**Research Article**

# The Status of Environmental Health and Its Implications in an Urban Community in Accra, Ghana: Using Community Diagnosis as a Tool in Medical Education

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**Abstract**

**Background:** A community diagnosis assesses the living conditions and health status of a community. This paper reports the environmental health aspect of a community diagnosis performed by undergraduate medical students from a private medical school in Accra, Ghana. An assessment of knowledge and skills gained from participation in the activity are also reported.

**Methods:** A descriptive, cross-sectional, questionnaire-based household survey was conducted at Lenshie Quarters, Accra. Households were selected by cluster sampling. One household head or informed adult with a minimum age of 18 years was interviewed (face to face) in each household. Descriptive statistics were generated using statistical software (SPSS, Microsoft Excel). Knowledge and skills gained by students were assessed, summarized and presented as graphs.

**Results:** Respondents had a mean age of 30 (± 1.88; n=430) years. Lack of ceilings, scarce household ownership of latrines and sewerage systems, inadequate solid waste disposal, pests and noise were identified as environmental hazards. The most commonly reported diseases were malaria (42.6%) hypertension (19.2%), urinary tract infections (8.5%). Improved water sources for domestic purposes and hand hygiene might have mitigated diarrheal diseases. Knowledge and skills were gained in health planning, design and conduct household surveys, analysis and presentation of health data. Group benefits included team work, communication skills and respect for one another.

**Conclusion:** Students learnt skills relevant to professional practice through the conduct and presentation of a community diagnosis. Mitigating the hazards identified requires behavior change and enforcement of by-laws at district level to promote a more health supporting environment.

## ABBREVIATIONS

**GLISS:** Ghana Living Standards Survey; **HAP:** Household Air Pollution; **ITNs:** Insecticide Treated Nets; **KVIP:** Kumasi Ventilated Improved Pit Latrine; **LEKMA:** Ledzokuku-Krowor Municipal Assembly; **LPG:** Liquefied Petroleum Gas; **NMCP:** National Malaria Control Program

## INTRODUCTION

A community diagnosis aims at identifying health problems in a specified community and the related facets which are useful in understanding the context of the problems and potential for improvement. This context includes the history and demographic composition of its people, the leadership structure, community institutions, traditions, cultural values and norms, social network, its living environment, health services and lifestyles [1]. A community diagnosis provides useful information to health authorities, civil society and implementing partners for advocacy and planning health programs. Factors that promote or demote health and sustainable development in a community are identified and tracked in subsequent surveys to monitor progress in addressing health inequities.

Community diagnosis is an essential aspect of medical education in which students become familiar with characteristics of a community and develop skills in the design, conduct and

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presentation of research. Students also learn team work, time management and social etiquette as they would often work in groups. This is essential as healthcare professionals often work in teams, both intradisciplinary and multidisciplinary. The sub-disciplines of Community Health are applied in practice to assess the health status of the community. These include demography and biostatistics, epidemiology, environmental health, occupational health, reproductive health, health promotion, health systems management among others.

Several studies have reported relationships between environmental conditions and health outcomes. For instance, lack of access to improved water and toilet facilities poses a threat to children's health through diarrheal diseases [2]. Furthermore, the proximity of toilets to a house (within 15 meters), and presence of uncollected garbage inside compounds has been associated with acute diarrhea [3]. Living in houses built with sub-standard materials has been associated with a higher odds of respiratory tract infections in children aged below five years [4] and living in houses with mud roofs has been associated with higher odds of Plasmodium falciparum infection [5]. Overcrowded housing facilitates the spread of communicable diseases such as scabies and impetigo [6]. The lack of privacy in housing has been associated with poor self-rated health [7]. Noisy environments can disrupt sleep resulting in daytime drowsiness, fatigue and low productivity at work. Within this urban context, a community diagnosis was conducted by Level 400 medical students at Lenshie Quarter, Teshie, a suburb of Accra, Ghana. This article presents two aspects of student learning in Community Health. The first part presents the environmental health status of the community as a demonstration of student learning in Community Health. The second part presents gains in knowledge and skills acquired by students from participation in the survey.

## MATERIALS AND METHODS

### Study setting

The study was undertaken at Lenshie Quarter, Teshie a suburb of Accra, the capital of Ghana. It is located in Ledzokuku-Krowor Municipal Assembly (LEKMA) of Accra. The municipal has a total population of 227,932, of which 109,185 (47.9%) are males. LEKMA has 60, 859 households with a total population of 221, 757 and a household size of 3.6 [8]. Lenshie Quarter is one of the five main clans (or quarters) of Teshie; others are Kle, Krobo, Agbawe and Gbugblah.

### Study design and eligible population

A descriptive, cross-sectional study was conducted over two days in November, 2017. A questionnaire based pre and post-evaluation was done to assess learning outcomes of Level 400 medical students from a private medical school in Accra, who conducted the community diagnosis.

Heads of household were approached or in their absence an adult aged 18 years and older who was well informed about the household. The household head was a male or female recognized by family members as having economic and social responsibility for the family. A household was defined as a group of persons, who lived together in the same house or compound and shared daily living activities. It consisted of the man, his wife, children

and relatives by blood or marriage and non-relatives like a house help [9]. They had to be residents of Lenshie Quarters to participate in the study.

Twenty-three medical students undertook the community diagnosis under the supervision of Faculty and residents in Community Health and responded to a questionnaire assessing their learning outcomes.

### Data collection

Prior to the study, questionnaires were designed and pre-tested among ten residents of Adedenikpo, a community with similar characteristics in LEKMA. Questionnaires were modified based on feedback. To conduct the study, Lenshie Quarters was divided into four clusters using roads as landmarks. The clusters were assigned numbers serially and a single cluster chosen by ballot. A total of 108 households in the cluster, with a population of 430, were enumerated. Structured questionnaires containing close-ended questions were used to collect data on demographic and environmental characteristics (house type and characteristics, drinking and domestic water usage, waste management, hand washing practices, food source and storage, air and noise pollution and pest and vector control).

Medical students were assessed using self-administered questionnaires post-survey. In the first section, the questionnaire captured biodata of the students. In the second section, knowledge in planning health programs, ability to design a cross-sectional study, field experience in data collection and interviewing, and skills in statistical analysis were assessed. In this section, twelve questions were scored by the student on a scale of 1 to 5, where 1 = None or limited knowledge/skills, 2 = Below average, 3 = Average, 4 = Good and 5 = Very good to Excellent. The third section assessed lessons learnt as a group and comprised of two open ended questions "Collectively, what are the skills you have acquired?" and "What one teamwork lesson did you learn?". The data collected were analyzed using the Statistical Package for Social Science (SPSS) IBM Statistics 23.0 and Microsoft Excel version 2016. Descriptive statistics generated enabled the students to practice data analysis using software and apply statistical principles in interpretation of the results. Environmental characteristics were provided for 108 households, while demographic characteristics were provided for 430 residents in these households.

## RESULTS AND DISCUSSION

### Sociodemographic characteristics of the respondents

One hundred and eight households were surveyed with a total population of 430, of which 192 (44.6%) were males (Table 1). The average household size was 4 persons, exceeding the household size reported by the Ghana Demographic and Health Survey, 2014 [10] of 3.4 persons and 3.6 persons reported for LEKMA District in the 2010 Housing and Population Census report [9] (Table 1).
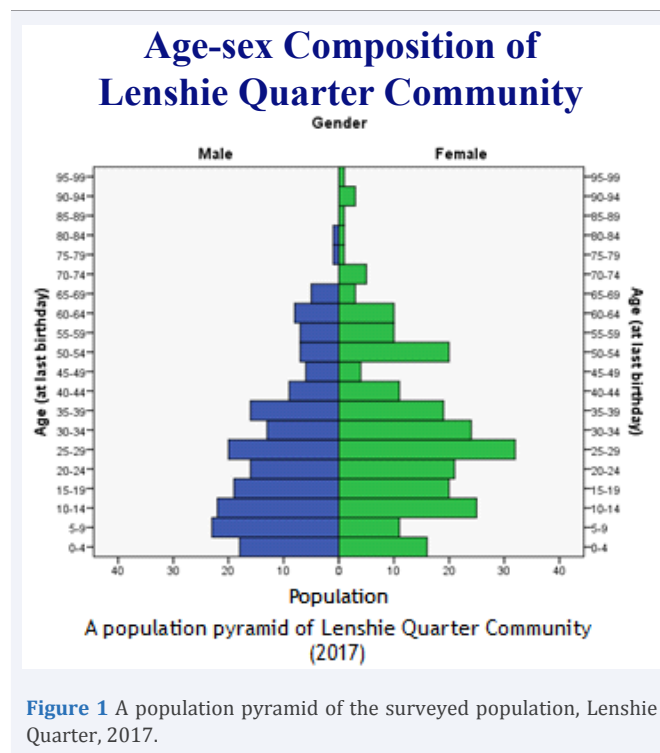
The median age of 26 years qualifies the population as an intermediate population which ranges between 25-29 years (Figure 1).

The predominance of female respondents was most likely

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**Table 1:** Sociodemographic characteristics of surveyed population, Lenshie Quarter, 2017 (N = 430).

| Demographic characteristics | Frequency (%) |
|---|---|
| Total population | 430 (100%) |
| Males | 192 (44.7) |
| Sex ratio | 81 males per 100 females |
| Total surveyed households | 108 |
| Average household size | 4.0 |
| Age (years) mean (s. d.) | 30 (± 1.88) years |
| Marital status | |
| Never Married | 228 (53.0) |
| Married | 144(33.5%) |
| Co-habiting | 15 (3.5) |
| Widowed | 26 (6.0) |
| Divorced | 11 (2.6) |
| Separated | 6 (1.4) |
| Total | 430 (100) |
| Ethnicity | |
| Ga/Ga-Adangbe | 263 (61.2) |
| Akan | 81 (18.8) |
| Northern tribes | 53 (12.3) |
| Ewe | 17 (4.0) |
| Others | 16 (3.7) |
| Total | 430 (100) |
| Level of Education | |
| No formal education | 66 (15.3) |
| Basic education | 102 (23.7) |
| Junior High School | 112(26.1%) |
| Senior High School | 111 (25.8) |
| Tertiary education | 36 (8.4) |
| Vocational School | 3 (0.7) |
| Total | 430 (100) |
| Occupation | |
| Traders | 116 (27.0) |
| Artisans | 39 (9.0%) |
| Professionals | 32 (7.4) |
| Civil servants | 11 (2.6) |
| Retired | 15 (3.5) |
| Students | 125 (29.1) |
| Unemployed | 79 (18.4) |
| *Others | 13 (3.0) |
| Total | 430 (100) |
| Religion | |
| Christianity | 383 (89.1) |
| Islam | 34 (7.9%) |
| Traditional | 4 (0.9%) |
| Others | 9 (2.1%) |
| Total | 430 (100) |

*Others = drivers, electricians, services



**Figure 1** A population pyramid of the surveyed population, Lenshie Quarter, 2017.

related to female responsibility for practical aspects of food hygiene, solid and liquid waste management. Indeed, a study by Eugene and colleagues posits that in developing countries, women are directly concerned with household chores and they play a decisive role in areas such as solid waste management [11]. Majority of the respondents had either basic (23.7%) or secondary education (Junior High School 26%, Senior High School 25.8%). Attainment of tertiary education was low (8.4%). The level of education is related to concern for the environment since individuals with advanced levels of education show more concern for the environment [12]. Most respondents were single (53%), mostly Ga/Adangbe (61.2%), and Christians (89.1%). The predominant occupation was trading (27%).

**Environmental conditions in Lenshie Quarter**

**Type of dwelling:** Eighty-seven percent of all dwelling units were compound houses. Semi-detached houses constituted 6.7% and 3.7% had lived in improvised shelters like a kiosk or a metal container. The 2010 Population & Housing Census indicates that majority of urban dwellers tend to live in compound houses, usually due to low, affordable rents. Those who cannot afford standard housing often resort to makeshift housing which can have detrimental effects on the physical and mental health of an individual [13]. The inner walls (96.2%) and floors (90.7%) of most houses were made from cement. This trend is also seen in the Ghana Living Standard Survey (GLISS) 2014, where in Accra, the main floor material used was cement (79.7%) [14]. The outer wall of dwellings in the present study were made from cement blocks (91.9%) similar to GLISS 2014 (91.5%). Two-thirds of respondents reported their dwellings lacked a ceiling. This affects thermoregulation in the dwelling units. The hot weather in the tropics would enhance the heat in the house and without a ceiling, pests and rodents may gain access to the building more

readily. Pests and rodents have the ability to transmit diseases in human habitation.

**Sources of and storage of drinking and domestic water:** The most common source of drinking water was from bottle or sachet water (80.6%), followed by pipe-borne water (16.7%), with the least mentioned source being boreholes (1.9%). This indicates an improvement over the 2010 Population and Housing Census Report of LEKMA which indicated that households obtained their main source of drinking water from pipe borne water outside their dwelling (32%), followed by sachet water (23.6%) and then bottled water (0.7%) [9]. Sachet water was originally considered an improved source of water only if the household used an improved water source for other purposes such as cooking and handwashing [15]. However, the Multiple Indicator Cluster Survey (MICS) 2017/18 now classifies 'packaged water' as an improved source [16]. For domestic use, the most patronized source was pipe-borne water (90.3%), followed by wells (4.4%) and a borehole (1.8%). This corroborates the report that 93% of urban areas in Ghana have access to improved drinking water [16].

**Waste management:** Solid waste was collected by private service providers (58.2%), or disposed by dumping at a communal bin (20%) and at unregulated dumping sites (16.4%). Burning and burial were less commonly practiced (2.7% and 1.8% respectively). Daily collection of household waste was reported by 58.2% of households (Table 2).

Although there was no report of indiscriminate dumping of refuse by residents who were unable to afford waste collection service fees, the transect walk through the community revealed choked gutters and littering of black plastic bags. Third party service providers reportedly collect 60% of refuse generated daily, resulting in heaps of rubbish in gutters, households, communal sites and other public places [17]. Uncollected litter and refuse dumps can habour vermin, rodents and vectors and cause stench within the environment. The presence of malodor has been associated with poor self-reported health [7]. A similar observation was reported in Sabo-Zongo, a slum neighbourhood in Accra, Ghana, where inhabitants dump rubbish in gutters [18]. Residents who lived downstream of run-off and flood channels bore the brunt of waste, both solid and liquid.

Sullage was often drained into gutters (55.7%) and thrown onto streets or on the ground (Table 2). A similar report in the GLISS 2014 indicates that urban dwellers discharge their liquid waste into drains (52.2%) [19]. Among the households surveyed, 78.7% lacked toilet facilities. When present, the most commonly used toilet facility was the water closet (38.5%), followed by the Kumasi Ventilated Improved Pit latrine (KVIP) (19.8%). Although there was no report of open defecation, bucket or pan latrines, 15.7% of respondents admitted defecating into plastic bags. The disposal of liquid waste and excreta into open spaces is associated with malodor and can facilitate transmission of diarrheal diseases. Regular handwashing with soap and running water can reduce the incidence of diarrhea and pneumonia by 50%, however it has been reported that only 15% of Ghanaian households have handwashing facilities [20]. The present study reports a higher proportion of toilets with handwashing facilities (84.3%). Among respondents who used hand washing facilities, 91% washed their hands with soap under running water.

**Food habits and cooking fuels:** Sixty percent of households cooked their food at home, while 6% and 34% of households bought food from food vendors or from both sources respectively. Leftover foods were mostly stored in covered containers. The main cooking fuels used by respondents were charcoal (46.4%) and liquefied petroleum gas (LPG) (46.4%) similar to the GLISS 2014 which reported charcoal (43.6%) and LPG (35.8%) as the main cooking fuels, with higher levels of use of LPG in Accra (52.7%) [16]. The use of biomass fuels like charcoal and firewood contribute to household air pollution (HAP) which is increasingly becoming recognized as a potential risk factor for asthma, pneumonia, lung cancer and cardiovascular diseases in low and middle-income countries [21]. Pregnant women have a two-fold risk of developing pre-eclampsia or eclampsia when exposed to fumes from burning biomass compared to those who use cleaner cooking fuels [22, 23]. Using cleaner fuels in conjunction with improved ventilation reduces exposure to household air pollution. Therefore, the use of LPG as a cleaner fuel should be encouraged by healthcare professionals, local governments, healthcare policy makers and the general public.

**Air and noise pollution:** The most common sources of air pollution were from burning waste (34.3%), cooking fuels (14.1%), and fumes of cars (10%). Other sources of air pollution included burning of plant materials like weeds, smoking fish and grilling meat for commercial purposes. These thermal activities emit particulate matter, nitrogen dioxide ($NO_2$), sulphur dioxide ($SO_2$), carbon monoxide (CO) and lead (Pb) which can increase the risk of mortality from asthma, chronic obstructive pulmonary disease and lung cancer [24]. Noise is any unwanted sound that can cause some physical and psychological stress to the human body and damage to the environment [25,26]. In the

| Table 2: Waste disposal methods in Lenshie Quarter, 2017. | | | | |
|---|---|---|---|---|
| **Solid Waste** | | **Liquid Waste** | | |
| Method | Frequency (%) | Method | Frequency (%) | |
| House-house collection | 64 (58.2) | Soak away pits | 1 (0.9) | |
| Dumping (unregulated areas) | 18 (16.4) | Drainage into gutters | 59 (55.7) | |
| Communal site | 22 (20.0) | Sewerage system | 3 (2.8) | |
| Burned by household | 3 (2.7) | Thrown into streets/compounds | 41 (38.7) | |
| Buried by household | 2 (1.8) | Others | 2 (1.9) | |
| Others | 1 (0.9) | | | |
| Total | 110 (100) | Total | 106 (100) | |
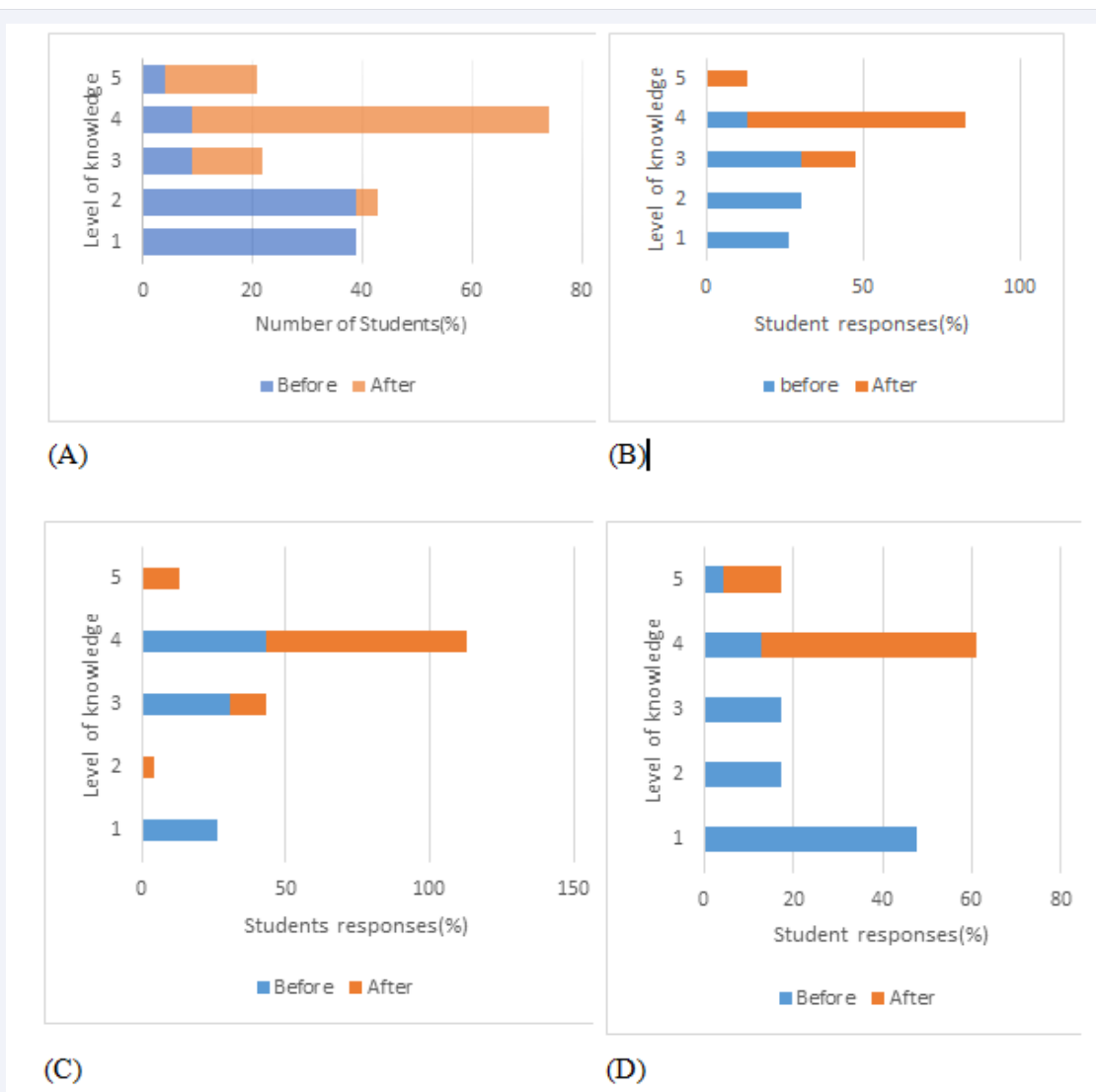
**Figure 1** Evaluation of student learning from the community diagnosis using self-rated responses.
(A) - The level of knowledge about health planning; (B) - Skills in study designs, data collection instruments, data validation; (C) - Data analysis and interpretation of results; (D) - Presentation skills, methods of presenting health data

present study, 28% of respondents complained about noise from churches. Event such as parties, funerals and matrimonial ceremonies (19%) and road traffic, music vendors, drinking bars and commercial waste collector vehicles (41%) were other reported sources of noise. Noticeably loud noise has been associated with subfertility and increased risk of type 2 diabetes, particularly prolonged exposure to road traffic noise [27,28].

**Pests and vector control:** Thirty-seven point five percent of responses indicated that residents were bothered by crawling insects (ants), flying insects (mosquitoes and houseflies) (32.4%) and rodents like mice (19.5%). The main methods of control were the use of insecticides (52.9%), manual killing (16.9%) and 'Kwawe last stop', a local term for a glue board (12.5%). The least used method was mechanical traps (2.9%). The use of residual spraying with insecticides is a vector management strategy promoted by the National Malaria Control Program (NMCP) to prevent mosquito bites within the home environment

[33], the frequent use of insecticides, particularly those containing pyrethroids has been shown to increase resistance in mosquitoes [29]. When combined with the use of insecticide treated nets (ITNs), indoor spraying can offer the greatest of protection against malaria [30]. Malaria (42.6%) ranked highest among self-reported diseases in the present study. This is consistent with morbidity profiles from outpatient departments in most parts of the country [31,32]. Between September and November, 2017, other diseases reported were hypertension (19.2%), urinary tract infections (8.5%), cholera and diabetes mellitus (2.1% respectively). Feedback to the community included: (i) District Environmental Health Officers (through communal or hired labor) should facilitate the removal of solid waste in and around homes, desilting of gutters and elimination of stagnant pools of water to prevent mosquitoes from breeding; (ii) Inter-sectoral collaboration between academic, health and environmental authorities to monitor noise levels and air quality for risk assessment and risk communication (iii) Dialogue and

collaboration between academic institutions and communities to strengthen advocacy efforts to improve their health and environment.

**Community Diagnosis in relation to Environmental Health:** Health promoting conditions identified were the use of pipe-borne water for domestic purposes, the practice of covering stored water and the practice of hand hygiene which together might have contributed to the low reported prevalence of cholera. Among the health demoting conditions described were choked gutters and inadequate drainage. Latrine facilities were mostly public facilities and therefore shared. On this basis, they were not improved latrines. Reports about air and noise pollution need further investigation. The pattern of diseases indicated a double burden of disease, some of which might have been aggravated by prevailing environmental conditions but this requires further investigation. Overall, the environmental health was adjudged sub-optimal and required improvement.

## Assessment of educational gains from the conduct of the community diagnosis

**Sociodemographic characteristics of the respondents:** A total of 23 medical students participated in the conduct of the community diagnosis, with 57% being male. The students' ages ranged from 22-42 years, with the mean age being 30.4 (±5.7) years. Majority of the students gained admission through the Graduate Entry Medical Education Program (57%) and others by direct entry. The students were predominantly Christians (87%) and the rest were Muslims.

**Student activities during the community diagnosis:** The students participated in community entry to debrief the community gatekeepers about the purpose of the survey. They also conducted face to face interviews with key informants of the community to practice a qualitative method of inquiry. The students compiled a community inventory of amenities, resources and infrastructure in the community such as a health facility, lorry parks, public toilets, public taps and recreational areas among others. The students designed the questionnaires for the household survey working in groups addressing different aspects including demography, environmental health, disease patterns, lifestyles, reproductive and child health. This enabled them to understand study designs and how to design study instruments. The students observed a practical application of sampling in selection of the cluster for the survey. Additionally, they pre-tested the study instruments and administered them in face to face interviews. Collation, data entry and interpretation of results were done and summarized results and potential implications presented to the community in a town hall meeting. These steps exposed the students to statistical analysis and presentation of health data.

**Assessment of the knowledge and skills of the students:** The students reported a significant improvement in all areas assessed. Figures 2a-2d illustrate some of the areas of learning covered. Prior to the community diagnosis, most of the students rated themselves as below average in relation to planning health programs, designing a study and data collection skills. They reported gains in knowledge and skills in these areas after the community diagnosis (Figures 2a-2d).

Most of the students stated team work, communication skills, tolerance and respect for one another as the key attributes they gained from the exercise. This might have been due to organization of students into groups to work on the different aspects of the community diagnosis namely: the community profile, demography, environmental health, disease patterns, lifestyles, health systems and reproductive and child health. The authors elected to include one aspect of the community diagnosis to demonstrate analytic and presentation skills students learnt from the community diagnosis. Furthermore, team work, communication skills, tolerance and respect for one another are useful skills in their career as much of health work is accomplished in intradisciplinary and multidisciplinary teams. Additionally, students reported learning and practicing qualitative methods of inquiry such as Key Informant interviews (KII) and Non-participatory observation. These methods were employed in the early phase of the community diagnosis to interview the community gatekeepers about the major aspects of the history, traditions and life in the community, as well as organizational structures inherent to the community. Community entry and social mobilization were other learning outcomes mentioned by the students. Causality was not implied in results of the survey due to the study design, but hypotheses may be generated for future investigation.

## CONCLUSION

A community diagnosis serves as a practical learning tool in medical education to study demographic characteristics of a community, identify adverse environmental and health conditions for intervention, and highlight positive behaviour for promotion and maintenance of health. The medical students learnt to examine the environmental health status of an urban community and make recommendations as presented in the first part of this paper. In the second part of this paper, student gains in knowledge of health planning, study design, data collection, data analysis, interpretation of results and presentation of health data were illustrated. Additionally, attributes important for healthcare practitioners such as team work, communication and mutual respect were gleaned from working together in teams.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained for the study from the Ethics Review Committee of the University of Ghana Medical School. All participants had the procedures and their rights to confidentiality, anonymity and withdrawal at any time during the study without

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repercussions explained to them and their voluntary consent obtained prior to administration of the questionnaires.

## CONSENT FOR PUBLICATION

Consent was obtained from the participants who responded to the questionnaire to report data in aggregate form in any publication originating from this research.

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