetal death. Poor structure and poor mental health are correlated to the weak school achievements, labor abstraction and earning. According to our survey most of the people living in slum due to cheap residency if the person is poor it mean there on other option instead of slum and the slum is again not an environment friendly place for living.

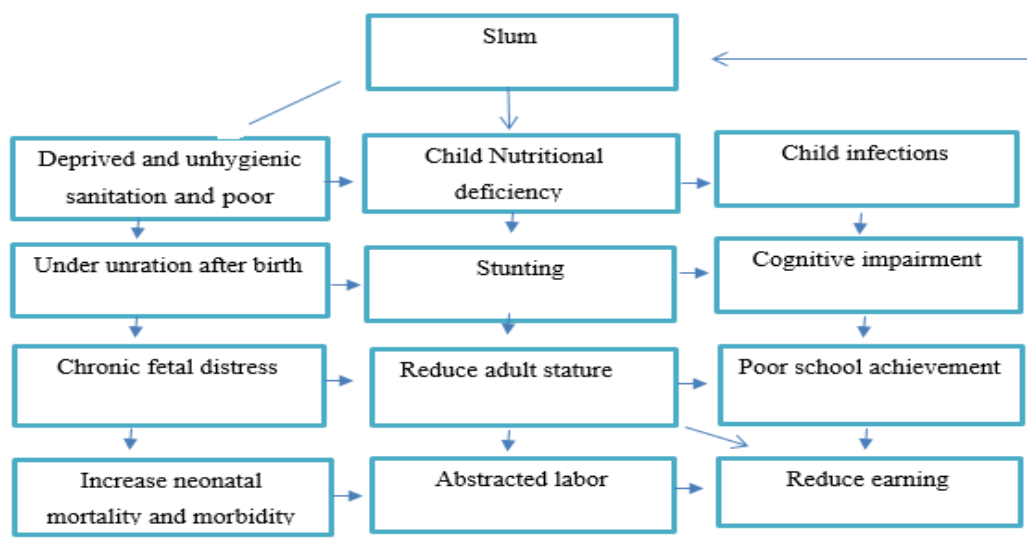


Figure.3.4: Vicious Circle of Slum

CHAPTER 4

DATA COLLECTION AND METHODOLOGY

The main attention is to study the negative impacts of slum on physical health and cognitive abilities of children.

4.1 Study Area

The area under the research study is Islamabad that is the capital of Pakistan and also the second most beautiful capital in the world. The area of Islamabad Rawalpindi lies between longs 72°45' and 73°30' E. And lots 33°30' and 33°50' N. In the Islamabad District, the Rawalpindi District of Punjab, and the Abbottabad District of North-West Frontier Province, Pakistan. The total population of Islamabad is 2,001,579 million and number of household 335,408 according to the population survey 2017. Total area of the Islamabad is 906.5 km².

Hypothesis formulation:

H₀ = Degradation in socio-ecological environment has no effect on Children's physical health and cognitive abilities

H₁ = Degradation in socio-ecological environment adversely affect the children's physical health and cognitive abilities.

4.2 Sample Size and Data Collection

Capital Development Authority (CDA) has declared ten recognized slums that have 3805 households in Islamabad. This include slum areas of G-7/1, G-7/2, G-7/3, F-7/4, G-8/1, F-6/2 Muslim Colony, Haq Bahu, Dhaka Najju, and Essa Nagri. There exists a difference in the availability of basic necessities. G-8/1 is the most developed while F-7/4 is the least developed slum due to no availability of the facilities according to the CDA. The aim of the study is to make a comparison of two areas, one considered as a treated area that is called Muslim colony located near the diplomatic enclave and other one is controlled area name Bari imam. Muslim

colony has a lack of basic facilities like infrastructure, sewerage system, clean-drinking water, availability of health care units. Also, there is no playground facility available for children, which is adversely affected their health. On the other hand, Bari Imam has most of the basic facilities. Although, there exist no significant difference in terms of household's income in both areas.

Using the 95% confidence level and 6% confidence interval, the sample size is 215 by adopting the random sampling technique for our analysis. We dropped some observation during data cleaning. Hence, the final sample size used in the analysis is 203. In the study area, the treatment group is Muslim colony slum while the controlled group is Bari Imam. The distance between them is 1 km. The sample size dividing equally between the two groups. Data from households have collected through household survey using questionnaire.

4.3 Econometric Specification of the Model

This study ordinary least square (OLS) method. Through this method, the study is able to find the effects of social-ecological environment on the children's health. Here health is divided in two parts, physical health and mental health.

For physical health, we used the following regression model

$$H_{ij} = \beta_0 + \beta_1 S + \gamma x + \varepsilon_i$$

H_{ij} is the health status of children i in area j . the health status can be physical (PH) or cognitive ability (CA).

The children characteristics include age, gender and school status of the child. The parents characteristics consist of parental age, education and their profession. Household characteristics include income, household size, no of kids, type of house in term of ownership, house quality, no of rooms, sanitation facility, electricity and source of cooking and environmental conditions include water logging, water quality, drain system, smell and solid waste management.

4.3.1 Description of Variables

School attendance express the child is attending school or not, household size mean no of kids in house, type of household in term of property, are they living own house or living on rent so 1 for own and 0 for rent, parents education if the parents are educated the code is 1 and 0 for other, quality of house in term of (kitcha, pakha), parents employment status in case of employ1, otherwise next variable is no of room, location of household if living in slum the value is 1 and if living in Bari Imam it gave the value 0, have they electricity connection. There is a multiple option for the source of cooking like natural gas, wood and other fuel use for cooking, water logging related issues 0 if facing, 1 for not facing and solid waste management.

In model H indicate the children's health that is based on PH and CA in the children.

PH is the physical health of the children aged (1-5) years. That measured using through the HAZ (height for age) index. For this purpose, required the height (HT), age (AG) and gender (GEND) of the children if the height of child is standard deviation less the (-2SD) that shows child is stunted. In case the height is (-3SD) then the child facing saver stunting. Data on physical health collected through statistics sampling technique. CA is the cognitive ability of the children aged. It measured through Raven-test score. 18 questions have been asked in a specific time if the answers are correct mark 1 then summed up and standardize (with mean 0 and standard deviation 1) for age and gender. After getting the response, the study standardized the results with age of the children and do comparison in both areas.

To achieve the second objective the study checking the relationship between stunting and the cognitive abilities and finalized the results how the cognitive abilities affect the future well-being of the children. According to the Alderman et. At (1996) one standard deviation increase in Cognitive score suggest the 10% increase in wages by using the OLS ordinary least square method in Pakistan that is higher future cost.

Hence, we use back of envelope calculation to estimate the impact of decline in health and cognitive ability on future wages.

Independent variables are slum for slum use 1 as dummy variable and for non-slum put 0 as dummy. Next independent variable is γx_i it's included on child, mother, father and household characteristics. In case of child the study note (age, gender and education) while for

parents characteristics (age, education and employment) it measure through year of schooling, employment value if he/she employed since last years and last one is household characteristics e.g. (family size, no of family, households monthly income, type of house, no of rooms, source of cooking) Environmental Characteristics (water logging, quality of water and availability of sanitation, solid waste, drain system and sewerage smell). In case of slum we were expecting sign is (-ve) between β_1 slum and outcomes because of slum characteristics children physical health and cognitive abilities both may decrease mean HAZ score will decrease.

GEND stand for child gender; for male child is 1 while for female child id 0. it is expected that Male children's CA more vulnerary then the female in slum.

AS its mean attendance of the children in school. The Raven Test score measures the natural cognitive ability of every. Its variable value (1 or 0) if he/she attends the school the value is 1 and 0 not attend the school.

HHI It shows the monthly income of each individual. More investment on so higher income positively correlated to children physical health and cognitive ability. HHS This shows size of the family. Increase in family size increase the burden on available resources of the household. TOH mean type of house like are they living in their own house or they are in rental house. Because own house reduces the burden of rent and improve the living condition that have a positive relation to the cognitive.

Chapter 5

RESULTS AND DISCUSSION

This section will discuss the results of impact of slum condition on physical health and cognitive ability of children that is analyzed through regression model. For this purpose, we first examine the descriptive statistics of dependent and independent variables. The descriptive statistics of these provided.

5.1 Descriptive Statistics of the Study

The table 5.1 demonstrates the enlightening insights of dependent variable (children's health) and the independent variable slum and other control variables which include children characteristics such as, age, gender, and school going status of the child. Parental characteristics consist of parental age, education and profession. Household characteristics include income, family size, and number of kids, house quality, and number of rooms, property ownership, and length of stay at this residence, sanitation facility, electricity provision, and source cooking.

Table 5.1: Descriptive statistics

VARIABLES	N	Mean	SD	Min	Max
CHILDREN AGE	203	9.037	2.641	1	12
GENDER	203	0.773	0.4196	0	1
HAZ	203	-2.479	2.008	-6	4.458
COGNITIVE SCORE	203	9.389	3.1734	0	15
AGE	203	42.90	10.16	4	70
MALE EDUCATION	203	7.167	5.128	0	16
FEMALE EDUCATION	203	4.069	4.517	0	16
INCOM	203	20,685	8,295	500	45,000
FAMILY SIZE	203	8.148	2.998	3	15
NO OF KIDS	203	5.862	2.725	1	13
HOUSE QUALITY	203	0.310	0.464	0	1
PROPERTY	203	0.6059	0.490	0	1
LIVING	203	9.473	5.675	1	20
WATER LOGGING	203	0.3251	0.470	0	1
WASH ROOM FACILITY	203	0.9909	0.0990	0	1
WASH ROOM CONDITION	203	0.5123	0.501	0	1
SMELL	203	0.497	0.501	0	1

Environmental conditions include water quality, water logging, drainage system, sewerage smell, and waste management. We got these results by comparing two groups of area one group

is called slum (Muslim colony) and next controlled group is Bari Imam. The table of descriptive statistics explaining the mean, standard deviation, minimum and maximum values of the observation.

HAZ stand for Z score of height and age of the children living in slum condition so the average value of Z is -2.479 mean it's below the standard deviation. According to the WHO standard when Z score is below -2 the child is stunted. Mean value of male and female education is 7.167 and 4.069 respectively. According to the census 2017 typical size of household in Pakistan is 6.7 while the average family size in our sample is 8.148 that is higher than the non-slum area in Pakistan.

5.2 Impact of Slum on Physical Health of Children's

Slum is not an environment friendly residential place. Theory mentioned it many times and after analysis the results explains the true story of literature. Due to non- availability of necessities of life the children's have to face different kinds of challenges that not only creating hurdles in current life but their future productivity will also affect. In slum height of children is less than the children living in non-slum area of Islamabad.

Table 5.2: Impact of Treated Area on HAZ

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Slum	-2.133***	-2.018***	-2.543***	-2.917***	-3.553***
Robust standard errors	(0.239)	(0.194)	(0.361)	(0.694)	(0.754)
Constant	-1.418***	-4.575***	-3.808***	-6.409***	-7.773***
Robust standard errors	(0.169)	(0.467)	(0.748)	(1.549)	(1.709)
Observations	203	203	203	203	203
R-squared	0.283	0.536	0.545	0.582	0.594
Child Characteristics	NO	YES	YES	YES	YES
Parental Characteristics	NO	NO	YES	YES	YES
Household Characteristics	NO	NO	NO	YES	YES
Environmental Characteristics	NO	NO	NO	NO	YES

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are report in parentheses. The children characteristics include, age, gender, and school going status of the child. Parental characteristics consist of parental age, education and profession. Household characteristics include income, family size, and number of kids, house quality, and number of rooms, property ownership, and length of stay at this residence, sanitation facility, electricity provision, and source cooking. Environmental conditions include water quality, water logging, drainage system, sewerage smell, and waste management.

Table 5.2 shows the impacts of slum on children's physical health. The first model only examines the treatment variable with controlling for other characteristics. In mode 2, we add

the child characteristics. The result in both remain significant and shows an adverse effect. In slum on children health. In model 3, we also control for parental characteristics. Household and environmental characteristics are controlled for in models 4 and 5 respectively. In all these, model the results remain robust in terms of sign, significance and magnitude.

Model 5 in our preferred specification. The results shows that children living in adverse socio-ecological environment of slums are 3.55 SD shorter compare to children living in non-slum areas. This confirms the adverse and significant effects of deteriorated socio-ecological conditions of slum on children’s physical health.

5.3 Channel_ Diarrhea

It is natural to are what could be the possible reason for this adverse effects. Is it only the nutrient deficiency?

OR it has something to do with water and sanitation quality. The literature outline several possible channels. However, our data allow us to empirical examine one channel- diarrhea.

Table 5.3 shows the impact of living in slum on the probability of having diarrhea in children. As evident from the table, residing in slum increases the livelihood of having diarrhea. The relationship between the two variables is positive and significant. Table 5.3 reveals that children living in slums are 94% more likely to experience diarrhea compared to these who living in non-slum area. Since the water quality and diarrhea are formed to be strongly correlated, are many conclude that the unimproved drinking water and, to some extent. This model explains how much impact these variables have on diarrhea, according to the first model in the

Table 5.3 Channel - impact of slums on diarrhea

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Slum	0.655***	0.647***	0.610***	0.758***	0.940***
Robust standard errors	(0.053)	(0.053)	(0.099)	(0.192)	(0.207)
Constant	0.167***	0.255**	0.386*	-0.083	0.518
Robust standard errors	(0.038)	(0.128)	(0.205)	(0.429)	(0.468)
Observations	203	203	203	203	203
R-squared	0.429	0.440	0.449	0.486	0.511
Child Characteristics	NO	YES	YES	YES	YES
Parental Characteristics	NO	NO	YES	YES	YES
Household Characteristics	NO	NO	NO	YES	YES

very important finding. It highlights the importance of parent’s education for children mental growth even if they are living in an unhealthy socio- ecological environment.

5.5 Impact of Slum Area on Cognitive Ability

Largely, we examine the impact of residing in slum on children cognitive ability development. The results are provided in table 5.5 as evident, living in slum has a negative impact on children’s cognitive ability in first two models. However, the relationship became insignificant in last three models. As disused earlier, parent’s education can offset the negative impact of adverse socio- ecological conciliations on children’s cognitive development.

Table 5.5: Impact of Slum on Cognitive Ability

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Slum	-0.474*** (0.137)	-0.417*** (0.112)	0.122 (0.201)	0.233 (0.380)	-0.062 (0.412)
Constant	0.236** (0.096)	-1.737*** (0.269)	-1.811*** (0.417)	-0.626 (0.847)	-1.622* (0.932)
Observations	203	203	203	203	203
R-squared	0.056	0.380	0.430	0.496	0.513
Child Characteristics	NO	YES	YES	YES	YES
Parental Characteristics	NO	NO	YES	YES	YES
Household Characteristics	NO	NO	NO	YES	YES
Environmental Characteristics	NO	NO	NO	NO	YES

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are report in parentheses. The children characteristics include, age, gender, and school going status of the child. Parental characteristics consist of parental age, education and profession. Household characteristics include income, family size, and number of kids, house quality, and number of rooms, property ownership, and length of stay at this residence, sanitation facility, electricity provision, and source cooking. Environmental conditions include water logging, drainage system, sewerage smell, and waste management.

The second objective of the underlying study was to calculate the long term loss due to the adverse effect of living in inadequate socio-ecological environment of slums. This is done by examining the loss in future wages of the affected children.

Vogl (2012) founded that an extra centimeter of height in Mexico is related with an hourly gain of 2.3% in wages. Using back of envelope calculation, we conclude that Pakistani children living in slum are likely to face a reduction of approximately 12% in their future wages due to their exposure to adverse socio-ecological conditions of slum decreasing their childhood.

Chapter 6

CONCLUSION AND RECOMMENDATIONS

The study reached on this conclusion that, the environment of slum is the main cause of many health issues in children. It is not only limited to physical health but also mental health which is referred as cognitive ability in this research.

The prime objective of this study was to analyze the impact of slum environment on children's physical health and cognitive ability. For this purpose, all the independent variables which are children, parents, household and environmental characteristics are controlled in the analysis of HAZ and cognitive ability. HAZ score of children is less in slum as compared to the non-slum area and the result shows a negative relationship between slum and children health. Water in slum is contaminated and also not provided properly. Water supply is limited and is leading to diarrhea. This leads to stunting and diminishing cognitive ability. There is a belief that education or schooling can reduce stunting. But in this research, we found that kids who go to schools have no impact on their stunting. The reason is the lack of basic health facilities in school which could help boost the process.

To divide the sample on gender basis, it is observed that male kids who are mostly out the streets and are exposed to garbage and other unhygienic environment affects mostly. Parenting is one of the most vital factor in child's upbringing. The result in this research shows that parents who have no proper livelihood are unable to provide best caring or upbringing to their kids. We have the results in chapter 4 table 4 the impact of slum on child cognitive ability, cognitive ability in slum is low then the cognitive ability in controlled area. These results are according to the literature and reality basis polluted environment reduce the growth of child's. Here study found parents and household characteristics have insignificant but surprising results to the children cognitive ability.

If parents are educated they will be worried about their growth development and education. Similarly, if the parents have good profession they can provide better education facilities to their cognitive ability development.

After analyzing the impact environment of children on physical health and cognitive ability. The results show the environment play very keen role on human development while children are more vulnerable to the environment, environment conditions have negative significant impact on children physical health in slum area as compared to the non-slum area. Children are facing high level of stunting in slum its mean height is very lower that weak them physically while cognitive ability also concern with physical health at initial level of growth. Slum condition like water quality, sanitation, drain system and smell etc. all these factors also the reason of less cognitive ability, similarly, parent's education and their profession cause to increase the cognitive ability in children.

The primary objective was to analysis the relationship slum dwellers' child and their health and the secondary objective is related to the cognitive ability and future productivity results showed cognitive ability affect in slum that is connected to the human development, as we know when there are low mental abilities there will be low productivity.

Keeping in consideration the negative impact of slum conditions on children's physical and cognitive abilities, the suggestions are as follows:

- 1- Slums are illegal by the regularity authorities. There is an issue of property rights. That is why; it's very hard for welfare organization to implicate development projects. Hence, an up gradation should be indicated on legal side.
- 2- In slum, contaminated water is the main source of spreading diarrhea in children that leads to low growth level which is a cause of stunting and reduce the cognitive ability as compared to non- slum area. Hence, piped water should be provided in their areas, may be it can minimized the issue.
- 3- Government should promote education. Study found, children living in slum or not if the parents are educated their cognitive ability not affected.

Since our results show that parent's education offset the negative affect of adverse socio-ecological condition of slums, it is important to promote education, especially for female, to have long term welfare impacts. In additions, various awareness campaigns need to be initiated about use of clean drinking water and sanitation facilities.

REFERENCES

1. Akhtar, N. "Measuring well being of the people living in Slums of Islamabad by Wealth Index and by household deprivations as an application to Human Development Index (HDI)."
2. Bartlett, S. (1999). "Children's experience of the physical environment in poor urban settlements and the implications for policy, planning and practice." *Environment and Urbanization* 11(2): 63-74.
3. Calderón-Garcidueñas, L., A. Vojdani, et al. (2015). "Air pollution and children: neural and tight junction antibodies and combustion metals, the role of barrier breakdown and brain immunity in neurodegeneration." *Journal of Alzheimer's disease* 43(3): 1039-1058.
4. Capps, K. A., C. N. Bentsen, et al. (2016). "Poverty, urbanization, and environmental degradation: urban streams in the developing world." *Freshwater Science* 35(1): 429-435.
5. Chauhan, B. G. and A. R. Navodaya (2015). "Factors Affecting to the Child Health in Urban India: A Comparative Study between Two Mega Cities."
6. Coley, R. L., T. Leventhal, et al. (2013). "Relations between housing characteristics and the well-being of low-income children and adolescents." *Developmental psychology* 49(9): 1775.
7. Davies, D. (2010). *Child development: A practitioner's guide*, Guilford Press.
8. Dewey, K. G. and K. Begum (2011). "Long-term consequences of stunting in early life." *Maternal & Child Nutrition* 7(s3): 5-18.
9. Dickerson, A. and G. K. Popli (2016). "Persistent poverty and children's cognitive development: evidence from the UK Millennium Cohort Study." *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 179(2): 535-558.
10. Duque, V. (2015). *Essays in Early Life Conditions, Parental Investments, and Human Capital*, Columbia University.

11. Duque, V., M. Rosales-Rueda, et al. (2017). "Integrating Early-life Shocks and Human Capital Investments on Education Outcomes: Evidence from Colombia." borrador del 10.
12. Everett Jones, S., A. M. Smith, et al. (2010). "School policies and practices that improve indoor air quality." *Journal of School Health* 80(6): 280-286.
13. Fund, F. U. C. s. (06 Dec 2017). How air pollution can affect brain development in young children.
14. Garciduenas, L. C., G. Melo-Sanchez, et al. (2015). "Air pollution and children: barrier breakdown, inflammation, brain immunity and neurodegeneration." *Journal of the Neurological Sciences* 357: e509.
15. Ghanem, S. K. (2018). "The relationship between population and the environment and its impact on sustainable development in Egypt using a multi-equation model." *Environment, Development and Sustainability* 20(1): 305-342.
16. Grantham-McGregor, S., Y. B. Cheung, et al. (2007). "Developmental potential in the first 5 years for children in developing countries." *The lancet* 369(9555): 60-70.
17. Habitat, U. (2016). "World cities report 2016. Urbanization and development. Emerging futures." Nairobi: UN Habitat. Google Scholar.
18. Hackman, D. A. and M. J. Farah (2009). "Socioeconomic status and the developing brain." *Trends in cognitive sciences* 13(2): 65-73.
19. Harris, M., M. L. Alzua, et al. (2017). "Community-level sanitation coverage more strongly associated with child growth and household drinking water quality than access to a private toilet in rural Mali." *Environmental science & technology* 51(12): 7219-7227.
20. Hillman, C. H., M. B. Pontifex, et al. (2009). "The effect of acute treadmill walking on cognitive control and academic achievement in preadolescent children." *Neuroscience* 159(3): 1044-1054.

21. Ijaz, M. K. and J. R. Rubino (2012). "Impact of infectious diseases on cognitive development in childhood and beyond: potential mitigational role of hygiene." *Open Infectious Diseases Journal* 6(1): 65-70.
22. JOYS, S. O. and C. O. PRAYER (2016). "Agenda for the Stated Session Meeting Bayside Presbyterian Church 15 March 2016 7: 00 PM Room 508." Agenda 7.
23. Khalid, H. and E. G. Martin (2017). "Female-Headed Households Associated with Lower Childhood Stunting Across Culturally Diverse Regions of Pakistan: Results from a Cross-Sectional Household Survey." *Maternal and child health journal* 21(10): 1967-1984.
24. Leight, J., P. Glewwe, et al. (2015). "The impact of early childhood shocks on the evolution of cognitive and non-cognitive skills." *Gansu Survey of Children and Families Papers*.
25. Machlis, G. E., J. E. Force, et al. (1997). "The human ecosystem part I: the human ecosystem as an organizing concept in ecosystem management." *Society & Natural Resources* 10(4): 347-367.
26. MacPepple, E., N. Okereke, et al. (2017). "Effect of Raw Sewage on Surface Water Quality in Opobo Town, Nigeria."
27. Meghir, C., O. Attanasio, et al. (2015). *Human Capital Development and Parental Investment in India*.
28. Mihelcic, J. R., C. C. Naughton, et al. (2017). "The grandest challenge of all: The role of environmental engineering to achieve sustainability in the world's developing regions." *Environmental Engineering Science* 34(1): 16-41.
29. Nataro, J. P. and R. L. Guerrant (2017). "Chronic consequences on human health induced by microbial pathogens: Growth faltering among children in developing countries." *Vaccine* 35(49): 6807-6812.
30. Oller, I., S. Malato, et al. (2011). "Combination of advanced oxidation processes and biological treatments for wastewater decontamination—a review." *Science of the total environment* 409(20): 4141-4166.
31. Paul, S. (2015). "A comparative study of home environment and adjustment among adolescents: Gender differences." *Indian Journal of Health and Wellbeing* 6(6): 616.

32. Perera, F. P., Z. Li, et al. (2009). "Prenatal airborne polycyclic aromatic hydrocarbon exposure and child IQ at age 5 years." *Pediatrics* 124(2): e195-e202.
33. Rajgire, A. (2013). "Open defecation: a prominent source of pollution in drinking water in villages." *International journal of life sciences biotechnology and pharma research* 2(1): 238-246.
34. Ross, J., S. Horton, et al. (1998). *Economic consequences of iron deficiency, Micronutrient Initiative, IDRC, Ottawa, ON, CA.*
35. Rubio-Codina, M., O. Attanasio, et al. (2015). "The socioeconomic gradient of child development: Cross-sectional evidence from children 6–42 months in Bogota." *Journal of Human Resources* 50(2): 464-483.
36. Sampson, N. (2012). "Environmental justice at school: understanding research, policy, and practice to improve our children's health." *Journal of School Health* 82(5): 246-252.
37. Siddique, S., M. Banerjee, et al. (2011). "Attention-deficit hyperactivity disorder in children chronically exposed to high level of vehicular pollution." *European journal of pediatrics* 170(7): 923-929.
38. Unger, A. (2013). "Children's health in slum settings." *Archives of disease in childhood* 98(10): 799-805.
39. Vanos, J. K. (2015). "Children's health and vulnerability in outdoor microclimates: A comprehensive review." *Environment international* 76: 1-15.
40. Rains, E., A. Krishna, et al. (2018). "Evidence on the range of policy needs and scope of mobility."
41. Chuhan, B., & Navodaya, A. (2015). *Factors Affecting to the child Health in India: A Comparative Study between Two Mega Cities.*
42. Hunter, D. R. (1968). *The Slums: challenge and response (vol.91549)*

43. Hass, J (2013) Remote Sensing of Urbanization and Environmental Impacts
(Doctoral dissertation, KTH Royal Institute of Technology).

APPENDIX

Polycyclic aromatic hydrocarbons:(PAHs) are a group of more than 100 different chemicals that are released from burning coal, oil, gasoline, trash, tobacco, wood, or other organic substances

Fluorides: An abnormal condition caused by excessive intake of fluorides, characterized in children by discoloration and pitting of the teeth

Alzheimer's: is a type of dementia that causes problems with memory, thinking and behavior. Symptoms usually develop slowly and get worse over time, becoming severe enough to interfere with daily tasks

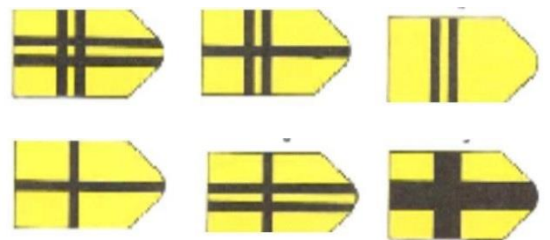
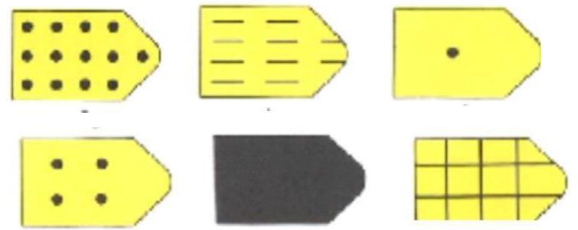
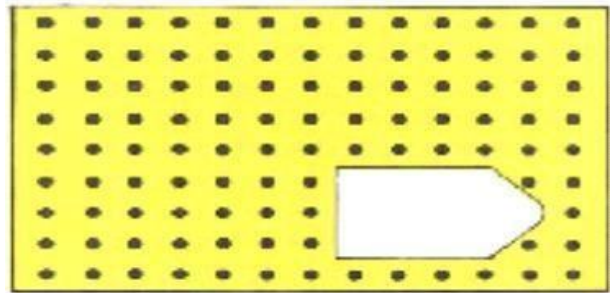
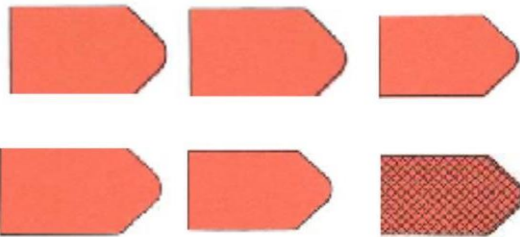
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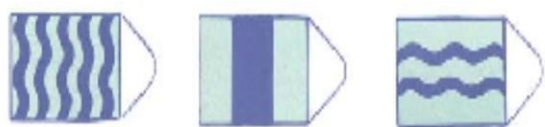
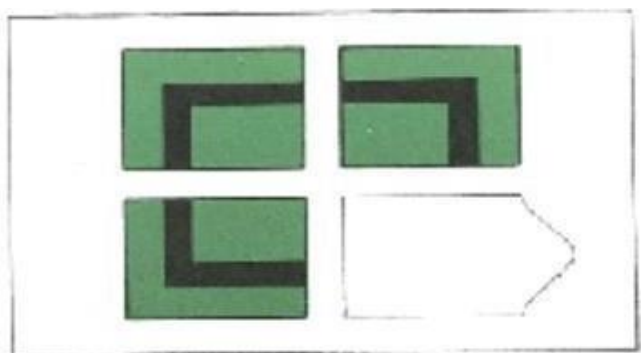
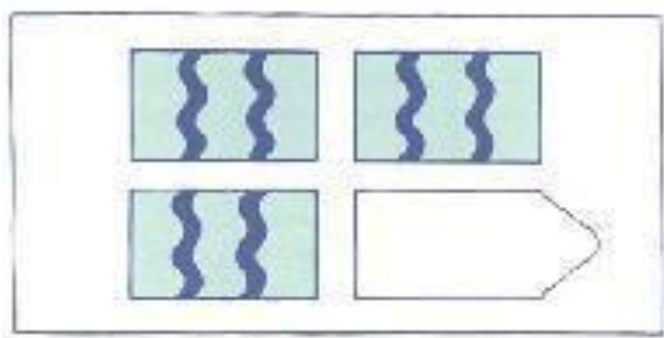
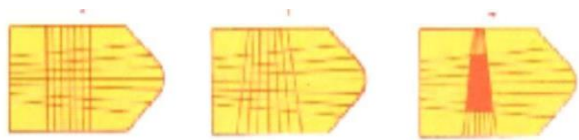
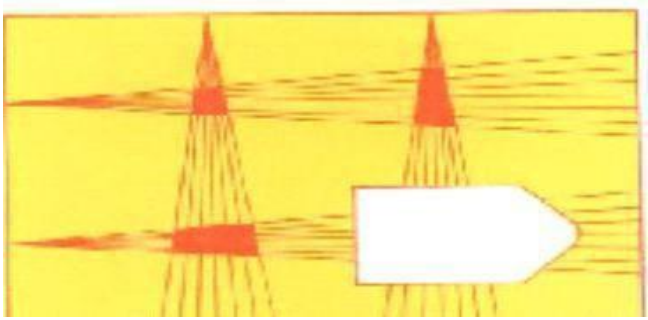
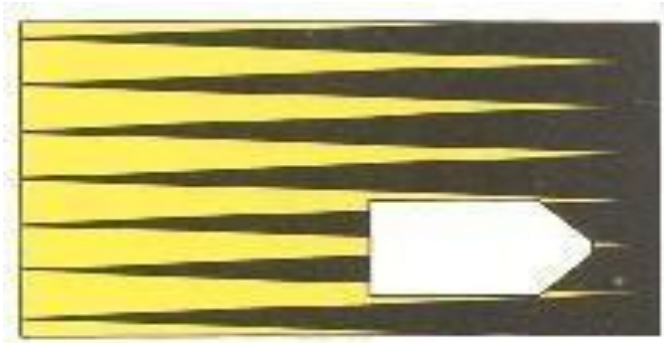
Cognitive abilities: are brain-based skills we need to carry out any task from the simplest to the most complex.

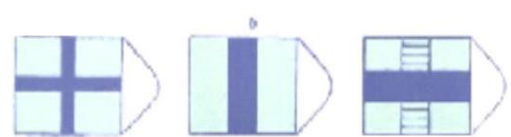
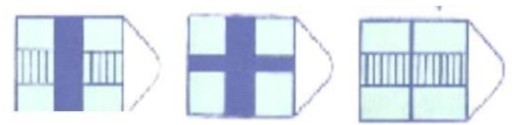
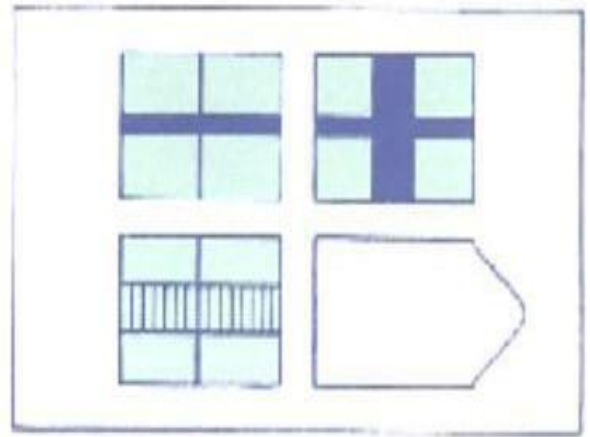
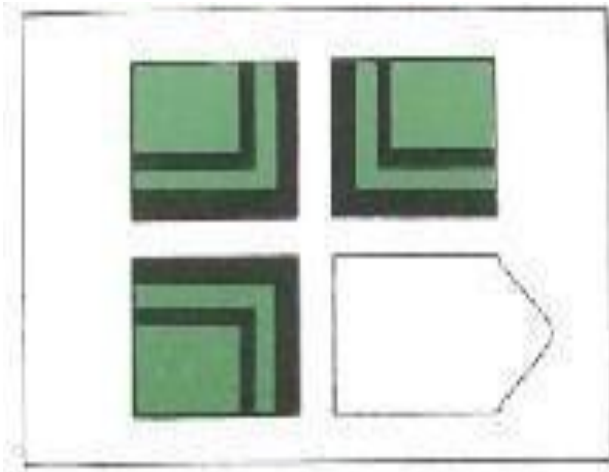
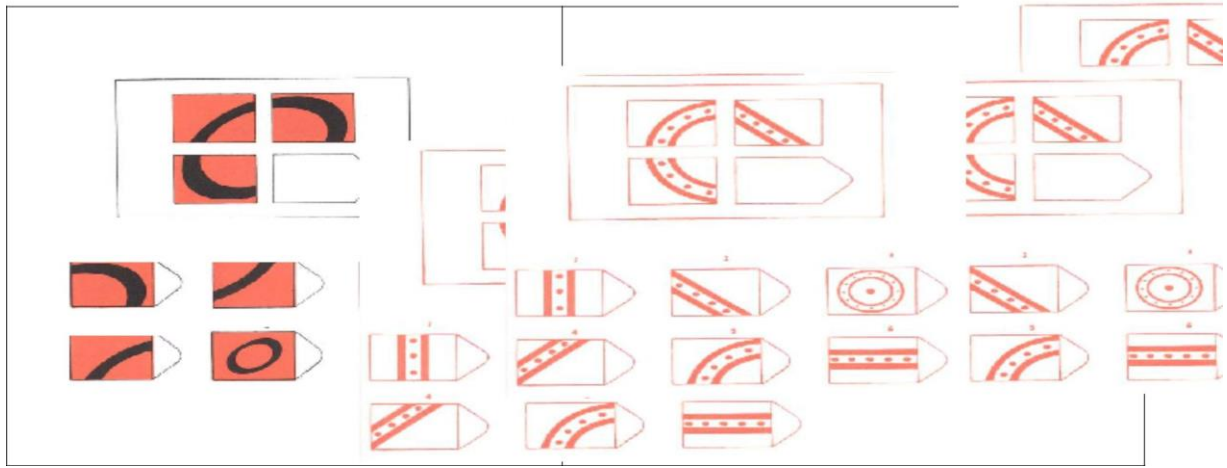
Stunting: below minus two standard deviations from median height for age of reference population

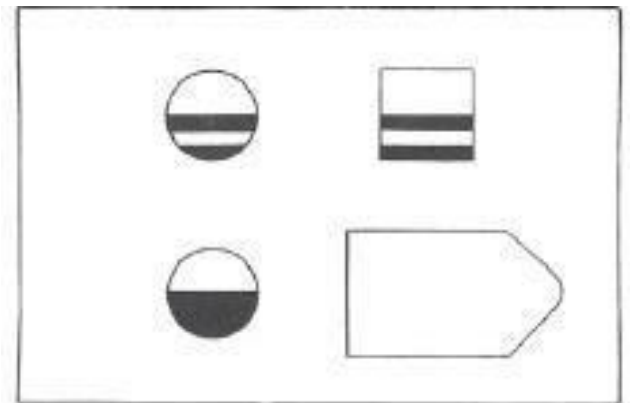
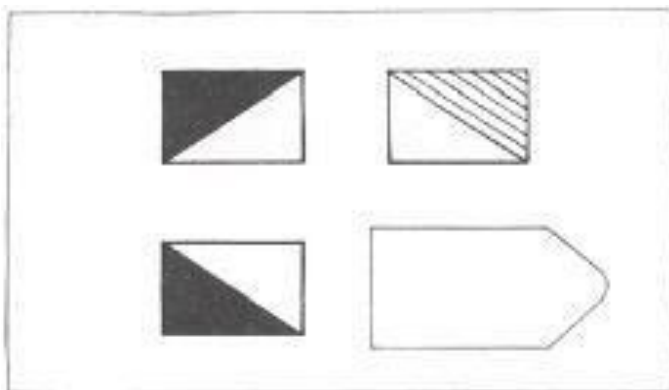
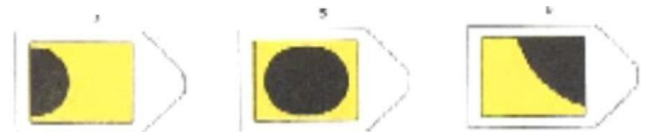
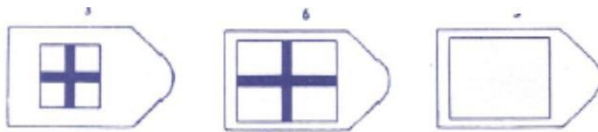
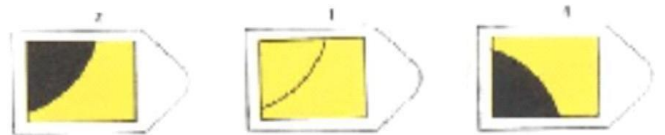
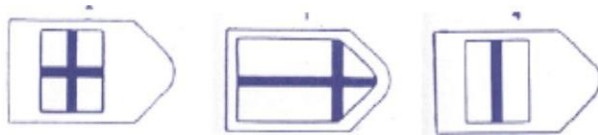
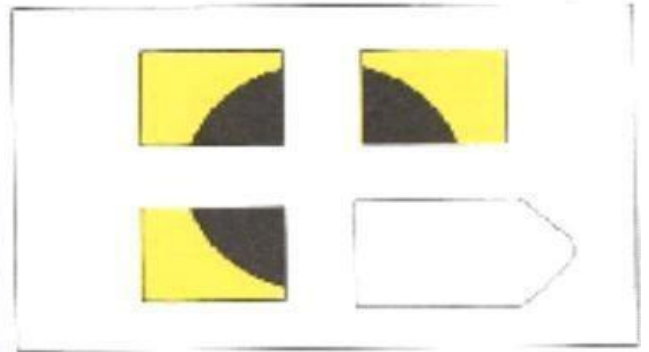
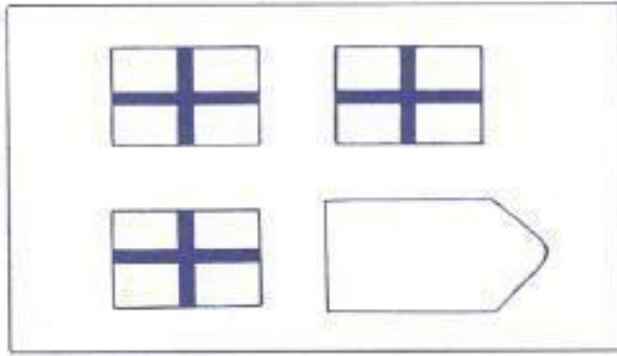
Obesity: is a condition where a person has accumulated so much body fat that it might have a negative effect on their health.

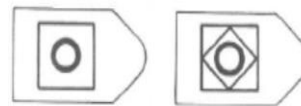
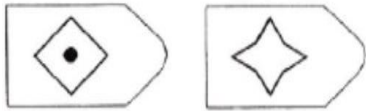
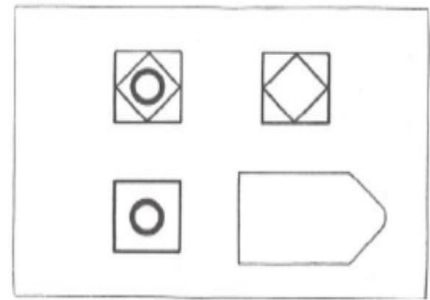
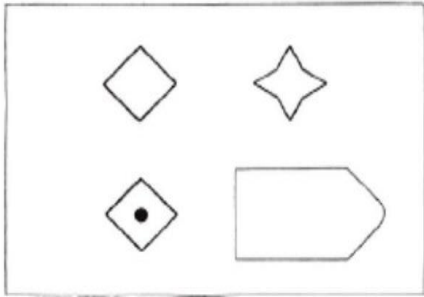
Questionnaire











Sr. No	Age	Height cm	Gender	Class enrolled

HOUSEHOLD SOCIO-ECONOMIC AND DEMOGRAPHIC INFORMATION

A: Household Information and Family Profile:

1. Name of respondent. _____
2. Age: _____
3. Gender: _____
4. Relationship with household: _____
5. Education: _____
6. Income: _____
7. Profession:
 1. Daily Wages
 2. security gard.
 3. Business
 4. Maid
 5. Taxi/ Rickshaw.
 6. Other
8. Family size: _____
9. How many kids you have? _____

1. Boys: _____ 2. Girls: _____

Sr. No	Age Group	Number of kids
1	1-4	
2	5-12	

10. Respondent Location:
 1. Slum colony
 2. Bari Imam
11. House quality
 1. Pucca
 2. Semi Pucca
- 11.1 No of rooms
12. Is this house your property?
 1. Own
 2. Rented
13. Why you are living here?
 1. Relocated by government
 2. Network of family and village kin in this area
 3. Cheap price
 4. parents shifted here
 5. Because of marriage
 6. Workplace is near
14. How long have you been living here?
15. Water logging in monsoon?
 1. Yes
 2. No
16. Source of water?
 1. Stream
 2. Tank/pond
 3. Public tap
 4. Tube well
 5. Hand pump
 6. Filtration plant
 7. Piped water
17. Do you have Washroom Facility in your house?
 1. Yes
 2. No

18. If inside house premises
 1. Covered
 2. Open.
19. If outside house premises?
 1. Open space outside the house
 2. Public toilet/bathroom
20. What type of drain system?
 1. No drainage system
 2. Open katcha
 3. Covered Pucca
 3. Underground
21. Do you feel any type of smell from the drainage system?
 1. Yes
 2. No
22. Where you put your home waste?
 1. No specific place
 2. Collection point
 3. Open land
 4. Collected from home
24. If take the garbage to the common dumpster, time period to collect the garbage
 1. Every day
 2. Alternate day
 3. Once a week
 4. Once in two weeks
25. Who comes to collect the garbage?
 1. CDA workers/ vehicles)
 2. Private groups through CDA
 3. Private groups through community
 4. NIL
26. Have you electricity connection?
 1. Yes.
 2. NO
27. Source of cooking?
 1. Kerosene stove
 2. Gas stove
 3. Electric heater
 4. Mitti ka chulha (mud stove)
 5. We take food from outside
 6. Any others
28. If gas stove the connection taken by?
 1. Own connection
 2. Owned by any other
 2. Buy it in Black
 4. Any others
29. Do children in your area play/spread the waste dump?
 1. Yes
 2. No
30. Do your children go to school?
 1. Yes
 2. No
31. How many children go to school?
32. In which class he/she enrolled?

Sr. No	Enrolled class

33. Where the children's go for study?
 1. Govt. School
 2. Private School
34. If Private schools?
 1. Teachers are good
 2. Better education
 3. Better environment/facilities
 4. Go any other school
35. If Govt. schools?
 1. Less expensive
 2. Better education
 3. Better Facilities
 4. Closer to home

36. Where you go for medical treatment?

1. Govt Dispensary
3. Private doctor

2. Private OPD
4. Chemist shop

37. Health expenditure within the month

38. Personal hygiene hand wash before eating/after visiting toilet?

1. Yes

2. No

39. Have you face disease any of them?

Diseases Suffered by the Sample Respondent / Their Family Members in the 6 month or 1 Years.

Sr. No	Name of diseases	How many time	Over time
1	Viral fever/ Respiratory Infections		
2	Dengue fever		
3	Skin diseases		
4	Cough & cold/ Throat & eye infection		
5	Diarrhea		
6	Chicken pox		
7	Typhoid		
8	Hepatitis		
9	others		