A comparative appraisal of environmental conditions in two urban low-income communities in Accra, Ghana

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ABSTRACT

This paper examines (i) the state of environmental conditions in two low-income urban communities in Accra, Ghana, using a Participatory Rapid Assessment (PRA) method, and (ii) changes in the environmental conditions in the two low-income communities over the years using the PRA method. The PRA was augmented with qualitative interviews with selected heads of household and other stakeholders from the study communities. The results showed that environmental conditions in the two study communities were poor as indicated by the computed average scores for the environmental problem areas. However, conditions were poorer in Chorkor compared to La. The paper recommends that local governments units in Ghana must prioritise sustained, improved, and reliable funding for Water, Sanitation, and Hygiene (WASH) to ensure undisruptive implementation of environmental health programs and policies. This must be accompanied with improved community education and sensitization on proper sanitary practices, which have the potential to mitigate the effects of disease epidemics such as cholera in the two communities. The study also provides important perspectives on differentials in environmental conditions in low-income communities in urban Ghana.

KEYWORDS

environmental conditions; environmental health; rapid assessment; hazards; Accra

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1. Introduction

Rapid urbanisation is a characteristic feature of most developing countries (UN-DESA 2010). Projections show that by 2050, about 68% of the world's population will be living in urban areas, with a larger share of this population expected to come from developing countries (Ritchie and Roser 2018). In regions such as Africa and Asia, rapid and unsustainable urban growth have had a consequential impact on the management of urban areas due mainly to resource constraints and poor planning. Unsustainable urbanisation in developing countries has significantly impacted human health due to challenges in accessing social and environmental services (World Health Organisation (WHO) 2016). Problems relating to the provision of essential environmental services have consequently impacted the environmental conditions of urban areas, which pose a serious threat to the health and safety of residents (Heymann and Rodier 2001; Nelson et al. 2005).

Environmental problems in cities of global south countries have been exacerbated by social and economic inequalities which stems from ineffective policies and lack of inclusivity in the planning and management of cities (Arku and Marais 2021). As argued by Cobbinah et al. (2017), poor urban communities' face a disproportionate share of the environmental problems in cities which invariably indicate uneven exposure to environmental health burdens. While acknowledging the efforts made over the years through the enactment of environmental health policies and establishment of governing structures, the problem is still persistent and likely to exacerbate as a result of increased population and poverty (Cobbinah et al. 2017). Using the situation of Ghana as a case in point, while 24% of households in urban Ghana have access to pipe-borne water inside their dwelling, 26% of them have access to pipe-borne water outside their dwelling (Ghana Statistical Service (GSS) 2014a). In the Accra metropolis, 37% and 39% of households share bathrooms and toilet facilities respectively (GSS 2014b; Antwi-Agyei et al. 2020). Due to the lack of toilet facilities in many houses occupied by households, public toilets are the commonly used sanitary facilities, especially in poor urban communities (Tanle and Kendie 2013; Peprah et al. 2015). Aside from water and sanitation, urban areas in Ghana such as Accra, Kumasi, and Tamale face a huge challenge with waste management. For instance, only 10% of the about 12,710 solid waste generated daily in areas is collected (Miezah et al. 2015).

There has been a plethora of studies on the enormity of urban environmental challenges in Ghana (see Owusu 2012; Oteng-Ababio 2013; Mensah, 2014; Cobbinah and Korah 2015; Owusu-Sekyere et al. 2016; Cobbinah et al. 2017; Oteng-Ababio et al. 2017; Songsore et al. 1998; 2005; 2009; Songsore and McGranahan 2007; Songsore 2017). However, further understanding is needed regarding how environmental problems can be measured and scaled to facilitate assessment of environmental problems across space and time. This brings to the fore the issue of environmental hazard indicators as an important tool or measure in assessing environmental conditions in urban areas. In Ghana, the well-known studies that assessed environmental conditions in urban communities using proxy environmental hazard indicators are Songsore et al. (1998; 2005; 2009). Indeed, in their study, Songsore et al. (1998) argued that the use of the PRA method, which uses standardized environmental hazard indicators for assessing environmental conditions can facilitate continuous assessment and monitoring of environmental conditions in urban communities. This paper builds on previous studies by Songsore et al. (1998; 2005) and adopts the PRA method to assess the environmental conditions in two low-income indigenous communities in Accra, Ghana's capital.

The choice of two low-income indigenous communities in this paper is premised on the fact that previous studies that have used the PRA in assessing environmental conditions focused on communities of varying socio-economic statuses (see Songsore 1998; 2009). The expected results from these studies have been obvious from the onset since high-income communities have for a long time enjoyed unparalleled access to essential environmental services. The intention of these studies admittedly have been to build a case that a section of urban residents is privileged compared to others, and thus make a case for equal access to essential environmental services for all. On the other hand, these studies often mask the differentials in the environmental conditions in low-income communities, since the situation is often worse for some low-income communities than others. Therefore, the present paper seeks to depart from the long held assumption that poor communities are similar because of the commonality of their environmental problems. In view of this, the paper seeks to address the following objectives (i) assess the state of environmental conditions in La and Chorkor, two low-income communities in Accra using the PRA method, and (ii) examine the extent of progress made over the years in improving the environmental conditions of La and Chorkor using the PRA method. In all, the paper attempts to provide a better understanding of varying environmental problems faced by urban low-income communities.

After this introduction, the paper presents a conceptual model on human ecology and environmental health. Next is the institutional and policy frameworks that guide environmental management in local communities in Ghana. This section is intended to contextualise environmental problems within the institutional and policy frameworks in Ghana. The study area and the methodology are next presented. Followed by the results, discussion and conclusion.

1.1 Human ecology and environmental health problems: An overview

The environment – a very significant component for human well-being and health, can also be a source of problems for residents. These problems are manifested through pollution and poor environmental conditions (European Environment Agency (EEA) 2022). Yet, a good environment provides residents with essential amenities such as clean water and air (EEA 2022). Improving environmental quality through the provision of these amenities could prevent diseases and safeguard the health of residents (EEA 2022), especially those in urban communities. Poor environmental conditions – one of the major causes of mortality, accounts for more than 8 out of 10 of major diseases and injuries across the globe (Cissé 2019). Among these conditions is the critical role played by food and water contaminations in disease transmission (Cissé 2019), which accounts for about 93 million illness and 140,000 deaths in Africa (WHO 2018). An important framing within the disease-environment nexus is the concept of human ecology (Li 2017), which has become an important conceptual lens for understanding population and space-based environmental problems (Dudley and Poston 2015). The concept provides a nuanced understanding of human organisation in space, their use of resources, and how daily activities impact the physical conditions of their habitat (Kassam et al. 2011; Milner-Gulland 2012). Changes in population including the scale, composition, and pace of population growth contribute to a variety of environmental-related concerns since such changes affect how the physical environment is managed, and the ability of the environment to cope with pollution and other negative externalities (de Sherbinin et al. 2007; Dietz et al. 2007). Human activities and poor management of the environment often release pollutants into the surroundings which affect human health (Babayemi et al. 2016).

Related to the ecology, environment and human health interrelationships, is the different pathways provided by environmental conditions or hazards through which pathogens spread (Songsore et al. 1998). Akin to this are three main concepts in the environmental health literature. First, the process and the rate of release of pollutants in both time and space (Eckelman et al. 2020), second, the transmission process of pollutants through different pathways such as food, water, and air (Corvalan and Kjellstrom 1996) and third, the contact between people and pollutants in their immediate surroundings (Songsore et al. 1998). The latter is a function of the convergence of variables such as the quantity and duration of contact with sources of pollutants. Thus, daily exposure is likely to increase the impact and severity of environmental health burdens.

The spread of diseases among urban dwellers is a function of their interaction with the environmental risk factors present in their environment (Flies et al. 2019). These environmental health risk factors are created and conditioned by how people manage and use the environment in which they live. However, exposure to environmental health risks varies depending on where one lives because of variations in exposure levels to environmental pollutants in different surroundings. This differential exposure also reflects issues such as social and spatial inequalities, and unevenness in access to environmental services (WHO 2010).

The foregoing discussion necessitates the need to employ human ecology as a conceptual lens to explain how urban low-income communities are often characterised by poor environmental conditions, and to devolve the implications of these conditions on the health of residents. The human ecology model is significant in the context of this study because it provides the basis for understanding residents' use of environmental services and their outcomes such as access to and use of water and sanitation (Marten 2010), hygienic food environment (Sotiangco et al. 2016), and conservation of biodiversity in a changing urban climate (Ogato 2013). Despite these essential merits offered by the model in understanding the interdependence between humans and their environment, it has also received a couple of criticisms. Arguing from a human-environment ecological perspective, Ray and Jacob (2015) argue that there is always a difficulty in comprehending fully, the diverse and infinitesimal relationships in ecological analysis. This situation according to the authors can occasion decision-making without recourse to sound ecological analysis. Further, on the limitation of the ecological analysis, Ray and Jacob (2015) suggest that political institutions, economic systems, and local social systems often compel people to make decisions irrespective of whether such decision impinges on the sustainability of human societies, the environment within which they live or even their own welfare within the larger surroundings.

1.2 Institutional and policy framework for urban environmental management in Ghana

Urban environmental problems are handled at the local government level within Ghana's decentralised administrative system, which is the Metropolitan, Municipal and District Assemblies (MMDAs). The Environmental Health Department (EHD) of the MMDAs is a legally established unit that is in charge of managing water and sanitation issues in the MMDAs (Ministry of Health 2005). In addition to water and sanitation, the EHD is also required to collaborate with other state and non-state actors to provide a healthy environment that enhances the safety of the populace. Personnel who work in the EHD are called Environmental Health Workers (EHW) and they are required to discharge environmental health and sanitation

services at the MMDAs. This includes monitoring and reporting of environmental problems for appropriate actions to be taken. They are also to ensure that proper sanitation, hygiene and waste management practices are complied with in accordance with national laws and policies, and local government bye-laws (Ministry of Health 2005).

Aside from the local government administrative structure, there are also national policies which aim to guide the delivery of services, allocation of resources, and the management of the Water, Sanitation and Health (WASH) sector. Two policy documents, the National Water Policy (NWP) and The National Environmental and Sanitation Policy (NESP) are given attention here. The NWP, which was launched in 2007 aims to provide a framework for the sustainable management of water resources in the country. It aims to bring water management within Ghana's decentralised administrative structures under one umbrella, and also link water use to other sectors such as sanitation, agriculture, and energy (Monney and Ocloo 2017). It combines policy documents from three agencies which are the Ghana Water Company Limited (GWCL), which is in charge of urban water supply, the Community Water and Sanitation Agency (CWSA), which is in charge of rural water supply, and the Water Resources Commission (WRC), which is in charge of regulating and managing water resources in the country (Netherlands Development Organisation (SNV) 2018). By harmonising the policies of the agencies, the NWP aims to integrate water management and supply for sustainable economic and social development. The second policy document which is the NESP was developed in 1999 and focuses on all aspects of environmental health including sanitation and waste management. At the local level, the implementation of the policy is carried out by the MMDAs through the EHD.

Despite efforts made to improve environmental health conditions in urban areas, there are limitations that have stymied the effective and efficient implementation of these policies at the local level. These include inadequate funding for agencies and local government institutions as well as a high dependency on external funds for sanitation-related investment, which is also a challenge in itself as its utilisation is often regulated. There are also problems regarding inter-sectoral coordination in the implementation of these policies as well as inadequate human resource capacity at the local level.

1.3 Environmental context of study communities: La and Chorkor

La and Chorkor are indigenous low-income communities in the Greater Accra Metropolitan Area (GAMA). La is the administrative capital of the La Dade-Kotopon Municipality, while Chorkor is located in the Ablekuma South Sub-Metro of the Accra Metropolis (Figure 1). La and Chorkor have a total population of 98,683 and 78,918 respectively (GSS 2014b; GSS 2014c). Both are slum communities and have similar social and cultural characteristics. They are also characterised by high levels of unemployment, poverty and deprivation, as well as overcrowded houses with inadequate access to water, sanitation, private bathrooms, and drainage systems (Darko-Gyeke and Kofie 2015; Quaye 2018). Both communities lie along the coast and have sandy beaches, also the Kpeshie and Chemu lagoons located within the outskirt of the two communities respectively are polluted with human and liquid waste. Further, these lagoons serve as a principal outlet through which major drainage channels in Accra empty their waste into the sea (Boadi and Kuitunen 2002; Oteng-Ababio and Arguello 2014). Chorkor is one of the many low-income communities in Accra which depends on groundwater due to its availability and affordability (Ketadzo 2019). But a recent study has shown that this groundwater contains a mean lead concentration of 1.00 mg/l which is above the WHO recommended lead limit of 0.01 mg/l (Ketadzo 2019). Likewise, studies have also shown that poor environmental conditions contributed to the high cholera cases recorded in 2014 in La and its environs (Ansong 2015).

2. Methodology

2.1 Data collection process

The data used in this study is from a household survey conducted in the study communities in 2016, by the first and third authors together with two other research assistants. The study adopted the PRA method which involved constructed values on indicators (McGranahan et al. 2001; Songsore et al. 1998; 2005). The constructed values are based on Key Informant Interviews (KIIs), Focus Group Discussions (FDGs) with community members and field observations carried out in the study communities. In addition to the PRA, the data included qualitative interviews with residents and other stakeholders in the study communities. La and Chorkor were randomly selected from a pool of indigenous communities in the Greater Accra Metropolitan Area (GAMA)[1]. Incidentally, these two communities were part of the 2001 and 2005 citywide PRA of the environmental conditions in residential communities in the Accra metropolis (see McGranahan et al. 2001; Songsore et al. 2005). Thus, by conducting the PRA in these two communities, the paper provides insight as to whether environmental conditions as measured using environmental indicators in previous studies have changed over the years. Subsequently, the PRA scores generated by Songsore

1 GAMA is the unofficial name given to the larger functional area of Accra, Ghana's capital.

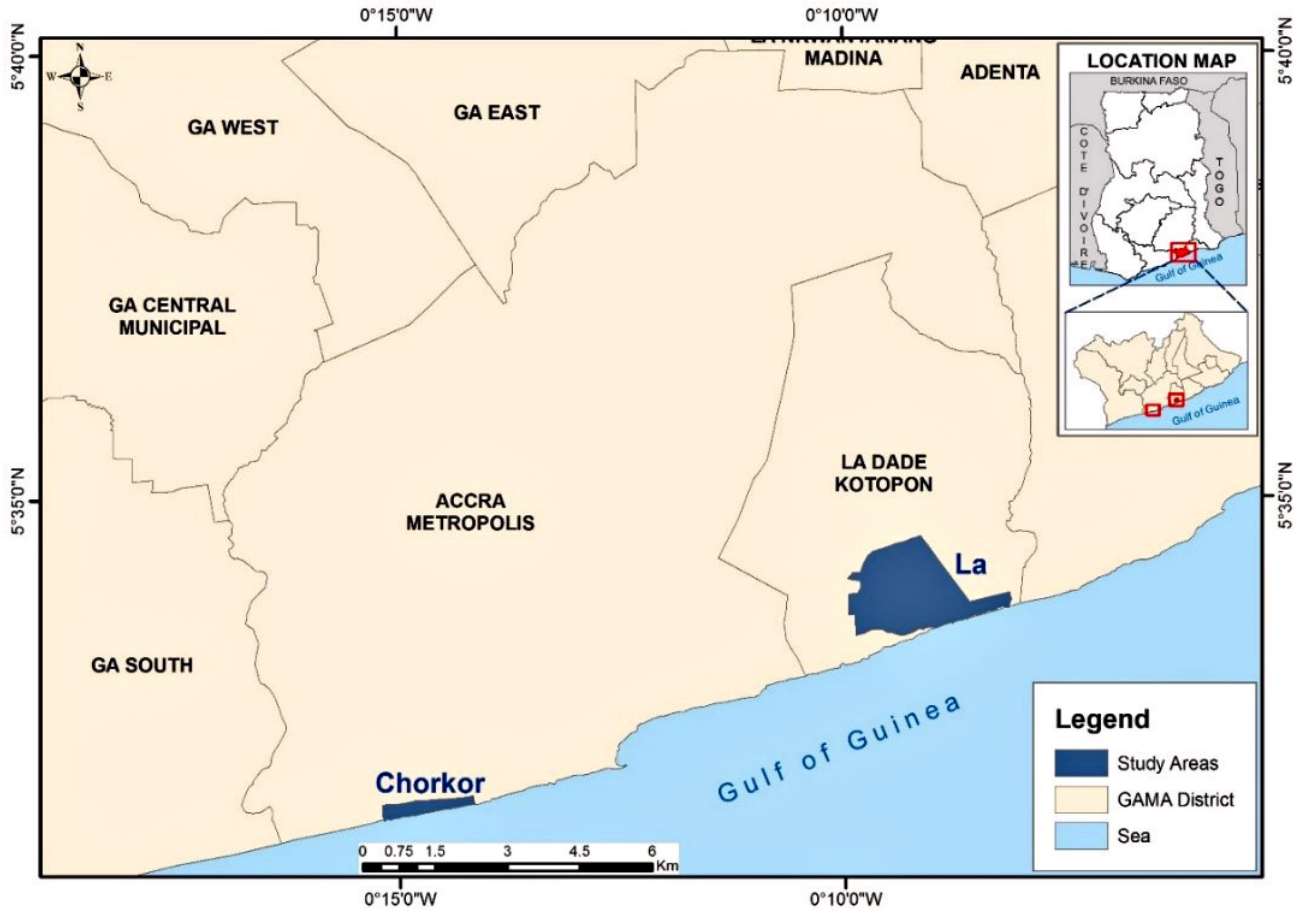

Fig. 1 Map of study areas.

et al. (1998) were used as the benchmark scores. The qualitative data was collected through in-depth and KIIs with household heads and community leaders in the two communities to complement data gathered from the PRA. In total, 36 KIIs (i.e. 18 from each community) were conducted. The 18 key-informants comprised of 2 Assembly members, 2 environmental health officers in charge of one of the communities, 2 planning officers in charge of one of the communities, 2 traditional leaders, i.e. one from each of the community and 10 residents who were conveniently sampled from the two communities (i.e. 5 from each community).

2.2 Use of indicators and rationale

The PRA is one of the research methods used for assessing environmental problems in urban communities and can be adopted in studies focusing on intra and inter-urban analysis of environmental conditions and services (McGranahan et al. 2001). Environmental indicators provide the opportunity for routine monitoring of community environmental problems, and can systematically quantify environmental risk factors in a community.

In the study by Songsore et al. (1998), nine major environmental problem areas were identified as having strong implications for the health status of urban residents. These areas include; water, sanitation, hygiene, sullage/drainage, pests, housing problems, indoor and outdoor air pollution, food contamination and solid waste. Within each environmental problem area, there are specific indicators which are measurable and provide more information on the problem area they fall under. Upon physical observation by the researchers and their assistants coupled with interaction with residents and key informants such as assembly members[2], traditional leaders, and representatives of interest groups, weights were assigned to the individual indicators under the problem areas. Not all indicators were assigned the same weight because some indicators are deemed to be essential or instrumental to the problem areas than others. For instance, in Appendix 1, an indicator like 'water from ponds/streams as principal source of water supply within community' is assigned a higher score than 'frequent water supply interruptions within community' because the former is deemed to be a serious challenge than the latter in terms of its contribution to environmental health risk. The sum of all weights assigned to the specific indicators gave the overall score or value for the problem area. Individual

2 Assembly members are elected officials who represent members of their electoral areas in the various MMDAs.

communities were then assessed based on the indicators, and weights were assigned to these indicators to ascertain how close or far their weights are to the maximum weight[3] there is for that indicator.

2.3 Weighting procedure of environmental problem areas and indicators

The scoring system consisted of two stages. The first stage generally entailed the allocation of weighted scores to the problem areas. A total score of 100 was distributed to the nine environmental problem areas (e.g., water, sanitation, hygiene, sullage/drainage, pests, housing problems, indoor and outdoor air pollution, food contamination and solid waste). At this stage, experts from the field of environmental health from academia, government institutions, and non-governmental organisations gave their opinions and suggestions on the appropriate score that should be assigned to each problem area out of a maximum score of 100. This was done during a stakeholder consultation (see Songsore et al. 1998). An important consideration in the distribution of the maximum score was the contribution of the problem area to the disease burden of the Greater Accra metropolis.

The second stage entailed the weighted scoring of indicators/hazards within individual environmental problem areas. Indicators for each problem area were chosen and weighed individually. The weighting was done to reflect the relative impact of distinct hazards within each problem area while taking cognizance of the problem area's overall importance. The second stage had two main steps. In the first step, the average score for each problem area was doubled and then distributed among the hazards/indicators under each problem area, thus making the new total a maximum score of 200. Hence, if all hazards were present, the overall score allocated to that problem area in the first stage would be two times as high in the second stage. In the second step, maximum scores were assigned to each hazard/indicator in the problem areas (see Appendix 1) based on opinions shared by stakeholders. The impact of environmental problem areas on health risk was then assessed by their scores, where the higher the score the more severe the environmental problem area and vice versa.

2.4 Computing of the indicators into aggregate data and analysis of results

In applying the environmental indicators as a rapid assessment tool, La and Chorkor were divided into four blocks (sub-locations). La was divided into the following divisions; New Lapkana, Abese, Adiembra and Lakpakpa. Chorkor on the other hand was divided into the following divisions; Lanteman, Chemuana, Alhaji and T-Gardens. To create a community average for each problem area, the indicators for each problem area were scored at the block level (see Appendix 1). The sub-total from the blocks on each of the problem areas were summed up and divided by 4 as expressed in equation 1. Thus, the average score for each problem area was based on the aggregate of the individual indicators in that problem area within individual blocks. The grand maximum score was determined by aggregating each of the nine problem areas as defined in equation 2.

In the rapid assessment, the total score for each community (La and Chorkor) was expressed as a percentage of the maximum score as defined in equation 3. The scores were further expressed in quintiles of environmental burden, where the first quintile is between 1% and 20% and the fifth quintile between 81% and 100%. The first quintile had the least serious environmental risk condition, whereas the fifth quintile had the most serious environmental risk or burden. The results were expressed as quintiles of aggregated environmental burden for each community. This measures the level of deprivation and the level of risk each community is exposed to as far as environmental risk factors are concerned. The following equations were used in constructing weighted indexes for the environmental problem areas;

$$Community\ Average\ (e.g.\ La) = \frac{Sum\ (Sub\ locations)}{4}, \quad (1)$$

$$Grand\ Maximum\ Score = Sum\ (Sub\ Total\ of\ Environmental\ problems), \quad (2)$$

$$Percentage\ of\ Environmental\ Problem\ Area = \frac{(Mean\ Score)}{(Maximum\ Score)} \times 100, \quad (3)$$

3. Results

3.1 Index of environmental conditions for La and Chorkor

Table 1 shows that the mean score for water as a problem area was 19.78 and 26.30 representing 53.4% and 71.1% for La and Chorkor, and put them within the third and fifth quintiles respectively. Comparative analysis within the blocks on this problem area indicate that while Adiembra was the worst-off block in the case of La, Alhaji was the least worst-off in the case of Chorkor. The findings also revealed that Chorkor's problem with water is more acute than La (see Appendix 1), even though being in the third quintile is still an undesired situation for La. Results from the PRA, as summarised in Table 1 also shows that sanitation remains a serious problem in both communities. Both La and Chorkor recorded a mean score of 24.00

3 The maximum weight is the maximum score assigned to an indicator. The study used the maximum weight computed by Songsore et al. (1998) as the benchmark for the study.

and 27.15, representing 80% and 91% and put them within the fourth and fifth quintiles respectively. While all four blocks in La were equally worst-off in this problem area, Chemuana was the most affected block in the case of Chorkor (see Appendix 1). Field observation and qualitative interviews indicated that there were a litany of sanitation problems in the two communities, albeit residents in Chorkor were worst-off. Open defecation and littering of faecal matter in polythene bags are widespread in Chorkor, but also a situation which is not hard to find in La. Public toilets remain the main source of toilet facilities for most households and these are provided by the government, Non-Governmental Organisations (NGO's) and private entities at a regular fee ranging from 30 to 50 pesewas (0.07 to 0.11 USD). Unfortunately, some residents resort to other alternative means of convenience if they are unable to pay these fees, or when there are long queues to use the facilities during rush hours. This leaves most people defecating in unauthorised locations, particularly along the beaches (see Figure 4).

The PRA also revealed that residents face unhygienic conditions in the two communities as, La scored 12.1 and Chorkor scored 17.4 representing 62% and 89%. This places them in the fourth and fifth quintiles respectively (see Table 1). Whereas Abese was the worst-off block in this problem area in the case of La, Lanteman and Chemuana were the worst-off blocks in the case of Chorkor (see Appendix 1). Some of the unhygienic practices identified during the fieldwork include unwashed hands in food preparation, unwashed dishes in households, and inadequate public bath facilities among others. The qualitative interviews below capture the concerns of residents regarding water access and usage, sanitation and the hygiene situation in the study communities. The quotes show that the irregularity with the flow of pipe-borne water creates conditions whereby residents have to pay more for water access. Field observations showed that the main source of water supply (pipe-borne) was located outside the dwelling, and water used for household chores was stored in open containers, making residents very susceptible to infectious diseases such as cholera, as most households do not treat water before using it. There was also evidence of exposed pipelines in drains in the two communities putting users' or residents' health at risk as indicated in figure 2 and 3.

Response on water in La:
Access to water has been a major problem in the community, although over the years the situation has improved. From my next house neighbour, I get water, but frequent water interruption has been very difficult for my house chores duties (45-year-old female tenant).

Response on water in Chorkor:
… although in our house we have pipe-borne water, it is only accessible to the landlord." We, therefore, collect water from the neighbourhood pipe stand of which we pay GH 0.50 ($ 0.085) per bucket (10 litres). We are also forced to store water in barrels for several weeks due to the frequent water interruption, which affects its quality and taste, as a result, we mostly rely on sachet water for drinking (38-year-old female tenant).

Response on access to toilet facilities in Chorkor:
Many houses do not have toilet facilities so we all depend on the public toilets. Unfortunately the toilet facilities are not many. I think in my area we have just two. How can two public toilets serve all the people here? That is why many people go to the beach to ease themselves (41 year old Assemblyman).

Fig. 2 Pipelines found along and in drains in Chorkor.

Fig. 3 Pipelines found in drains in La.

Fig. 4 Open Defecation along the Beach in Chorkor.

There is a huge gutter behind us which has now become a receptacle for waste but you find people selling around this place. Conditions in our houses are also not good and that is why most people get cholera and malaria all the time (36-year-old female resident).

Response on sanitation in La:
Where people sell food in this area is not good at all. You find people selling close to drains which can transmit various diseases. Even conditions in peoples' homes are not hygienic (52-year-old Assemblyman).

Table 1 shows that the mean score for pest infestation was 12.48 and 21.30 representing 50.7% and 86.6% for La and Chorkor and places them in the third and fifth quintiles respectively. In this problem area, while Abese was the most affected block in La, Alhaji was the least affected block in Chorkor. Here also, the result shows that pest infestation is a serious problem in the two communities and is attributable to the poor environmental conditions, albeit Chorkor's situation is more acute between the two communities (see Appendix 1). Pest infestation is a conduit for the spread of diseases such as typhoid and malaria. There was also evidence of uncovered foods, food sold near drains, dusty eating areas, indiscriminate dumping of waste in drains and choked drains in the two study communities. The results also revealed that with respect to the mean score for food contamination, La had a total score of 10.4, while Chorkor also had a total score of 16.9, representing 49% and 81%, thus placing them in the third and fifth quintiles respectively (see Table 1). This situation increases the risk of transmitting foodborne diseases such as cholera, dysentery, and typhoid fever. Findings from the individual blocks in this problem area indicate that Abese was the most affected block in La, while Alhaji was the least affected in Chorkor.

The study also found that even though drainage facilities in the two communities were designed to facilitate the movement of rainstorms. Overcrowding, the extension of buildings to accommodate the increasing population, and the erection of structures at unauthorised places have blocked some of these drains. Such occurrences pose health risks to residents especially during the wet season as they facilitate the spread of pathogens. Results from the PRA (see Appendix 1) also indicate that drains clogged with waste and silts were the acute problems in the two communities. On this indicator, La scored 13.2 while Chorkor scored 20.3, representing 56% and 87%, putting La and Chorkor in the third and fifth quintiles respectively (see Table 1). Here also we find that, comparatively, Chorkor is worse-off than La. Compared within the blocks, while New Lakpana was the least affected block in this problem area, it was the Alhaji and T-Gardens blocks in the case of Chorkor (see Appendix 1). The qualitative interviews with households in the study communities and field observations showed that there were practices that increased food contamination. The interviews also confirmed that residents have problems with their drainage as they are mostly filled with refuse, sand and silt, which impedes the flow of water and serves as a breeding ground for pests.

Response on pest infestation from Chorkor:
The environmental conditions in most homes are deplorable. You find litter all around and the surroundings are not clean at all. This allows houseflies, cockroaches, and mice to enter people's homes (41 year old male household head).

Response on food vending practices from La:
In this community most of the food vendors here do not cover the foods that they sell, sometimes they are sensitised on the negative effects of their actions but they continue to do the wrong thing. It is actually very difficult to sometimes buy and eat food from the street (27 year old female resident).

Response on drainage from Chorkor:
The gutters in this community are filled with a lot of refuse and sand, this does not allow the easy flow of wastewater. As a result, it breeds a lot of mosquitoes and you know this causes malaria among a lot of us (36 year old male household head).

Proximity to and poor management of refuse dumps contribute to the spread of diseases. The results from the PRA revealed that La and Chorkor scored 12.9 and 17.5, representing 67% and 91% on the management of solid waste. This places them in the fourth and fifth quintile ranks respectively (see Table 1). The problem of waste management as identified in the two study communities is an epitome of the situation in most parts of Accra. Figure 5 provides some evidence of the current situation where solid wastes are dumped along the shoreline and indiscriminately in the community. Backyard waste dumps as a result of long-distant dumping sites and lack of skip containers were a common feature in both communities, especially in Chorkor. Many of the dumpsites were found along the beaches, and there were no properly commissioned landfill sites in both study communities. This makes residents very vulnerable to infectious diseases. Inter-block comparison indicates that while Abese was the most affected block in La, it was Alhaji in the case of Chorkor. From the above discussions, it is clear that residents of La and Chorkor were susceptible to both indoor and outdoor pollution due to the poor environmental conditions. Hence, findings from the PRA also revealed that practices such as use of wood/charcoal for cooking, mosquito coils as repellents, smoking of fish and occurrences such as pollution from maize mills, burning, and odour from sanitary and solid waste facilities were predominant. In this problem area, La and Chorkor scored 4.9 and 9.7, representing

Fig. 5 Indiscriminate Dumping of Solid Waste in Chorkor.

42% and 82%, this places the two communities in the third and fifth quintile respectively. Here, while Abese was the most affected block in La, Chemuana was the least affected block in Chorkor (see Appendix 1).

Housing is one of the major challenges and is responsible for the poor environmental conditions in the two communities. Since most people, particularly migrants, do not have decent dwelling places due to the short supply of rental housing units. Overcrowding in housing units is a common feature in the two communities. The PRA showed among others that inadequate and inappropriate housing conditions, overcrowding, and unplanned housing layouts are some of the housing problems confronting the two communities. In this problem area, La and Chorkor scored 8.53 and 11.45 representing 63% and 84%, this places La and Chorkor in the fourth and fifth quintiles respectively (see Table 1). At the block level while Adiembra was the least affected block in La, it was the case of Lanteman and Chemuana in Chorkor (see Appendix 1). The qualitative interviews revealed that residents in the two communities are confronted with varying challenges on solid waste management, air pollution and housing. The quotes below capture some of these perspectives.

Response on solid waste in Chorkor:
We live with a lot of filth in this community because we don't have enough waste communal containers. The few ones available too are left to overflow when it is full. This leads to increase in houseflies, and is a problem for houses who are around the dumpsites, but what can we do, we have to live with it (41 year old male household head).

Response on air pollution in La:
In this area what we suffer mostly with regards to air pollution is the smoke from the women who cook and sell, sometimes it is very bad that it affects our breathing (52 year old Assemblyman).

Response on housing challenges in Chorkor:
As for housing, many people are living in wooden structures because it is cheap to rent from those areas or easy to erect one. The problem with those places is that they don't have gutters, toilet facilities and other important amenities. But because they don't have the money to rent nice places, they are very happy here (36 year old female resident).

3.2 Quintiles of aggregate environmental burdens in La and Chorkor (2001–2016)

The rapid assessment tool was used in 2001, 2005, 2009, and 2016 for monitoring the environmental health conditions of residential communities in the GAMA by (McGranahan et al. 2001; Songsore et al. 2005; 2009; Gyimah 2017). The results of these studies showed that several residential communities were susceptible to environmental health diseases such as cholera, malaria, and dysentery due to the poor environmental conditions. However, environmental conditions in Chorkor in 2001 and 2005 were better than La for most of the problem areas. A later assessment showed that conditions in La improved somewhat

Tab. 1 Environmental Health Indicators and Total Weighted Environmental Health Index for La and Chorkor, 2016.

Indicators	Max Score	La			Chorkor		
		Means Score	%age (%)	Quintile	Mean Score	%age (%)	Quintile
A. Water	**37.0**	19.78	53.4	3	26.30	71.1	4
B. Sanitation	**29.9**	24.00	80.3	4	27.15	90.8	5
C. Pests	**24.6**	12.48	50.7	3	21.30	86.6	5
D. Sullage/Drainage	**23.4**	13.20	56.4	3	20.30	86.8	5
E. Food Contamination	**21.0**	10.35	49.3	3	16.95	80.7	5
F. Hygiene	**19.6**	12.08	61.6	4	17.40	88.8	5
G. Solid Waste	**19.2**	12.90	67.2	4	17.45	90.9	5
H. Housing Problems	**13.6**	8.53	62.7	4	11.45	84.2	5
I. Indoor/Outdoor Air Pollution	**11.8**	4.92	41.7	3	9.69	82.2	5
Grand Total	**200**	**118.22**	**59.1**	**3**	**167.99**	**84.0**	**5**

in the 2016 assessment while those in Chorkor have remained the same (Gyimah 2017). Overall, results, as shown in Appendix 1, indicate that La and Chorkor scored 118 and 168 out of the maximum score of 200. This represents 59% and 84% and places La and Chorkor in the third and fifth quintiles respectively. The inference here is that the environmental conditions in La have significantly improved than Chorkor. This suggests that Chorkor is one of Accra's most deprived communities, and therefore most vulnerable to diseases associated with poor environmental conditions. Notwithstanding this, findings for La in Table 2 indicate that there are still some challenges with regards to sanitation, waste management, and housing problems

4. Discussion

The findings indicate that low-income urban communities continue to face significant environmental challenges owing to limited provision and access to basic environmental services (Appiah-Effah et al. 2019; Mariwah et al. 2017). Beyond the problem of insufficiency, the result shows that the extent of environmental challenges varies across low-income communities and within the communities. This situation suggests that these communities ought to be treated differently according to their own needs and peculiar problems, while priority must also be given to specific locations in the individual communities. The findings also show that Chorkor's environmental problems are worse when compared to that of La. This is not to discount the environmental risk conditions in La, but in terms of exposure and severity to environmental health risks, Chorkor is the worst-off among the two communities. The study has also shown that even though WASH and environmental health problems need to be given attention by policymakers, there is also the need to prioritise which areas require more investment in specific communities. For instance, in La, the municipal authority has to devote resources to addressing sanitation and management of solid waste. In the case of Chorkor, there is the need to look at the environmental sector as a whole since every aspect of the sector seems to be moving from bad to worse. This point is in tandem with the human ecology model on environmental health which suggests that environmental health risk factors are shaped by levels of exposure to pollutants and a situation that may vary by location (Flies et al. 2019), and which are also occasioned by the way people manage and organise their environment.

In addition to the differentiation in the extent of environmental challenges in low-income communities, the result also shows that environmental conditions can worsen or improve temporarily. Reference is made to the case of La, where in 2005 it was in the fourth and fifth quintiles when it comes to water and sanitation respectively. However, the 2016 PRA shows a move to the third and fourth quintile on water and sanitation respectively. Chorkor on the other hand shows a downward spiral of environmental quality over the years. For instance, the 2005 PRA placed Chorkor in the third and fourth quintile on water and sanitation respectively. However, it moved to the fourth and fifth quintile in the 2016 PRA for water and sanitation respectively. A multiplicity of factors might account for the improved environmental conditions in La, including effective monitoring and investment in critical environmental services. The situation of Chorkor on the other hand raises serious concerns about potential health outcomes for residents since the enormity of environmental problems increases the pathways for pollutants into the environment (Corvalan and Kjellstrom 1996), and the disease burdens of residents. The above findings call for both prioritisation and sustenance of efforts towards improving

Tab. 2 Quintile of Environmental Burden in La and Chorkor (2001, 2005 and 2016).

Indicators	2001		2005		2016	
	LA	Chorkor	La	Chorkor	La	Chorkor
A. Water	4	2	4	3	3	4
B. Sanitation	5	4	5	4	4	5
C. Pests	5	5	5	5	3	5
D. Sullage/Drainage	5	5	5	4	3	5
E. Food Contamination	5	2	5	4	3	5
F. Hygiene	4	3	4	4	4	5
G. Solid Waste	5	5	5	5	4	5
H. Housing Problems	4	3	5	4	4	5
I. Indoor/Outdoor Air Pollution	4	4	5	5	3	5
Quintile of Aggregated environmental burden	5	4	5	4	3	5

Source: Songsore et al. 2001; 2005; Field Survey 2016

access to environmental services in poor urban communities in Ghana (Monney and Antwi-Agyei 2018) as part of the quest toward achieving universal access to critical services such as clean potable water by 2030.

The findings can also be situated within the larger structural problems in Accra such as overcrowding, increased unemployment, and inadequate infrastructure (Owusu and Afutu-Kotey 2010; Okyere et al. 2021). Inequality in Accra has skyrocketed and poverty permeates many areas in the capital (Awumbila et al. 2014). Conspicuous are the conditions of low-income indigenous communities in Accra of which the two study communities are a part. For most residents in these communities, surviving the urban life is more important and therefore conditions of the environment are not immediate problems that they often attend to. However, these conditions pose a serious environmental health risk that increases the disease burden in these areas. The above point resonates with the suggestion by Ray and Jacob (2015) on the limits to ecological analysis, which is the issue of how economic systems and context often forces people into situations where they pay little to no attention to how their actions and inactions affect or is affected by the environment in which they live. Without holistically addressing the socio-economic and environmental needs of residents in Chorkor and other similar low-income communities, the situation is going to worsen. On the other hand, the study has shown that situations can improve over time as exemplified in the case of La. This differential exposure also reflects issues such as social and spatial inequalities, and unevenness in access to environmental services (WHO 2010).

The findings of the study evokes critical questions about the institutional arrangement for environmental management at the local level, in this case the local government system. The findings raise issues regarding how environmental problems in the communities are prioritised, and the mechanisms for ensuring sustained investment in WASH and other related environmental problems in the MMDAs where the communities are located. As was evident in the study, most problems bordered on the lack thereof of essential environmental services and facilities. Additionally, the findings bring to the fore the need to strengthen and improve the capacity of the EHD of the MMDAs of the two study communities. This is essential in the identification of the peculiar environmental needs and enhancing their ability to draw partnerships to facilitate investment in WASH. This will be instrumental in closing the infrastructural gap since the MMDAs on their own cannot raise sufficient funds to close this gap.

5. Conclusion and policy implications

The study aimed at comparing the environmental conditions of two low-income communities in Accra i.e. La and Chorkor. This was undertaken using the PRA method, which has been used in previous studies in Ghana, and involves the assessment of environmental conditions using objectively constructed environmental hazard indicators. Thus, by applying the PRA method, the paper sought to unravel the extent of change in environmental conditions in the two study communities' post-previous PRA studies, as well as perspective on the differences in environmental conditions that exist between them. Thus, challenging the narrative and the notion that often-homogenised environmental problems in low-income communities in urban Ghana.

The findings show that the two study communities face serious environmental challenges. However, the average index for all environmental problem areas was high and closer to the maximum average scores for Chorkor when compared to La. This placed Chorkor in the fifth quintile on almost all the environmental problem areas, showing clearly that Chorkor's environmental conditions have remained the same or worsened when compared with previous studies. For La, even though the environmental conditions were not good, the findings show that it has moved up to the third quintile on most of the environmental problem areas, suggesting some modest improvement over the years. The paper recommends that there should be sustained and reliable funding to MMDAs to effectively implement policies and projects on WASH. In addition, there is a need for infrastructural and socio-economic development in low-income urban communities to reduce poverty and improve the social and economic wellbeing of residents. Lastly, the authors recommend effective and efficient community education and sensitization on proper sanitary practices which have the potential to mitigate cholera epidemics in the two communities. These policies and projects must prioritise the worst affected blocks. For instance the Abese and Adiembra blocks contributed most to the poor environmental conditions in La, even though Abese was the worst affected block among the four in almost all the nine problem areas. In the case of Chorkor, Lanteman and Chemuana were the most affected blocks, but Lanteman was the worst affected block among the four in all the nine problem areas. In view of the foregoing, the Abese block in La and the Lanteman block in Chorkor should be prioritised in the application of the aforementioned recommendations.

Despite the relevance of this study in revealing the differentials in environmental conditions of urban low-income communities, the general applicability of the findings are limited by the use of only two communities. Hence, future studies could use more than two low-income communities from different MMDAs in the GAMA in order to make a significant generalisation of the findings. Also, the inventiveness of residents in dealing with the environmental problems in the communities were not considered. This obscures the creative abilities of residents of urban informal communities and slums in solving the environmental problems

confronting them. Future studies can explore this to propagate the positive role of these communities in helping address Accra's socio-environmental problems, which are often regarded by authorities to be created by residents from low-income communities

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Appendix 1: Results of Proxy Indicators for Rapid Assessment of Environmental Health Status of La.

		Sub-locations (Blocks)				All of La	Sub-locations (Blocks)				All of Chorkor
A. Water		*New Lakp.*	*Aba./Kow./ Abe.*	*Adie.*	*Lakp.*		*Lanteman*	*Chemuana*	*Alhaji*	*T Gard.*	
Indicators	***Maximum Score***	***Mean Score***					***Mean Score***				
1. Ponds/streams as principal source of water supply within community	6.7	–	–	–	–	–	–	–	–	–	–
2. Pipelines on ground surface and in drains (cross contamination)	4.8	–	4.8	4.8	–	2.4	4.8	4.8	4.8	4.8	4.8
3. Frequent water supply interruptions within community	4	4	4	4	4	4	4	4	4	4	4
4. Principal source of potable water supply outside house compound	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
5. Vendors as principal source of potable water supply within community	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
6. Potable water stored in open containers	3.1	–	3.1	–	–	0.775	3.1	3.1	3.1	3.1	3.1
7. Use of common dip cup for drinking water	2.8	2.8	2.8		2.8	2.1	2.8	2.8	–	2.8	2.1
*8. Distance above 200 meters from water collection points	2.7	–	–	–	–	–	–	–	–	–	–
*9. Queuing time of 20+ minutes at water collection points	2.4	–	–	–	–	–	2.4	2.4	–	2.4	1.8
*10. Pay as you use for water	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
*11. Community self-assessment of water quality using own indicators	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Sub-Total for Water	***37***	***17.3***	***25.2***	***19.3***	***17.3***	***19.775***	***27.6***	***27.6***	***22.4***	***27.6***	***26.3***

B. Sanitation		New Lakp.	Aba./Kow./ Abe.	Adie.	Lakp.	All of La	Lanteman	Chemuana	Alhaji	T Gard.	All of Chorkor
Indicators	Maximum Score	Mean Score						Mean Score			
5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	5.9	5.9
4.1	4.1	4.1	4.1	4.1	4.1	4.1		4.1	4.1	4.1	4.1
3.3	–	–	–	–	–	3.3		3.3	–	3.3	2.475
3.1	3.1	3.1	3.1	3.1	3.1	3.1		3.1	3.1	3.1	3.1
3.1	3.1	3.1	3.1	3.1	3.1	3.1		3.1	3.1	3.1	3.1
2.7	–	–	–	–	–	–		2.7	–	–	0.675
2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5
1.9	1.9	1.9	1.9	1.9	1.9	1.9		1.9	1.9	1.9	1.9
1.7	1.7	1.7	1.7	1.7	1.7	1.7		1.7	1.7	1.7	1.7
1.7	1.7	1.7	1.7	1.7	1.7	1.7		1.7	1.7	1.7	1.7
30	***24***	***24***	***24***	***24***	***24***	***27.3***		***30***	***24***	***27.3***	***27.15***

	New Lakp.	Aba./ Kow./Abe.	Adie.	Lakp.	All of La	Lanteman		Chemuana	Alhaji	T Gard.	All of Chorkor
Maximum Score	***Mean Score***	***Mean Score***									
5.3	–	5.3	–	–	1.325	5.3		5.3	5.3	5.3	5.3
5.2	5.2	5.2	–	5.2	3.9	5.2		5.2	–	5.2	3.9
4.4	–	4.4	4.4	4.4	3.3	4.4		4.4	4.4	4.4	4.4
2.8	–	2.8	–	–	0.7	2.8		2.8	2.8	2.8	2.8
2.7	2.7	2.7	2.7	2.7	2.7	2.7		2.7	2.7	2.7	2.7
2.2	–	2.2	–	–	0.55	2.2		2.2	2.2	2.2	2.2
7. Evidence of lice in children's hair within community	2	–	–	–	–	–	–	–	–	–	–
Sub-Total for Pests	***24.6***	***7.9***	***22.6***	***7.1***	***12.3***	***12.475***	***22.6***	***22.6***	***17.4***	***22.6***	***21.3***

C. Sullage/Drainage		*New Lakp.*	*Aba./Kow./ Abe.*	*Adie.*	*Lakp.*	*All of La*	*Lanteman*	*Chemuana*	*Alhaji*	*T Gard.*	*All of Chorkor*
Indicators	*Maximum Score*	*Mean Score*					*Mean Score*				
1. Evidence of mosquito and other larvae within stagnant water bodies	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
2. Pools of stagnant water (cesspools)	3.9	–	–	–	–	–	3.9	3.9	–	–	1.95
3. Drains choked with garbage, weeds and silt	3.7	–	3.7	3.7	3.7	2.775	3.7	3.7	3.7	3.7	3.7
4. Pools of stagnant water in drains	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
5. Evidence of children playing in and around stagnant water	3	–	3	–	–	0.75	3	3	3	3	3
6. Absence of narrow drains in the community	2.9	2.9	–	2.9	–	1.45	2.9	2.9	2.9	2.9	2.9
7. Evidence of flood risks within community	2.1	–	–	2.1	–	0.525	2.1	2.1	–	–	1.05
Sub-Total for Sullage/Drainage	***23.4***	***10.6***	***14.4***	***16.4***	***11.4***	***13.2***	***23.3***	***23.3***	***17.3***	***17.3***	***20.3***

D. Food Contamination		*New Lakp.*	*Aba./Kow./ Abe.*	*Adie.*	*Lakp.*	*All of La*	*Lanteman*	*Chemuana*	*Alhaji*	*T Gard.*	*All of Chorkor*
Indicators	*Maximum Score*	*Mean Score*					*Mean Score*				
1. Evidence of defecating children around food vending area/ cooking area with the home	3.2	–	–	–	–	–	3.2	3.2	–	–	1.6
2. Uncovered vendor prepared food/uncovered prepared food left-overs within the house	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	–	2.6	1.95
3. Food sold near public toilets	2.5	–	2.5	–	–	0.625	2.5	2.5	–	2.5	1.875
4. Food sold near drains	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
5. Use of unwashed or rotten vegetables for cooking/raw eating	1.8	–	1.8	–	–	0.45	1.8	1.8	–	–	0.9
6. Using (naked) hand as means of serving food.	1.7	–	–	–	–	–	1.7	1.7	1.7	1.7	1.7
7. Food sold in eating places without running water	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
8. Dusty eating areas or eating areas along main transportation arteries with vehicular smoke pollution	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
9. Serving food in leaves/paper	1.5	–	1.5	–	–	0.375	1.5	1.5	–	1.5	1.125
10. Lack of medical certification of food vendors (from health inspectors)	1.5	–	–	–	–	–	1.5	1.5	1.5	1.5	1.5
11. Food cooked in the open for sale	1	1	1	1	1	1	1	1	1	1	1
Sub-Total for Food Contamination	***21***	***8.9***	***14.7***	***8.9***	***8.9***	***10.35***	***21.1***	***21.1***	***9.5***	***16.1***	***16.95***

E. Hygiene		New Lakp.	Aba./Kow./ Abe.	Adie.	Lakp.	All of La	Lanteman	Chemuana	Alhaji	T Gard.	All of Chorkor
Indicators	Maximum Score	Mean Score					Mean Score				
1. Hands not washed after toilet	3.5	–	3.5	–	–	0.875	3.5	3.5	3.5	3.5	3.5
2. Hands not washed before food preparation/ eating	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
3. Evidence of spitting around in community	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
4. Evidence of unwashed plates/dishes in house compound	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
5. No facility for hand washing attached to toilet, chopbars, etc.	1.8	–	–	–	1.8	0.45	1.8	1.8	–	–	0.9
6. Presence of children/adults with open sores/ running noses	1.6	–	–	–	–	–	1.6	1.6	1.6	1.6	1.6
7. Communal handwashing practices within home	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
8. Absence of household bathhouse facility	1.3	–	–	–	–	–	–	–	–	–	–
9. Presence of barefooted children in community	1.3	1.3	1.3	–	–	0.65	1.3	1.3	1.3	1.3	1.3
10. Inadequate public bath-house facilities	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Sub-Total for Hygiene	***19.6***	***11.4***	***14.9***	***10.1***	***11.9***	***12.075***	***18.3***	***18.3***	***16.5***	***16.5***	***17.4***

F. Solid Waste		New Lakp.	Aba./Kow./ Abe.	Adie.	Lakp.	All of La	Lanteman	Chemuana	Alhaji	T Gard.	All of Chorkor
Indicators	Maximum Score	Mean Score					Mean Score				
1. Mounds of uncollected garbage within community	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
2. Indiscriminate dumping of garbage in community	4	–	4	4	–	2	4	4	–	4	3
3. Evidence of uncovered solid waste within house compound	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
4. Evidence of children playing around waste dumps and/or scavenging in them	3.4	–	–	–	–	–	3.4	3.4	–	3.4	2.55
5. Paper and plastic litter within community	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
6. Evidence of animals scavenging on waste dumps and spreading the litter	2	–	2	–	2	1	2	2	2	2	2
Sub-Total for Solid Waste	***19.2***	***9.9***	***15.9***	***13.9***	***11.9***	***12.9***	***19.3***	***19.3***	***11.9***	***19.3***	***17.45***

G. Housing Problems		*New Lakp.*	*Aba./Kow./ Abe.*	*Adie.*	*Lakp.*	*All of La*	*Lanteman*	*Chemuana*	*Alhaji*	*T Gard.*	*All of Chorkor*
Indicators	*Maximum Score*	*Mean Score*					*Mean Score*				
1. Evidence of crowding in sleeping places	2.4	–	2.4	–	2.4	1.2	2.4	2.4	2.4	2.4	2.4
2. Absence of mosquito/insect screens in building	2	2	2	–	2	1.5	2	2	2	2	2
3 .Evidence of domestic animals sharing dwelling places with humans	1.8	–	–	–	–	–	–	–	–	–	–
4. Droppings of domestic animals in and around house compound	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
5. Evidence of crowding and unplanned layout of houses	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
6. Evidence of people sleeping outside of rooms in community	1.1	–	–	–	1.1	0.275	1.1	1.1	1.1	1.1	1.1
7. Evidence of leaking roofs during rains	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
8. Evidence of damp walls	1	–	–	1	–	0.25	1	1	1	1	1
9. Presence of noise pollution from artisanal works/micro-enterprises etc.	0.7	0.7	0.7	0.7	0.7	0.7	–	–	0.7	0.7	0.35
10. Evidence of dirty floors	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
11. Evidence of cracks in walls	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Sub-Total for Housing Problems	***13.6***	***7.3***	***9.7***	***6.3***	***10.8***	***8.525***	***11.1***	***11.1***	***11.8***	***11.8***	***11.45***

H. Indoor/Outdoor Air Pollution		*New Lakp.*	*Aba./Kow./ Abe.*	*Adie.*	*Lakp.*	*All of La*	*Lanteman*	*Chemuana*	*Alhaji*	*T Gard.*	*All of Chorkor*
Indicators	***Maximum Score***	***Mean Score***					***Mean Score***				
1. Smoke pollution from corn mills and micro-enterprise/vehicle (e.g. garages, fish smoking, rubbish burning etc.) in community	1.9	–	1.9	–	–	0.475	1.9	1.9	1.9	1.9	1.9
2. Wood as principal cooking fuel in community	1.8	–	1.8	–	1.8	0.9	1.8	1.8	1.8	1.8	1.8
3. Evidence of widespread cigarette/pipe smoking within home	1.8	–	–	–	–	–		1.8		1.8	0.9
4. Evidence of cooking done indoors (in sleeping rooms)	1.7	–	–	–	–	–	1.7	1.7		1.7	1.275
5. Evidence of cooking with wood/charcoal in kitchens	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
6. Charcoal as principal cooking fuel in community	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
7. Use of pump-spray insecticide	1	–	–	–	–	–					0
8. Use of mosquito coil/burning of leaves as repellent	0.7	0.7	0.7	0.07	0.7	0.5425	0.7	0.7	0.7	0.7	0.7
Sub-Total for Indoor/Outdoor Air Pollution	***11.8***	***3.7***	***7.4***	***3.07***	***5.5***	***4.9175***	***10.9***	***7.4***	***10.9***	***9.575***	***9.69375***

Grand Total	**200**	**101**	**148.8**	**109.07**	**114**	**118.2175**	**181.5**	**180.7**	**141.7**	**168.075**	**167.99375**

* Data was obtain through a focus group discussion.