

# Pollution Risk Accumulation from Households in Dar-Es-Salaam, Tanzania

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**Abstract:** *Today, more than half of the worlds' population lives in cities, in which one third reside in informal settlements, under conditions of constrained services and infrastructure. Consequently many of them are exposed to a wide range of health risks. The aim of this qualitative study was to assess the factors that pose health risks to the urban dwellers in the informal settlements of Dar-Es-Salaam. To achieve this aim the study focused on the assessment of conditions of the informal urban living environment, that if not managed can pose a health risk to the urban dwellers. The urban environment factors that were assessed include housing water supply, solid waste, drainage system, road access and waste water sewage. Mnazi Mmoja and Midizini sub wards in Dar-Es-Salaam were used as case study. The data was collected with the aid of semi structured interviews, focus group discussions, observations and literature review, and was analysed qualitatively. The diseases that were found to be predominant in Mnazi Mmoja and Midizini Sub-wards are; Malaria, Cholera, Diarrhoeal and Typhoid. The factors that present health risk in the case study areas were found to be: Use of unsafe water because of limited access to safe water supply, Pilling up of solid waste due to inadequate waste handling and collection, Poor housing condition including overcrowding, Indoor smoke from cooking and filthy external surrounding, Stagnant water on storm drains due to waste accumulation that leads to blockage, Narrow and inaccessible part during emergency services. These factors were driven mainly due to absence of proper urban planning that leads to proliferation of informal settlements following rapid urban population growth, but unmatched and slow expansion of infrastructure and housing. It is important for the government to take measures in planning and advocating the upgrading of these informal settlements through more participatory approach by including residents of these settlements.*

**Keywords:** Urban Health Risk; Diseases; Slum Dwellers; Urban Planning; Urban Environment; Urban Growth; Water Supply; Sewage and Waste-Water; Solid Waste; Drainage; Dar-Es-Salaam, Tanzania

## 1. Introduction

More than half of the world's population lives in areas that are categorized as urban areas,[85]. In developing countries, with increasing urbanisation process a significant and growing proportion lives in or around metropolitan areas, [84]. Most of them live in the city outskirts, where they depend to some extent on natural resources such as land for food, water and fuel, and space for living, [2]. The urban fringe comprises the habitat of diverse populations, including lower income individuals who are mostly exposed to negative externalities of both rural and urban systems,[21]. These externalities comprise of; health risk, life and physical dangers associated with the living or working in unsuitable sites, lack of access to clean water and basic sanitation and poor housing conditions. Environmental changes also affect the livelihood strategies of these communities by decreasing or increasing their access to different types of capital,[72]. Many of Sub-Saharan Cities are undergoing increased rates of urbanization with uncontrolled changes in land and building uses, increasing densities and intensifying spatial size which if not effectively managed could result into hazards or even disasters,[92]. For example, lack of access to safe and clean drinking water can expose the urban dwellers to epidemics such as cholera, [99]. The situation can be worsened if floods occur hence, leading to widespread contamination of water sources particularly in those areas with low sanitation, [71]. In such circumstances, if appropriate control measures are not implemented, may lead

to health risks due to intensification of diseases risk which can cause disaster epidemic.

Urbanization in Tanzania has been on a rapid increase in the last two decades, [66]. The rapid urbanization has led to profound expansion of among others the four major urban centres - Dar-Es-Salaam, Mwanza, Mbeya and Arusha,[88]. Dar es Salaam comprises about 10% of the total national population (5.1 million people) and about 40% of the national urban population, [89]. Because of absence of adequate urban planning measures, 40% to 80% of the urban population reside in unplanned parts of the cities that lack most of the essential municipal services such as sanitation, waste management system, water supply systems, and road systems, [35]. Additionally, Lerise et al.,(2003),[35] have indicated that these parts of the city are highly populated with record high population densities.

### 1.1. Research Problem, Objectives and Aim

Urbanisation process in Tanzania is characterised by unguided spatial expansion and settlement densification. This unguided development has led to spread of informal settlements, worsening of social services (e.g. environmental care, health care services, foster care and residential care) and public utilities (e.g. housing, electricity, water and sewage and sanitation) increasing urban poverty and lack of security of tenure, [34]. Many urban areas in Tanzania thus have poor drainage systems, poor sanitation, and lack access

roads, poor housing condition and deteriorating environmental qualities. Consequently, people residing in these urban areas are exposed to a wide range of risks,[34]. It is therefore, important that the exact sources of health risk factors are understood to aid the policy intervention to control, and prevent the occurrence of disasters.

Therefore, this study attempts to assess the health risks that can affect people living in an urban environment; analyse the factors that contribute to the health risks; and discuss possible measures/interventions that can be adopted to address the problem. This is achieved by ensuring that the existing situation is addressed and worked out, through questions like:- What kind of health risks are households in urban areas exposed to?, and What are the strategies used by the urban households living in these informal settlement to avoid health risk accumulation. The outcome of this research will bring to the fore, the health risks to which people are exposed to, their causes and recommended interventions to reduce impact. This information can serve as a good basis from which the government can design, and implement policies to increase preparedness, to prevent or adapt to various urban health risks- consequently, provide a good living and working environment for all groups of urban dwellers.

## 2. Literature Review

The literature review gives a clear understanding on how common infrastructure like; housing, water supply, sanitation and sewage, solid waste and transport systems, can affect urban environment and contribute to accumulation of health risks. It begins by giving a brief understanding of terminologies like; Urban Health, Urban Growth, Urban Planning, and the in-depth description on the Urban Environment.

### 2.1. Urban Health

Galea et al.,(2005),[14], defines Urban Health as the study of the health of urban population. According to Galea et al.,(2005),[14], the urban health can focus on the health of the whole urban population or a segment of the population. Urban growth, urban planning and urban environment in general, [24], are important factors that can affect the health status of the urban population in a particular urban region. For instance, a rapid urban growth in absence of proper planning can result in adverse impacts on the urban environment (i.e. housing, landscape, sanitation, water supply, air and other infrastructure),[62].

### 2.2. Urban Growth

Urban growth is a rapid process in most parts of the world, [5]. However, the rate of urbanization varies from region to region and between various cities in a country. The rapid urbanization is drawing large population from rural areas to cities,[8] and this trend is expected to continue into the future,[58] which in turn will accelerate rural urban migration. The rural urban migration is often economically driven as people strive to move to areas where they can

secure jobs and get access to basic infrastructure (schools, health clinics, workplaces and communication networks),[23]. Most cities in the developing world are growing rapidly leading to high population densities as well as expansion into the city's outskirts,[9]. The crossroads and market towns rapidly convert into urban centres, [8].

Thus despite that formally all big cities were situated in developed countries, (Vitousek et al.,1997),[91] reports that; nowadays most of the large cities (10 million inhabitants) are located in the developing world,[42]. Thus the rate of urban growth in most developing countries is fast and rising steadily, [10],[77],[42]. The rapid urbanization in the developing countries has been experienced particularly from the 1950s – in which period the urban population in developing countries has grown to 2 billion from approximately 300 million, [7].

The rate at which the urban infrastructures are developed and expanded in most developing countries is much slower than the rate of the urban population growth,[102]. Thus the urban population in most of the developing countries far outweigh the available basic facilities such as roads, water supply, sewage facilities, education and healthcare facilities among others, [60]. Consequently, employment opportunities, conflict due to competition for the limited resources, as well as depletion of city budgets are among the impacts that can arise, [8]. Additionally, constrained infrastructure can lead to various adverse human health problems. According to Mavalankar et al.,(2009), [40] absence of sufficient infrastructure lowers the quality of services and can increase vulnerability of individual and the community to various health risks.

### 2.2. Urban Planning

Urban Planning according to Kotchitzky et al.,(2006),[28] is a multidisciplinary field that involves many experts for successful implementation. Urban planning is often conducted in order to enhance the wellbeing of the urban dwellers through a healthy environment that is clean and aesthetically suitable for living in. Urban planning is used to ensure that the community's requirements such as housing, healthcare infrastructure, water supply, natural resource utilization, transport and garbage collection are available in sufficient levels to meet the rapidly changing urban population,[28]. Because of the diversity of issues that need to be considered in the urban planning, besides the master plan, many other sectorial urban plans such as regulatory and incentive strategies, economic development plans, health programme plans and disaster preparedness plans, housing plans,[23] are often applied.

Through urban planning, the design of the built environment are well coordinated to ensure that the built infrastructures are suitably placed geographically and functionally, [44] in a manner that promotes sanitation, protection from accidents, fire hazards and access to basic public services. Through such planning the living standards rise and inequalities are minimized,[11]. In other words, proper planning will thus facilitate access to quality services for the urban

population,[14] which in turn will promote a health urban living environment. But many countries around the world particularly the developing world either lack proper urban planning policies or the existing urban plans are not implemented satisfactorily,[78].

Consequently, informal settlements sprawl, the basic infrastructural development lags behind the rapidly increasing urban population, hence leaving most people without access to proper housing, clean water supply, sanitation and sewage system, roads, healthcare infrastructure among many other necessary services and infrastructures – all these adversely affect the urban living environment which exposes the dwellers to various health risks.

### 2.3. The Urban Environment

The urban environment is constituted of a complex mix of natural elements (e.g. air, water, land, climate, flora and fauna), built environment (buildings, infrastructure and urban open spaces) and other socio-economic activities. It can thus be said that it is the interaction of the natural, built and socio-economic factors that will affect the kind of urban living environment. The kinds and state of infrastructure that is available often affects the natural environment, socio-economic activities and the health of the urban population. The most common infrastructure that have been observed to have a major impact in this regard are; housing, water supply, sanitation and sewage, solid waste and transport systems, [68]. In the following sub-sections a literature review describing how these infrastructure can affect urban environment and contribute to accumulation of health risk is presented.

#### 2.3.1. Housing

According to HREA,(2011),[17] every human being has a right to adequate housing. “*Adequate housing is the housing that conforms to basic standards with regard to security of tenure, availability of services, materials, facilities, and infrastructure, affordability, habitability, accessibility, location, and cultural adequacy*”,[17]. The aim is to ensure that everybody can access quality life, human dignity and promote good health (mental and physical health).

However, due to the rapid urban population growth coupled with unmatched housing and infrastructural development, a substantial percentage of urban dwellers are either homelessness or live in poor quality housing in informal settlements,[17]. The homeless lack access to regular and customary housing,[74] – such people live and sleep in the open public areas (e.g. sidewalks, under bridges and public parks). According to the UN-Habitat,(2010a),[82], approximately 100 million people are homeless globally. According to UN-Habitat,(2003a),[75], one third of the urban dwellers globally live in informal settlements. However, according to UN-Habitat,(2003b),[76] the urban population that lives in slum areas globally is estimated at 1 Billion people. Both the urban homeless and the urban slum dwellers live in abject poverty and in an environment that often lack access to basic infrastructure and services (water, sanitation, sewage, security) in addition to being

overcrowded,[57]. Such conditions expose the residents of these areas to diverse health risks such as water-borne disease, HIV/AIDS and respiratory,[41].

#### 2.3.2. Water

Access to safe water supply is one of the basic fundamental human rights, [93],[94]. However, still a large global population (1.1 Billion) have no access to safe water supply sources, [93],[94]. Safe water is often accessed from water sources such as piped water (to dwelling, plot, yard or public tap), borehole, protected spring and rain water,[97]. The inadequate access to safe water can be attributed to many factors such as insufficient water management system, lack of sufficient finances and weak institutional capacity,[1]. Thus it must be acknowledged that clean water is a limited resource, [1] that is essential for a health population,[86]. Lack of access to adequate amount of safe water can adversely affect lives and livelihoods,[104]. In absence of safe water supply the urban dwellers become vulnerable to a wide-range of water-borne diseases,[95],[16].

#### 2.3.3. Sewage and Waste Water

According to Smith,(2002),[65], many people (2.4 Billion), world over have no access to right infrastructure for safe disposal of sewage and waste water. Thus in many parts of the world, particularly Africa, Latin America, Caribbean and Asia, a greater percentage of waste water and sewage are discharged to the environment without treatment,[93]. Such discharge exposes the population to a wide range of adverse health impacts through polluted drinking water, contamination of food, and contamination of bathing water. It can also create a suitable environment for various vectors such as flies and insects which in turn would lead to proliferation of vector-borne diseases,[94]. The most vulnerable to contracting the diseases are the children, and the elderly as well as those people whose immunity has been compromised by other diseases such as HIV/AIDS,[65].

#### 2.3.4. Solid Waste

Because of the rapid increasing urban population, coupled with increase in industrialization and consumption, enormous quantities of solid wastes are generated globally,[79],[19]. The large quantity of solid waste that is generated is causing many problems in waste handling in low and middle income countries.[79]. The solid waste management is more pronounced in low-income neighbourhoods in both low-income countries and in the large cities in middle-income countries.[19]. Uncollected solid waste can cause harmful environmental problems by blocking drainage systems and contaminating water sources.[19]. Poorly handled solid waste can also cause ground water pollution through leaching of chemical substances from hazardous waste in the disposal landfills,[19]. Consequently, it can be concluded that through the afore-mentioned pathways, poorly handled or undisposed solid waste can cause profound health risks to the urban population,[19].

#### 2.3.5. Accessibility

Easy accessibility to basic needs (water supply, energy and food), social welfare (health and education), and economic welfare (trade and industry) is essential in quality living,



[20],[83]. Accessibility is therefore determined by the location of the above-referred infrastructure and services in relation to where people live, [20]. Thus to enhance access for instance to basic needs, the health care facilities and schools need to be located close to the residential areas or an affordable, reliable and quality means of transport e.g. road or rail be available for easy commuting. But in many developing countries most of the above-mentioned infrastructure is limited and unreliable particularly in informal settlements and slum areas. Depending on what kinds of infrastructure that are constrained, there would be a risk of adverse health impacts – for instance lack of access to safe water supply may result in proliferation of water-borne diseases.

### 3. Methodology

The methodology used in this qualitative study was case study and survey methodology, with the research design being descriptive, in which interviews, focus group discussions, literature review, questionnaire and field observations, were used. Descriptive design was used to make a detailed assessment of the health risks that can affect people living in an urban environment. As identified by Mugenda & Mugenda,(1999), and Kothari,(2004),[45],[29]; descriptive research is a process of collecting data in order to test hypothesis or to answer questions concerning the current status of subjects in the study.

#### 3.1. Data Collection

In this study, the data collect both secondary and primary data, in which data were collected from both primary and secondary data sources, that included; books, reports, journal, internet publications, academic articles, field work observation and interviews. The data collected was analysed qualitatively. For the secondary data; the literature was reviewed to gives a clear understanding on how common infrastructure like; housing, water supply, sanitation and sewage, solid waste and transport systems, can affect urban environment and contribute to accumulation of health risks. This was achieved by reviewing several documents containing information on health risks, health policies, legislations, regularization, informal settlement and research studies. Furthermore, the data collection was also achieved gathering both spatial and non-spatial data from central and local government authority. The spatial data include: *Topo*-images, area boundary, ward administrative boundaries and sub-wards and blocks, while the non-spatial data include the health risk survey, the regulations applicable to the households.

The primary data, was collected from the field conducted in Mnazi Mmoja and Midizini of Manzese in Dar-Es-salaam, Tanzania, through; interviews, focus group discussions and field observations. Semi-structured interview technique was employed, in collecting data from various actors and stakeholders that were directly or indirectly working or were affected by the urban health risks in Mnazi Mmoja and Midizini. These included dwellers, business men/women and local authority, area clinics. Semi-structured interview were

used for varied reasons, the study was carefully being done to avoid researcher's influences in opinions of the respondents. At the same time the researcher was in control of the main domain of the research. Due to the nature of health risk management in Manzese area, the views and practices of the interviewees might not be lucid to the researchers, and for this reason questionnaires were used to supplement the semi-structured interview method and focus group discussions. The questionnaires serve to sample opinion on various health risks and help to fill the information gap where the interviewee will not grant the interview.

Moreover, the interviews covered four main areas like;— the type of health risks, factors contributing to the causes of health risks, the investigation on local strategies taken against factors causing health risk, and the investigation on the effectiveness of the local strategies and how can it be improved. The respondents interviewed were selected from various levels and occupation. The interviewed respondents were from household residents, academia, central government, local authority, Ward level, Sub ward level, and Ward clinics. The aim for interviewing people from various level was to acquire a clear image of the health risk situation. The household respondents were purposively (randomly) selected in both Mnazi Mmoja and Midizini area during the field visit. The respondents from academia were from Ardhi University, who have previously worked on the same area, and on the similar issues. Health officers and planners were interviewed at government, local authority and ward level. Respondents at sub ward level were mainly area ten cell unit leaders and local authority officer. The respondents interviewed were as per the summary in Table #3.01 below.

Additionally, the field observation, was one of the most significant ways to collect data from the field. Observations were conducted by physically visiting the field and assessing the condition of different infrastructures (water source, road access, housing, solid waste, waste water, and drainage) and situations where major health risks are found. The observations aimed at supplementing the information from the respondents, in which photographing was done for further understanding of the infrastructure condition. While assessing the infrastructure condition and situations where health risks are predominant, results from observation was further used to analyse information gathered from the respondents.

Again, during data collection, information was gathered from the field using three different focus group discussion (FGD) within the case study area, by purposively selecting a set of participants for discussing issues and concerns relating to the health risks that can affect people living in an urban environment. Each focus group were having member from various levels (households, local authority and municipal level) with a total of fifteen(15) members in each focus group. Lists of key themes were drawn up to discuss the condition of the infrastructure,[31]. The focus group discussion was very effective, and it created a friendly atmosphere for the respondents where it was easy to convey the information,[12]. For this particular study it was important to conduct focus group discussion, as it was

observed that respondent in the study area responded more when in group. The main aspects discussed with the focus group were the current infrastructure condition, the health risks posed and diseases involved. In order to keep the discussions on the right path and at the same time allowing respondents to talk freely and spontaneously, a discussion guide was employed to guide the sessions.

**Table 3.01:** Summary of the respondents and interviews conducted during the fieldwork, **Source:** Authors,(2017)

SN	Interviewee's Institutions	Interviewed Person's Position	Number of Persons Interviewed
1.	Mnazi Mmoja and Midizini Sub ward	✓ Households	30
2.	Academia (Ardhi University)	✓ Researchers ✓ Lecturer	2 2
3.	Central Government ▪ Ministry of Health (MoH) ▪ Ministry of Lands, Housing, and Human Settlements Developments (MLHSD)	✓ DSM Health Officer ✓ Planning Officer	1 1
4.	Local Government ▪ Dar-Es-Salaam City Council ▪ Kinondoni Municipal Council	✓ DSM Planner ✓ DSM Health Officer ✓ Kinondoni Municipal Planner ✓ Kinondoni Municipal Health Officer	1 1 1 1
5.	At Ward Level	✓ Manzese Ward Executive Officer ✓ Health Officer	1 1
6.	At Sub-ward Level	✓ Ten Cell Unit Leader ✓ Local Authority Officer	2 2
7.	Area Clinic Level	✓ Medical Doctor ✓ Medical Assistant	1 1
TOTAL			48

Moreover, for the sake of this study the snowballing sampling technique was used to collect data from households living within the case study area. This sampling technique is useful if the researcher knows little about the group or neighbourhood he/she wishes to study, as it needs only to make contact with a few individuals, who can then direct you to the other members of the group. Additionally, a preliminary investigation was conducted after gathering information from various literatures, research papers and learning from various sources (local people, government clerks and academia), in order learn more and decide on which settlement would fit for conducting the field study. Among the informal settlements visited were, Changanyikeni, Mlalakuwa(Survey), Tandale, Makongo Juu and Manzese. At the end, Manzese ward was selected as a case study area, basing on the principle stated by Nachmias,(1997) that; "selection of the study area must based on the information availability." Therefore, the following summary below in Table #3.01 and 3.02, were reasons for choosing Manzese as a case study area;—

**Table 3.02;** Summary for the criteria used to select the case study settlement/area

SN.	Criteria
1.	Ward with old age due to nature of its establishment, and ease of access.
2.	The information richness of the case study area.
3.	The ward with both formal and informal housing development.
4.	The ward with a mixed population covering those with lower, medium and higher earning, as well as the illiterate and literate.
5.	The areas were, many studies have been conducted before
6.	The ward with saturated activities and population, and it is easy to get respondents for interviewing.
7.	The area that has been existing for longer time.

**Table 3.03:** Summary for the criteria (weights or points) considered in selecting the case study settlement/area

SN.	Case Settlement	Criteria(Weight)					Total
		1	2	3	4	5	
01.	Changanyikeni	2	3	5	1	2	13
02.	Makongo Juu	3	4	3	4	3	17
03.	Mlalakuwa	1	3	2	4	5	15
04.	Manzese	5	5	5	5	4	24
05.	Tandale	1	2	4	5	3	20

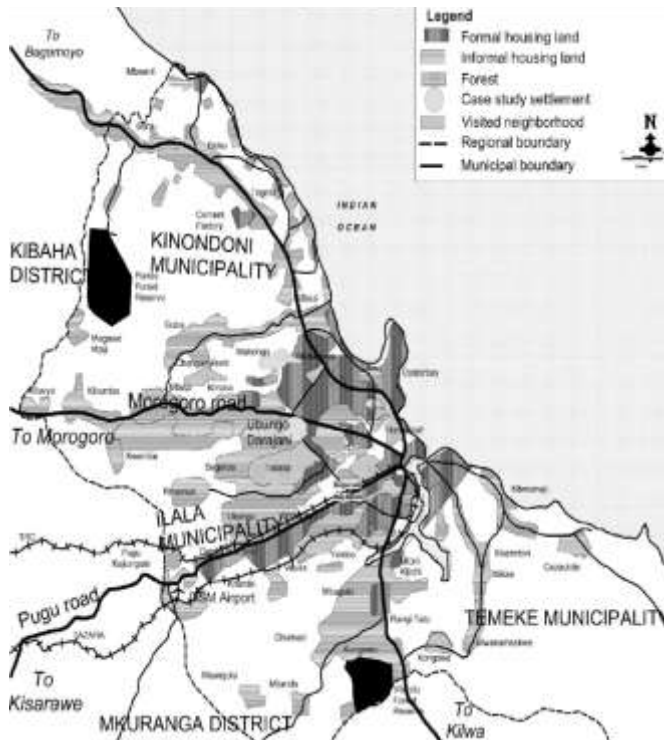
Key: 5 = Excellent, 4 = Very good, 3 = Good, 2 = Satisfactory, 1 = Poor

**Source:** Authors,(2017).

Basing on the selection criteria of the case study area as summarized in table #3.01 and table #3.02 as seen above, it was revealed that Manzese Ward scored 24 points more than any other settlements analyzed, implying that; it was the suitable ward, among others, selected for assessing the health risks that can affect people living in an urban environment in Dar-Es-Salaam, Tanzania, hence selected.

### 3.2. Description of the Study Area

This study was conducted in Mnazi Mmoja and Midizini sub-wards of Manzese ward of Dar-Es-salaam city in Tanzania. Manzese was chosen as a study area because it is one of the oldest informal settlements which has existed since 1960's - it was assumed to have better strategies to combat health risks. Within the Manzese ward, the study was conducted in Mnazi Mmoja and Midizini sub-wards. The two sub-wards were selected because of their information richness within the area, as health risk accumulation processes is a significant issue in these areas. Many studies have been conducted and documented that could also be used as a reliable sources for secondary data. These include studies by Sliuzas,(1988); Kironde,(1995); Kironde & Rugaiganisa,(2002); Nguluma, (2003); and Sheuya,(2004),[64],[27],[51],[63]. Though, the later studies do not cover Manzese, they deal with pertinent issues on housing transformation in informal settlements that are related in this study.



**Figure 3.01:** Geographical location of Dar-Es-Salaam City,  
**Source:** Dar-Es- Salaam City Profile,(2004).

Dar-Es-salaam is the Tanzania's capital city; the city spreads along the shoreline of Indian Ocean for approximately 100 Km starting from the entry of the river Mpiji in the north to the river Mbezi to the south. It also consists of 8 offshore islands. Dar-Es-Salaam's total area is approximately 1400 Square Kilometers of which 12.5% is compactly built. Dar-Es-Salaam experiences rapid urbanization, which causes the city to accommodate 10% of the nations' population estimated at 51 million (URT,2012). The heavily compacted area accommodates over 90% of the city's population,[26]. The geographical location of Dar-Es-Salaam city is shown in Figure #3.01. The Manzese ward is located in Kinondoni Municipality, in Dar-Es-Salaam, (Figure #3.02). It connects along the major Morogoro road and has six sub-wards that is, Midizini, Mnazi-Mmoja, Muungano, Kilimani, Uzuri and Mvuleni. The first two sub-wards have been chosen as study area. The population of Manzese ward is estimates at 70,507, [89]. In terms of population and area size, it is believed to be the largest squatter area in Dar-Es-Salaam city.

Moreover, (Kironde,1994),[26] narrated that; during 1940's Manzese was a rural settlement located in outer part of Dar-Es-Salaam, however by 1957 portion of it had been incorporated inside the city area. Initially it used to be a farmland owned by an Asian origin known as Alibhai, who used it for keeping livestock in the area.



**Figure 3.02:** The Map of Manzese ward, locating the study area,  
**Source:** Ramadhani, (2007)

Sliuzas,(1988),[64] reports that; when the settlement of Manzese was merged into the city like other squatter areas in the city, it started as a small peri-urban village where the division and provision of land and the development process was mainly administered by traditional tribal customs. The settlement was fully integrated within the city boundaries by 1968, and had already started developing very fast pace. At the same time the development of manufacturing industries in Ubungo area, its favourable distance from main centre of Dar-Es-Salaam, and ease of access through Morogoro road connecting to the main roadway to the rest of the country contributed to the areas progress.

## 4. Results

### 4.1. Common Diseases Experienced in Mnazi Mmoja and Midizini Sub-wards

The most common diseases affecting the dwellers in Mnazi Mmoja and Midizini Sub-wards according to the majority household respondents are malaria, cholera, typhoid and pneumonia. Most of the respondents emphasized that themselves and their household members are frequently attacked by some of these diseases particularly malaria and typhoid. Within the area, cholera and pneumonia are common during periods of high rainfall. However, cholera was also said to be rampant during extreme drought periods. The response from a medical doctor working in one of the clinics in the area corroborated with the claim by the households that the above-mentioned diseases are the most predominant in the study areas. However, he added that



"many of the patients I treat in my clinic are often sick from malaria" thus; implying that malaria is the most common disease in the area.

Findings by URT,(2006),[88]; also indicate that malaria, typhoid and cholera are the common diseases affecting the residents of Manzese. However, according to URT,(2008), [87], malaria, acute respiratory infection, HIV & AIDS, pneumonia, and urinary tract infection were found to be the dominant diseases within the municipality. According to WHO,(2011a),[110], acute respiratory infection(ARI), malaria, HIV/AIDS and diarrhoeal diseases are the most common diseases affecting population in urban informal settlement in most parts of Africa. It was observed that Mnazi Mmoja and Midizini areas were generally lacking access to basic services such as clean water supply, sewage and garbage handling facilities. According to majority household respondents, absence of the fore-mentioned facilities are the main factors accelerating disease proliferation in the study areas. The respondent from the local authority, mentioned air pollution, inadequate housing, poor drainage system, poor sanitation and absence of safe water supply to majority residents as the main factors contributing to high disease prevalence in Mnazi mmoja and Midizini areas.

#### 4.2. Water Source Condition in Mnazi Mmoja and Midizini sub-wards

The majority household respondents, collected water for their household activities mainly from vendors, kiosks, water streams and wells. According the respondent who was in charge of the municipal water supply, currently the municipal water supply system is available only to a very small segment of the population in Mnazi Mmoja and Midizini sub-wards. The rest have to rely on alternative water supply sources e.g. vendors, kiosks, water streams and wells. The municipal council water system is comprised of: piped water into individual household homes (covering about 6%), and public distribution point i.e. standpipe or kiosks (covering about 10%).

However, the respondents emphasized that the quality of water from other alternative sources is not subjected to safety standard assessment which in turn makes the water from those sources unfit for health. For instance, it was observed that some of the wells were dug very close to drainage channels and pit latrines -a situation that can lead to serious water contamination which in turn can result in epidemics of water-borne diseases. Though some of the respondents had indicated that, "*they don't use the water for drinking purpose but rather for washing and bathing only*". However it was noted that many household depend on this water source.

Water streams in the study areas are highly polluted with waste materials as can be depicted from Figure #4.01. One of the respondents noted that during the rainy season these streams are full of waste water from households. Some respondents also indicated that; occasionally they use water from these streams for washing purposes, like washing cooking utensils and clothes. The same respondents were aware of the health risk of using such water;- but they added

that based on the circumstances they live in, they have no other option than utilizing the water. It was observed that, The Dar-Es-Salaam Water and Sewage Corporation (DAWASCO) had provided standpipes in several areas within Mnazi Mmoja and Midizi area but these were not enough to cater for all the residents. Standpipes are authorized water kiosks with piped water –they are operated as private or community owned providing water at affordable prices to urban dwellers. According to the responses, the price of water from the standpipes is approximately 25 times less than the price of the other water vendors particularly those who deliver water on wheelbarrows.



**Figure 4.01:** One of the polluted water stream but still being utilized for washing utensils

**Source;** Authors, (2017)

The safe water supply problem in Tanzania does not seem to be synchronized to Mnazi Mmoja and Midizini areas only but it is rather a common problem in most urban areas in Tanzania. For instance, Kyessi,(2002) & Lerise et al.,(2004), [32],[34], reported that; most informal settlements in Dar-Es-Salaam have enormous safe water supply problems and hence leaving a majority of the population in those settlements relying on unsafe water sources.

#### 4.3. Sewage and Waste-Water Situation in Mnazi Mmoja and Midizini sub-wards

The respondents revealed that the residents of Mnazi Mmoja and Midizini areas had no access to municipal sewage line. Thus pit latrines are the facilities used by most households in the area. Some of the pit latrines are shared by more than one household, while other are owned and utilized by individual households. Most of the pit latrines are constructed above the ground to enhance emptying when filled to capacity. One of the respondent indicated that "*it is constructed over the ground because it is easy to clean*"- here referring to easiness emptying when full. The pit latrines are usually emptied during the rainy season through a pipe at the bottom of the pit latrine (Figure #4.02). The pipe is unlocked and the sewage content from the pit latrine allowed to flow freely to nearby drainage system.

The respondents, further observed that; most of the pit latrines in the case study areas are not well constructed, since

most of them are constructed with non-skilled local builders. According to the respondent from the municipal council office, there are a number of incidences on leaking pit latrines, while others collapse causing spillage of the sewage to the environment, and at times injuries and deaths. The findings from the household responses, also indicated that a few households had toilets inside the house, in addition to owning the pit latrines. In such cases, the content from the toilets and baths that are located inside the house are emptied directly into a pit latrine located outside the house using a drainage pipe. The reason for locating the toilets and baths inside the house was to enhance the security of the household members, particularly women and children, specifically during night time usage.



**Figure 4.02:** (Left) a photo of a pit latrine showing the emptying pipe at the base; and (Right) the main access road and some of the narrow foot paths used to access the slum areas

Source; Authors, (2017).

The results further indicated that a few of the residents had no reliable access to pit latrines and toilets;— these latter category of people were using the free-range system (would relieve themselves in the open fields. For example some would just go out in some open shaded area dig a hole on the ground —on which they excrete and cover immediately with some soil. Due to lack of sewerage service in the case study area, it was observed that some residents had directed the waste-water channels/pipes from their bathrooms, toilets and kitchens directly into the open storm water drains. According to Mulengeki,(2002),[46], the acidic and salinity of waste results into the gabions marsh, which then forms blockage. According to a response from one health officer working in the area, all the households living closer to the drainage channels are exposed to a wide range of health risks including malaria (due to stagnant water that forms pools for mosquito breeding); diarrhoeal, injuries among many other diseases that are rampant in the area.

#### 4.4. Water Drainage Condition in Mnazi Mmoja and Midizini sub-wards

During the field observations, it was found that; the storm water drainage systems covered only a small area along the main roads – thus most of the residential areas (about 80% as per responses) had no access to any drainage system. However, most of the existing drainage system was not functional since some sections of the system were blocked with enormous accumulation of solid waste. Surprisingly according to the respondent from the municipal council, even the newly (opened six months before the field study) constructed storm water drainage systems are also blocked by

refuse (Figure #4.03). The new storm water drainage system was constructed under the project "The Community Infrastructure Upgrading Project (CIUP)"- through this project, 2.2 km and 24.7 km trunk and road side drains have been constructed respectively.

One of the respondents stated that; "during rainy season every walking place is filled with water, and if it is heavy rainfall then the water enters the house as well". Since some of the households were found to be releasing the waste water and sewage from their pit latrines to the open drains during the rainy season, this situation of overflowing water on the paths and into houses would be potentially risky in terms of contraction of water-borne diseases such as diarrheal, typhoid among many other diseases that were also found common in the study areas as earlier mentioned.



**Figure 4.03:** Storm water drainage systems blockage from solid waste accumulation, Source; Authors, (2017).

#### 4.5. Solid Waste Collection System in Mnazi Mmoja and Midizini sub-wards

According to the responses from the households, local authority officials and the health officials Mnazi Mmoja and Midizini area are not well covered with solid waste collection and disposal system. It is only about 25% of the households that access the municipal garbage collection system while, the remaining 75% households utilize other alternative waste collection and disposal methods. These other alternatives included burying, burning, dumping garbage in drains or open spaces-which pose adverse health implications. However, the responses also revealed that recently, high-income groups in Manzese ward have initiated private garbage collection system (known as contractors) which works parallel with that owned by the municipal council. But the respondents emphasized that still even with this new initiative, the garbage collection is not regular which in turn leads to large piles of uncollected garbage at the collection point and throughout the landscape. Another problem with the garbage collection is the existence of only a single garbage collection point that serves the whole area of Mnazi Mmoja. Consequently, most residents are forced to walk a very long distance to dispose their solid waste.

It was further found that a few local residents in Mnazi Mmoja have recently, initiated a door to door waste



collection system at a fee –since it is a newly initiated project its spatial coverage is small. This door to door waste collection system is aimed at reducing the rapidly increasing pile up of garbage in these settlement areas where it is perceived to cause a wide range of health risks. Besides reducing the burden of garbage in the area of operation, it has created employment opportunities, and is positively influencing people into changing their behaviour in regard to garbage handling. Because of the above-mentioned problems with the garbage collection and disposal systems, there is enormous garbage strewn in many parts of the study areas including in storm water drains (where it causes blockage of the systems), many open spaces, along the roadside, and walk ways. Most of the garbage was already rotting and stench – potentially a health hazard. The solid waste accumulated in a storm drain and roadside are as shown in Figure #4.04.



**Figure 4.04:** Solid waste handling problem in the study areas  
**Source;** Authors,(2017)

#### 4.6. Road Access System in Mnazi Mmoja and Midizini sub-wards

Mnazi Moja and Midizini are accessible through Morogoro highway (a tarmac road) and minor roads which are rough and during rainy season mostly muddy and overflowing with runoff water. Extending from these minor roads are numerous narrow foot paths that are often dark and mucky. In some of these passages there are some on-going commercial activities such as frying chicken, washing clothes, and other minor activities resulting into multiple uses of the passages and in solid waste generation and accumulation.



**Figure 4.05:** the main access road and some of the narrow foot paths used to access the slum areas  
**Source;** Authors, (2017).

Household responses revealed that these narrow foot paths, often hamper access to emergency services when needed for instance during fire outbreak, or if someone is critically ill in need of ambulance. Respondents had indicated that in such cases neighbours help in addressing the emergency situation as a coping strategy, but are often overwhelmed since they work without the right emergency combat gears. Thusly most of the emergency situations end up being catastrophic, often causing enormous socio-economic losses, and even

mortalities in events of fire outbreaks. In many cases women feel insecure to these foot paths at night for fear of being attacked mugged or raped. It is only about 30% of the dwellers of the study areas who had access to roads. The main roads and an example of the narrow foot paths are shown in Figure #4.05. The local authority officer had stated that there has been the Community Infrastructure Upgrading (CIUP) phase I in Mnazi Mmoja area which covered construction of 1.86 km of bituminous road, 14.6 km of gravel roads, 3.4 km of gravel footpaths, 24.7 km road side drains, 2 culverts and 6 footbridges. However, he further stated that the access road situation is still problem to many people in Mnazi Mmoja area and needs further investments.

#### 4.7. Housing Condition in Mnazi Mmoja and Midizini Area

The housing condition in Mnazi Mmoja and Midizini area are built in unorganised manner and are poorly oriented. Some houses are very small in size in comparison to the number of occupants living. Many houses that are constructed follow the Swahili house design. They comprise of 6 rooms linked with corridor and common toilets, bath room and kitchen in the back yard. Each room (average size 3m by 4m) is occupied by a household which comprises approximately of 4 occupants. It was found that many houses were not build with minimum required standards such that temporary materials were utilized in their construction. In case of rainfall, storm water mixed with waste-water enters these houses. In Figure #4.06 some of the residential houses in the study area are shown.



**Figure 4.06:** Photos illustrating some of the residential houses in the study areas  
**Source;** Authors, (2017).

It was found that some houses were actually built along the slope. The storm water often hits this houses causing damage, and injuries due to collapsing of the load bearing walls. If the drains are block then polluted storm water remains stagnant and enters the households. It was found that many household use charcoal or wood for cooking purpose which creates

heavy smoke that circulates and hence pose a risk to infection from respiratory diseases. The respondents also noted that women and children are considerably affected by the smoke. Some of the houses are built near to each other such that there is no enough space for ventilation and sunlight.

It was witnessed that some households have taken measures to avoid health risks. Many houses had netting in their windows and some where even using mosquito bed nets. However, these are often used for long time without replacement such that they become less effective. Some respondents actually believed that they were safe by just having mosquito nets even though they were not adequate. Most of the households live in a rented house and are perceived as temporary residences by the tenants. In many cases this makes the household not to care much about their housing condition and their surrounding in general. Even the one who owns these houses often don't care since they get their rent due to high demand for housing. This adds on to the accumulation of health risks. According to a survey done by UN-Habitat,(2009c), [80], only 35% of housing structures are in compliance with existing construction standards. Housing is very important factor of infrastructure in accumulating and posing health risks to household. Studies done by Lerise et al.,(2004), Kyessi,(2002) & Nguluma, (2000), [34],[32],[50] tell that; housing condition have always been a significant aspects in posing health risks.

## 5. Discussion

On assessing the condition of the built environment, the study was conducted through mixed research method, which helped in verification of the information gathered from one method with the other one. The information presented in the result section is information that tally with other methods,

The predominant diseases that were found in Mnazi Mmoja and Midizini sub-wards are: malaria, cholera, diarrheal and typhoid. The factors that present health risk in the study areas were found to be: use of unsafe water because of limited access to safe water supply; piling up of solid waste due to inadequate waste handling and collection; poor housing condition including overcrowding, indoor smoke from cooking and filthy external surrounding; stagnant water on storm drains due to waste accumulation leading to blockage; narrow and inaccessible parts during emergence services. With these findings two question arise: 1) what role do these factors play in disease proliferation and prevalence?; and 2) what does these study findings imply for the policy? The discussion below focuses mainly in answering these two questions.

### 5.1. What Role Do these Factors Play in Disease Proliferation and Prevalence?

Majority residents in the study areas use the unsafe water because of limited access to safe water supply sources. This finding is not surprising since access to safe water supply has been identified as a major problem affecting most urban residents in many developing countries around the world, [103],[81],[100],[101]. The limited access to safe water has been attributed to increasing water demand due to rapid

urban population growth that overstretches the existing urban water supply infrastructure, [70],[82],[83]. According to WHO,(2011),[100],[101] use of unsafe water can lead to increased prevalence of infectious water-borne diseases such as cholera, typhoid and dysentery. For example due to consumption of unsafe water cholera outbreaks were experience in Zimbabwe and Haiti during 2009 and 2010, [98],[44]. Following the cholera outbreaks in these two countries, several hundreds of thousands of people were infected and many thousands of people were reported dead in each country, [43]. Globally approximately 1.7 million people die annually due to use of unsafe water and sanitation problems,[101]. On this basis the cholera, diarrheal and typhoid that were found to be among the predominant diseases in the study area are due to consumption and usage of unsafe water and unhygienic conditions in the study areas. It was found that many residents in Mnazi Mmoja and Midizini sub-wards live in poor housing condition including: indoor smoke from cooking, overcrowding, filthy external surrounding, and most of them constructed from temporary materials –exposing residents to cold. The problem of poor housing in Tanzania should not be seen as a problem affecting only these two study areas but rather many studies have revealed similar problems in other parts of Dar-Es-Salaam as well as in other major towns,[54],[34][80],[38],[59],[52]. Housing problem is also seen as a global problem, affecting approximately 1 billion people, UN-Habitat publications.

Accumulation of smoke in the house as result of cooking with various types of biomass energy sources in houses without proper ventilation as it is in the case of the study area can lead to a wide range of diseases, [95],[96]. Examples of diseases that commonly affect people due to inhalation of smoke are: “lower respiratory infections, chronic obstructive pulmonary disease and trachea, bronchus and lung cancer”, [95],[96]. Approximately 32% of all the deaths recorded in Africa are related to indoor air pollution, [95],[96], majority of the victims being women and children who are usually involved in household chores including cooking. Though the respondents never mention respiratory diseases as being predominant in the study area, an emphasize is made that, these diseases are critical especially in these study areas where smoke accumulation in the house is rampant. Therefore, further study to assess indoor air pollution and various respiratory diseases in Mnazi Mmoja and Midizini sub-wards are recommended.

Overcrowding, filthy external surrounding, and house construction from temporary materials are other common problems related to housing problems in Mnazi Mmoja and Midizini sub-wards. Overcrowding in houses without proper ventilation can expose residents to pollution from carbon monoxide when biomass energy sources such as charcoal are use, and to various viral and bacterial diseases,[67]. A filthy external environment exposes people to various infectious diseases since it creates a suitable environment for vector and pathogen proliferation and hence can lead to various vector-borne and water-borne diseases. The filthy external environment may thus be seen as one of the pathways driving some of the major diseases that were observed in the study



areas particularly malaria, cholera, diarrheal, and typhoid. The construction of houses from temporally waste materials often leaves the residents exposed to the cold during rainy seasons a condition that may expose the residents to pneumonia – which is one of the predominant diseases that was mentioned by the respondents. Living in these kinds of houses further exposes the people to attack from disease vectors such as mosquitoes leading to malaria infections.

It was found that solid waste was piling up throughout the study areas including roadsides, drainage systems and walkways due to inadequate waste handling and collection. Kyessi,(2002),[32]; has shown that many other parts of Dar-Es-Salaam city besides the Mnazi Mmoja and Midizini sub-wards are also affected with solid waste management problems mainly due to limited budget and proper waste management strategies. A similar problem is experienced in many cities around the African continent, [4]. Improper solid waste management and disposal can lead to a suitable environment for the development and proliferation of disease pathogen especially when it constitutes of a mixture of rotting household waste, [53]. Thusly the residents will be exposed to various diseases such as cholera, diarrheal, typhoid especially during the rainy seasons when these waste materials are transported in runoff to surface water sources. Solid wastes can also form stagnant water pools by blocking runoff and storm drainage systems creating fertile vector breeding grounds e.g. for mosquito –this would increase malaria prevalence.

The paths that are used to access most of the residential areas and dwellings were found to be narrow and inaccessible during emergence services. Inaccessible pathways in most urban slum areas and informal settlements globally have been found to be a main hindrance to collection of sewage sludge from filled up pit latrines and among other wastes since service vehicles cannot penetrate these narrow paths,[78]. Consequently, the residents of these areas are left exposed to hazardous waste which in turn exposes them to a wide range of diseases and other health impacts such as injuries, failure in harvesting much cross ventilation and natural lighting.

Sewage and waste-water disposal system was found lacking in the study areas. These facilities according to WHO, (2000b),[94], are a major problem globally where approximately 2 billion people are affected. Lack of adequate sewage and waste-water treatment facilities can pose a major health risk to the urban dwellers of these informal settlements,[34]. For instance in Cameroon, severe diarrheal was experienced in unplanned settlement because of sanitation problems related to among other factors absence of sewage and waste-water disposal and treatment facilities. Stagnant water in storm drains due to waste accumulation leading to their blockage was found to be rampant in the study areas. According to Martens et al.,(2000),[39], the stagnant water becomes a suitable breeding ground for mosquitos and hence led to increased malaria prevalence. Malaria was found to be the most predominant disease in Mnazi Mmoja and Midizini sub-wards. Additionally, according to Tukur,(2010),[69], malaria is a major disease affecting many people globally- the disease leads to over 300

million malaria cases annually and approximately one million deaths each year.

## 5.2. What Does the Study Findings Imply to the Policy?

It has been shown that it is a combination of many interacting factors that lead to accumulation of health risks in the study areas. This implies that the government must strive to effectively address the root causes of the factors that affect the health of the population. To achieve this the government must strive to: provide access to safe water supply sources to all the population; adequate and reliable solid waste collection and disposal system; upgrade the housing in the slums to improve living conditions; and improve accessibility to basic services by contracting wide and all-weather roads to all residential areas. The specific strategies that can be adopted to improve each of the above-mentioned areas are discussed below.

To ensure that all residents get access to safe water supply, the government should expand its water supply system either to every individual household or ensure that the standpipes are many and in close proximity to every household to improve access and reduce long queues. The government further should rehabilitate its old and leaking water supply systems to avoid water loss and contamination. The illegal water connections that are used by some water vendors should be terminated. These are some of the strategies, that have been successfully applied in water supply systems in many parts of the world including Kibera slums of Nairobi, Kenya. One main benefit from the successful implementation of the safe water supply to part of Kibera was a recorded reduction of health burden for the affected population leading to less expenditure for medical care. However, to be successful the participation of all stakeholders such as the affected slum dwellers, the municipal council, NGO's and other partners is recommended.

To address the housing condition problem an overhaul is necessary in order to ensure that all people live in adequate housing. Adequate housing will mean that the houses themselves are of good liveable standard and that the residents get access to all basic infrastructure and services such as: access to clean water supply; solid waste collection and disposal system; storm water drainage system; sewage and waste water collection and treatment systems; and wide and quality access roads –according to UN-Habitat,(2006), [77]; this is what is referred to as slum upgrading. However, other alternatives such as re-housing can be explored,[77]. It is worth noting that upgrading slums requires a lot of finances –it therefore would be advantageous to involve a wide array of stakeholders and development partners including the residents of the slums, private developers, NGO's and other governmental agencies,[76]. Participatory approach has been praised as one of the key factors behind a number of successful slum upgrades globally e.g. in Alexandra Egypt [76], and Andhra Pradesh state in India, [82].

The problem of solid waste collection and disposals can be address through both short-term strategies and long-term



strategies. The short-term strategies that can be adopted include use of non-motorized transport [83], and decomposing for fertilizer use, [13]. The non-motorized transport of solid waste enhances waste collection from the slum parts that are often not accessible by the motorized vehicles due to narrow access paths – this method has proved successful in Nairobi Kenya where it has been applied. Decomposing the organic solid wastes for fertiliser has a twin advantage i.e. it reduces the piling up of potentially unhealthy wastes, and also the resultant organic fertilizer is good for the environment when applied for crop production. But for long-term the government must strive to develop a well-functioning solid waste collection system covering all parts of the slum areas. It may include sorting, collection and re-use of the recyclable waste materials as applied in many developed countries,[15]. The decomposable organic waste can be used as fertiliser as described above. Other solid waste materials can be used for energy generation for heating or fuel, [15]. Through the adoption of the above strategies the solid waste problem can be solved and hence the health risk it causes to the residents be reduced.

The pollution in storm water can be solved using three main strategies: 1) proper solid waste collection and disposal to avoid it being transported by runoff or being dumped directly into the drainage system; 2) not discharging untreated sewage and waste-water into the storm water drainage system,[55]; and 3) ensuring that a functional storm water drainage system is built to cover all the residential areas. But for these strategies to work effectively behavioural change in regard to the handling and dumping of waste by the resident urban dwellers is of vital necessity,[55]. To achieve behavioural changes waste handling and disposal education should be provided by the government to all urban dwellers – such education should include the methods of handling waste and their advantages, the adverse impact on the health, environment and the ecosystem, the importance of storm water drainage system to the community at large among other factor. It is important that the planning and implementation of all these changes is conducted in an inclusive and genuine participatory approach involving all stakeholders –this will facilitate successful implementation.

The problem of pollution from sewage and waste-water can be solved through two strategies: expansion and development of the conventional sewage and waste-water system to cover all parts of the slum settlement; and adopting alternative approaches as a short term strategy. Alternative approaches that can be useful for adoption include “compositing, incineration toilets, small quarters and public toilet methods”, [53],[103]. Like all other strategies it is important that the strategies are implement with close collaboration with all other relevant stakeholders.

## 6. Conclusion

There are many factors that pose health risks to the residents of Mnazi Mmoja and Midizini sub-wards. These factors are: use of unsafe water because of limited access to safe water supply, pilling up of solid waste due to inadequate waste handling and collection, poor housing condition including

overcrowding, indoor smoke from cooking and filthy external surrounding, stagnant water on storm drains due to waste accumulation leading to blockage, narrow and inaccessible part during emergency services. The factors were driven mainly due to absence of proper urban planning that leads to proliferation of informal settlements following rapid urban population growth, but unmatched and slow expansion of infrastructure and housing. Due to the existence of the above-mentioned health risk factors, the following diseases were found to be predominant in the study areas: malaria, cholera, diarrhoeal, pneumonia and typhoid. It is important for the government to take measures in planning and advocating the upgrading of these informal settlements through more participatory approach by including residents of these settlements.

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