AKENTEN APPIAH- MENKA UNIVERSITY OF SKILLS TRAINING AND ENTREPRENEURIAL DEVELOPMENT

EXPOSURES TO ENVIRONMENTAL HAZARDS AMONG SELECTED BASIC SCHOOL IN THE ASOKORE-MAMPONG MUNICIPAL OF THE ASHANTI REGION, GHANA

KOFI AGYEI

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BY

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis, with the exception of quotation and references contained in published works which have been duly acknowledged; is the result of own original work and that no part of it has been presented for another degree in this university or elsewhere.

Kofi Agyei

Signature: …….. Date: …….

Supervisors' Declaration

We hereby declare that the preparation and presentation of this thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development.

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ABSTRACT

Globally children are more susceptible to airborne pollution, which can lead to lung and health problems. This study assessed environmental hazards and exposures among pupils and the prevalence of associated health conditions in the Asokore-Mampong Municipal. The study employed a cross-sectional design to evaluate environmental hazards and associated health conditions among basic schools in the Municipality. Structured questionnaires, face-to-face interviews, and observations were used to collect data from pupils and teachers. The data were analysed using descriptive statistics. The majority (65.6%) of the pupil were aged between 11-15 years and 52.3% were males. The prevalence of environmental hazard exposure was 97.5%, comprising of noise pollution (23.3%), chemical exposures (22.5%), and air pollution (20.0%). The most prevalent was noise pollution. Specific hazards in school premises included fumes from vehicles (55.8%) and excessive heat (44.2%). Road safety defects, such as no crosswalks (54.1%) and inadequate crossing signals (21.7%), were identified as well. Health conditions commonly reported among pupils were mild breathlessness (21.9%) and skin burns (18.3%). About 18.3% teachers reported difficulty concentrating while 16.7% students reported aches/pains. Most (80.0%) participants attributed their illnesses to environmental hazards within the school environment. Noise levels during different periods revealed that all schools assessed exhibited outdoor noise levels exceeding permissible limits of 55 dB, with indoor levels also remaining significant higher, between 50 to 62 dB. High noise levels (over 50 dB) were identified as potentially impacting students' concentration and well-being. The findings emphasize the importance of

protecting school premises from environmental hazards to mitigate risks factors and foster a healthier learning environment.

KEYWORDS: Environmental Hazards, School Pupils, Hazards Exposure, Noise Levels and Health Conditions.

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DEDICATION

I dedicate this work to the creator and sustainer of the universe, our Lord and Savior, Jesus Christ. Again, I dedicate this work to my lovely parents, wife, and my children who supported in all kinds.

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LIST OF ACRONYMS

Abbreviation	Meaning
ADHD	Attention-Deficit / Hyperactivity Disorder
BMI	Body Mass Index
BPA	Bisphenol A
CBR	Crude Birth Rate
CDC	Centre for Disease Control
dB	decibels
EEA	European Environment Agency
EPA	Environmental protection agency
ERA	Environmental risk assessment
GES	Ghana Education Service
GHS	Ghana Health Service
GMT	**Greenwich Mean Time**
KMA	Kumasi Metropolitan Assembly
Laeq	equivalent continuous sound level
LI	Legislative Instrument
Lmax	maximum sound level
Lmin	minimum sound level
PPE	Personal Protective Equipment's
SIDS	sudden infant death syndrome
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Globally, children are more susceptible to airborne pollution, which can lead to lung and health problems. Children in developing countries are particularly vulnerable to these hazards, which can contribute to childhood deaths, illnesses, and disabilities The adverse health consequences of exposure to environmental toxicants are major growing public health problems, yet they receive little attention (Landrigan et al., 2016). The global burden of disease study in 2019 labelled environmental factors as level 1 risk (Murray et al., 2020) accounting for a greater proportion of the global burden of diseases (1990-2019). Also, the WHO has labelled environmental risks as a key priority risk of public health concern, especially in developing countries (WHO, 2020). Environmental factors are estimated to be the primary cause of death, disease, and disability in developing countries, causing as much as 35% of deaths and diseases in Sub-Saharan Africa (WHO, 2020).

Global estimates by the World Health Organization indicate that 12.6 million deaths are attributed to unhealthy environments (Ericson et al., 2016; Prüss-Ustün et al., 2016). This includes all polluted environments that present physical, chemical, and/or biological risk factors external to a person (Oliveira et al., 2019 p. 181). Transport, industrial, energy/power, agriculture, and municipal waste management are particularly named by the European Environment Agency (EEA) as the sectors contributing most significantly

to environmental pollution (EEA, 2017). Epidemiological studies have shown both short-term and long-term effects of exposure to environmental hazards. For instance, exposure to particulate matter has been associated with decreased lung function and a higher incidence of respiratory diseases including shortness of breath, asthma, rhinitis, sinusitis, and chronic obstructive pulmonary disease in the short term and the development of lung cancer in the long term (Hamra et al., 2014; Kim et al., 2015).

Children are particularly vulnerable to environmental exposures since the environment is known to have a very substantial influence on the health and wellbeing of children (Rauh & Margolis, 2016). Children basically, are at increased susceptibility to environmental risks than adults (CDC, 2012; Oliveiraa et al., 2019; Olsen et al., 2019) due to their higher consumption of food, water, and air. This is as a result of greater metabolic activities in children's bodies, and have disproportionately increased exposure to environmental toxicants (Rauh & Margolis, 2016). Moreover, children have more windows of vulnerability due to immature metabolic pathways and rapid growth and development (Kumari & Sinha, 2020; Rauh & Margolis, 2016).

Many children, however, are exposed to environmental hazards causing serious health risks and increasing the global burden of non-communicable diseases (Ericson et al., 2016; Olsen et al., 2019; Prüss-Ustün et al., 2016). In Ghana for instance, the results of child-centered exposure assessments show that there are increased levels of exposure to environmental toxicants (Akoto et al., 2015; Cobbina et al., 2012; Y. Wang et al., 2017). It is worth noting that environmental exposures to children do not only happen in the

communities where they reside but also in schools (Gibbs & Melvin, 2008; Kweon et al., 2018; Oliveiraa et al., 2019). It is important that school environments promote children's health and well-being since children spend many hours in school. Thus, to effectively protect children from exposure to environmental hazards in the school environment, it is necessary to understand the environmental conditions faced by children in schools. The exposure of basic school pupils to environmental hazards is a critical concern for their health and well-being. Environmental hazards encompass a wide range of factors, including air and water pollution, hazardous chemicals, and inadequate sanitation, which can have adverse effects on children's health and development. Children are particularly vulnerable to these hazards due to their ongoing physical and neurological development, as well as their higher relative consumption of air, food, and water compared to adults. Understanding and addressing these environmental risks is essential to ensuring the safety and health of school pupils. Various environmental hazards can impact negatively on school pupils and the importance of addressing these risks to protect their health and well-being is critical.

1.2 Problem Statement

The Asokore-Mampong Municipal in the Ashanti Region is located along the major trunk roads in congested settlements and with a large human population of over 191, 000, accounting for about 5% of the regional population size. The area is known for poor air quality, inadequate sanitation facilities, and exposure to pollutants, exacerbated by high vehicular movements and noise associated with industries and highways. Rapid urbanization coupled with an unplanned settlement have aggravated environmental

hazards with health consequences which need pragmatic solutions. The municipal is host to many basic schools' where pupils are daily exposed to numerous environmental hazards that threaten their educational attainments, health and well-being. Despite the diverse environmental landscape, there are limited studies in this area to assess the levels of environmental hazard exposures. Continuous exposure to sources of environmental hazards contributes to a rise in respiratory, mental, and behavioral issues among pupils, negatively impacting academic performance. It has become crucial to bridge the knowledge gap of the nature and extent of environmental exposures among basic school pupils in the Asokore-Mampong Municipal. Identifying specific hazards and their prevalence will offer insights into community challenges. Therefore, implementing structured environmental monitoring, improving sanitation, enforcing pollution control, and integrating environmental education in schools can mitigate health risks and enhance academic performance.

1.3 Study Objectives

The main aim of the study was to assess environmental hazards and exposures among basic school pupils and the prevalence of associated health conditions in the Asokore-Mampong Municipality.

1.3.1 Specific Objectives

1. To determine environmental hazards basic school pupils are exposed to in the study area.

2. To quantify the levels of environmental hazard exposures and identify key risk factors affecting pupils in basic schools within Asokore Mampong Municipality.
3. To assess the health impacts of environmental hazard exposures, including prevalent medical conditions, among both teachers and pupils in basic schools within the municipality.

1.4 Research Questions

The study was guided by the following questions;

1. What environmental hazards are basic school pupils exposed to in the study area?
2. What are the levels of environmental hazard exposures, and what key risk factors affect pupils in basic schools within Asokore Mampong Municipality?
3. How do environmental hazard exposures impact the health of teachers and pupils, and what are the prevalent medical conditions among them?

1.5 Significance of the Study

The study sought to assess environmental exposures and associated health risks among basic school pupils in the Asokore Mampong Municipal and the health risks associated with hazard exposures. The results of this study would be relevant information necessary for municipal authorities to implement measures to reduce exposures among pupils. Also, the study would contribute to providing an understanding of environmental exposures and their consequences on childhood health outcome. The outcome of this study would provide empirical data for quick implementation of necessary measures to promote health among pupils, improving sanitary conditions in the school environment and ensuring the

appropriate siting of schools. This research would provide actionable data for local authorities and policymakers. It would also contribute to the environmental health and education literature for future studies.

1.6 Study Justification

Globally, environmental hazards negatively impact on the human health, especially vulnerable populations such as children (WHO, 2021). In developing countries such as Ghana, environmental factors have been identified as substantial risk factor for morbidity and mortality. Children are highly vulnerable to environmental hazards due to their rapid growth, high consumption rates, and immature metabolism. However, research on their exposure in Ghana, especially in Asokore-Mampong, is limited. Poor sanitation, heavy traffic, and pollution in the area heighten health risks. Assessing these exposures is crucial for informing policies to protect children's health, reduce non-communicable diseases, and promote sustainable development.

1.7 Thesis Organization

The study is divided into six main chapters. The first chapter addresses the background of the study, the problem statement, objectives, research questions for the study, justification, significance of the study, scope and organization of the study. In the second chapter, relevant literature related to this research topic was thoroughly examined. Chapter three focuses on presenting the study area and the methodology employed to conduct the research. Moving on to chapter four, the study data is presented. Chapter five discussed the findings of the study. Lastly, in chapter six, the summary of the results is

presented, along with drawing conclusions based on the main findings and offering recommendations based on the study's outcomes.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Environmental hazards are substances or conditions in our surroundings that can cause harm to human health, ecological systems, or economic assets. They encompass a wide range of physical, chemical, biological, and socio-economic factors that pose risks to individuals and communities. Understanding these hazards is crucial for developing effective strategies to mitigate their impacts and protect public health and the environment.

2.1 Overview of Environmental Hazard

Environmental risks are defined as abnormal occurrences or chemicals in the Earth's environment that could have adverse effects on people and the things they value (Rasuman et al., 2024). These consider unusual geophysical and meteorological phenomena like earthquakes and dry seasons. It can include any single poisonous substance or combination of poisonous substances that are organic or naturally occurring in the environment that are caused by human activity or natural cycles and may have an impact on an exposed subject's strength, such as heavy metals, pesticides, natural toxins, hazardous materials, and modern and domestic synthetic compounds (Rau et al., 2024).For the purpose of the study objective, two categories of environmental hazards, namely, air pollution and noise pollution will be explored.

2.1.1 Types of Environmental Hazards

Environmental hazards refer to harmful conditions or substances in the environment that can adversely affect human health and well-being. These hazards can be broadly categorized into physical, chemical, biological, and socio-economic factors. In the context of school environments, several types of environmental hazards are particularly relevant:

Noise Pollution: Noise pollution, characterized by unwanted or harmful sound, is a major environmental hazard in urban areas. Common sources of noise pollution include traffic, industrial activities, construction, and recreational noise (Basner et al., 2014). Noise pollution is especially problematic in school environments, as it can disrupt learning, communication, and cognitive development (Shield & Dockrell, 2003).

Chemical Pollutants: Chemical pollutants, such as pesticides, heavy metals (e.g., lead and mercury), and other toxic substances, are often found in soil, water, and building materials. These chemicals can cause a range of health issues, including cognitive deficits, developmental problems, and respiratory diseases (Landrigan et al., 2002). In schools, children may be exposed to these pollutants through contaminated playgrounds, drinking water, and classroom materials.

Biological Hazards: Biological hazards involve exposure to harmful microorganisms such as bacteria, viruses, and fungi. Poor sanitation, inadequate waste management, and contaminated water can increase the risk of infections and diseases among school children (Frumkin, 2016). For example, schools with inadequate sanitation facilities can be breeding grounds for diseases like diarrhea, which can significantly affect children's health and school attendance.

Physical Hazards: Besides noise, other physical hazards include inadequate lighting, extreme temperatures, and unsafe school infrastructure. Poorly designed school buildings can expose children to risks such as falls, burns, and other injuries (WHO, 2018). Furthermore, inadequate ventilation and poor indoor air quality can exacerbate respiratory problems and allergic reactions in children.

Socio-economic Factors: Socio-economic factors, such as poverty, overcrowding, and lack of access to clean water and nutritious food, can also be considered environmental hazards. These factors can exacerbate the effects of other environmental hazards and contribute to poorer health and educational outcomes for children (Evans & Kantrowitz, 2002).

Environmental hazards encompass a wide range of threats to both the natural environment and human health. These hazards include sun exposure, extremes of temperature, air quality, ionizing radiation, scuba diving-related injuries, altitude illness, arthropod bites, zoonotic exposures, food poisoning from marine toxins, safety and security concerns during travel, injury, trauma, and death among international travelers (Abdulkadir et al., 2024). Additionally, natural disasters like earthquakes, volcanic activity, lightning, hailstorms, droughts, fires, landslides, and epidemics are significant environmental hazards that elicit emotional reactions from observers (B. Wang et al., 2024). Urbanization has led to increased vulnerability to hazards such as pollution, floods, earthquakes, and the urban heat island effect, with population growth and rapid development exacerbating these risks (Kanchongkittiphon et al., 2015).

Furthermore, human activities that pollute the environment, poor waste management, and inadequate sanitation systems contribute to man-made environmental hazards that threaten public health and ecological well-being. These include natural disasters such as earthquakes, floods, hurricanes, and volcanic eruptions. These events can cause immediate and widespread damage to human life, property, and the environment. Man-made physical hazards include noise pollution, radiation from X-rays, and electromagnetic radiation (Oglesby et al., 2024).These are hazardous substances that can cause significant damage to the environment and human health. Examples include pollutants from industrial processes, pesticides, and heavy metals like lead and mercury (Foreman et al., 2021).These include pathogens such as bacteria, viruses, and other microorganisms that can cause diseases. Biological hazards also encompass allergens and toxins produced by living organisms(Foreman et al., 2021).These refer to the social and psychological stressors that can impact mental health and well-being. Examples include workplace stress, violence, and other forms of social stressors(Editorial, 2024).

Technological hazards arise from human-made technologies and processes. These include nuclear power plant accidents, chemical spills, and hazardous waste site (Biswas et al., 2024).Environmental hazards are diverse and can significantly impact human health and ecosystems. Effective management and mitigation strategies require an understanding of the different types of hazards and their potential effects.

2.1.2 Environmental Hazards and Exposures

Environmental hazards such as pollution, chemicals, and occupational hazards can lead to severe health problems including cancers, respiratory diseases, and psychological stress (Geetha & Dhanasekaran, 2018). The Bhopal disaster and Deepwater Horizon oil spill are examples of catastrophic events leading to widespread health issues. Long-term pollutant exposure has also been linked to increased cancer risks (Joyce & Senier, 2017).Exposure to environmental hazards is not distributed equally, often affecting low-income and minority communities more severely (Liverman, 2001).Marginalized populations face higher risks due to socioeconomic status and lack of political power (Kelley & Covi, 2013).Occupational hazards can extend beyond the workplace, affecting workers' families through take-home exposures (Jones & Burstyn, 2018).Many pollutants, especially those found indoors, are not adequately regulated despite contributing significantly to overall pollutant exposure (Steinemann, 2004).Community perceptions of risk can influence health outcomes, with subjective exposure to hazards being as critical as objective exposure in some cases (Peek et al., 2009).Environmental hazards pose significant risks to human health, with disproportionate effects on vulnerable populations. Comprehensive regulation, better risk communication, and equitable distribution of risk are essential for mitigating these hazards.

2.1.3 Levels of Environmental Hazards Exposures

Exposure to environmental hazards varies significantly across different regions and populations. Studies have shown that pregnant individuals identifying as Black or Hispanic are at a higher risk of living in high exposure census tracts compared to those

identifying as White or non-Hispanic (Tyler & Allan, 2014). Common environmental toxins like lead, mercury, and pesticides found in food and drinks can contribute to adverse health outcomes, especially in vulnerable populations such as children and pregnant women (Rau et al., 2024). Additionally, environmental exposures during fetal or child developmental time windows, such as lead, ionizing radiation, and ambient air toxicants, can lead to adverse health effects even at low levels of exposure (Shelton et al., 2015). Patterns of environmental exposure in early life are crucial, as exposures during this period can have both short- and long-term consequences on health, with pollution-related chronic diseases becoming increasingly prevalent (Danaei et al., 2016).

2.2 Determination of Environmental Hazard Exposure Levels and Health Risks

The determination of environmental hazard exposure levels and health risks involves a comprehensive risk assessment process. Hazard identification is the initial step, assessing whether exposure to stressors can lead to adverse health effects (Zanobetti et al., 2024). Exposure assessment is crucial, evaluating the pathways individuals may come into contact with hazardous contaminants, such as ingestion, inhalation, or skin contact (Dharmage et al., 2019). Environmental risk assessment methodologies, like ERA, quantify the potential health impacts from exposure to pollutants like nitrogen dioxide, sulphur dioxide, and particulate matter, aiding in risk characterization (Daiber et al., 2019). Environmental epidemiology plays a vital role in understanding how external factors, including environmental exposures, can impact health, contributing to informed decision-making and resource allocation (Perera, 2018). Additionally, studies on environmental risk to health highlight the presence of heavy metals and bacteria

pollutants in non-drinking water, emphasizing the importance of assessing chemical and biological contaminants for health risks (Perera, 2018).

2.2.1 Quantitative Measurements of Environmental Hazard Exposure Levels

Quantitative measurements of environmental hazard exposure levels are crucial for assessing vulnerability and ensuring safety. Various studies emphasize the importance of quantifying exposure levels to identify vulnerable communities and establish safe working practices (Gv et al., 2024)Incorporating quantitative and qualitative data aids in measuring community vulnerability to environmental hazards effectively (Neuwirth & Bell, 2024). Additionally, the use of probabilistic exposure modeling and quantification of operational condition concentrations play a significant role in determining risk levels and establishing reasonable worst-case scenarios for exposure assessments (Rasuman et al., 2024).

Furthermore, the development of quantitative frameworks and models, such as fuzzy inference systems and neuro-fuzzy systems, allows for the calculation of qualitative values for environmental risk, aiding in decision-making processes for environmental management and hazard prevention (Bergman, 2016). These approaches, combined with quantitative health risk assessments, contribute to a comprehensive understanding of environmental hazards and facilitate informed decision-making for mitigation and disaster reduction efforts (Cobham & Mcdermott, 2024).

2.2.2 Types of Measurements of Environmental Hazard Exposure Levels

Outdoor fixed-location monitoring provides general indications and trends of pollutant concentrations over time, but may be removed from the point of actual exposure. These data can be useful for establishing baseline values, but may not fully represent individual exposure. Measurements taken at the specific location and time of potential exposure, such as indoor air quality or contaminant levels in food or drinking water in the home, provide more accurate representations of individual exposure (Behbod et al., 2018). These are considered the most relevant for assessing personal exposure. Rather than characterizing an entire medium, this approach defines smaller microenvironments where exposure may occur, such as specific rooms in a home or workplaces, to better capture localized variations in contaminant levels.

Measuring the presence and concentration of a chemical or its metabolites in human tissues, blood, or urine can provide a direct assessment of the internal dose received by an individual. This can be a more accurate indicator of exposure compared to environmental measurements alone (Blodgett & Lanigan, 2018). Product analysis: Measuring the concentrations of chemicals in consumer or industrial products can help characterize potential exposures from those sources. The choice of measurement approach depends on the specific exposure scenario and how the data will be used in the risk assessment.

2.2.3 Health Risks of Environmental Hazard Exposure

Exposure to environmental hazards can pose significant health risks to individuals and populations. These risks can range from acute effects such as respiratory issues to chronic

conditions like cancer. The health impacts of environmental hazards are influenced by various factors including the type of hazard, the duration and intensity of exposure, and the susceptibility of the exposed individuals. High levels of heavy metals and bacteria pollutants in non-drinking water are common in many slum households, posing serious health risks (Tutu & Busingye, 2019). Exposure to ETS is linked to lung cancer in non-smokers, childhood bronchitis, and possibly heart disease. Workplace smoking bans can reduce ETS exposure and associated health risks (Brownson et al., 1997). Ambient air pollution and exposure to metals like arsenic, cadmium, and lead are significant risk factors for cardiovascular disease. These exposures can advance CVD through various pathophysiological processes (Cosselman et al., 2015).

Environmental exposures, such as lead and air pollution, are linked to adverse pregnancy outcomes. These exposures may disproportionately affect communities of color and low socioeconomic status (Sunyer et al., 2015).Environmental risks, such as exposure to hazardous wastes and pollutants, are inversely related to income and socioeconomic status. This exposure disparity contributes to health inequalities (Evans & Kantrowitz, 2002).The concept of hazardscapes highlights how natural and human-made hazards, combined with social and economic factors, create cumulative risks across geographical areas (Kelley & Covi, 2013).Environmental hazards, ranging from air pollution to heavy metals, significantly impact human health, particularly in vulnerable populations. Addressing these risks through targeted public health interventions and policies is essential for improving overall health outcomes.

2.2.4 Types Health Risks Associated with Environmental Hazards Exposures

These include exposure to toxic substances such as pesticides, heavy metals, and industrial chemicals. Common health risks associated with chemical hazards include, inhalation of pollutants like sulfur dioxide, nitrogen oxides, and particulate matter can lead to respiratory diseases such as asthma, bronchitis, and lung cancer. Exposure to heavy metals like lead and mercury can cause neurological damage, affecting cognitive and motor functions (Alavian & Afzali, 2024). Long-term exposure to carcinogenic chemicals such as asbestos and benzene can increase the risk of developing cancers. These also involve exposure to pathogens such as bacteria, viruses, and fungi. Health risks from biological hazards include infectious diseases. Pathogens can cause diseases like tuberculosis, influenza, and COVID-19. Allergic Reactions such as exposure to allergens such as mold spores and pollen can trigger allergic reactions and asthma attacks. Physical Hazards refer to environmental conditions that can cause physical harm. Examples include noise pollution. Chronic exposure to high levels of noise can lead to hearing loss, cardiovascular issues, and sleep disturbances (Akoto et al., 2015). Also, exposure to radiation like ionizing radiation from sources like radon gas, X-rays, and nuclear accidents can increase the risk of cancer and cause radiation sickness. Ergonomic Hazards involve conditions that can cause musculoskeletal disorders. Examples include repetitive movements, poor posture, and improper lifting techniques. Health risks include musculoskeletal disorders: Conditions such as carpal tunnel syndrome, tendonitis, and lower back pain can result from ergonomic hazards. Psychosocial Hazards include stressors related to work, social interactions, and living conditions. Health risks include

mental health disorders. Chronic stress, anxiety, and depression can result from poor working conditions, job insecurity, and social isolation.

Certain groups are more susceptible to the health risks of environmental hazards due to factors such as age, preexisting health conditions, socioeconomic status, and occupation. Vulnerable populations like children are more sensitive to pollutants and pathogens due to their developing immune systems and behaviors that increase exposure risks. The elderly has a higher risk due to weakened immune systems and preexisting health conditions (Fatima et al., 2021).Low-Income communities often live in areas with higher pollution levels and have limited access to healthcare. Occupational workers of certain professions such as industrial workers, healthcare workers, and agricultural workers face higher exposure to environmental hazards.

Regulation and Legislation is needed to enforce laws to limit emissions of pollutants and ensure safe working conditions. Informing the public about the risks and prevention methods for environmental hazards. Developing and implementing technologies to reduce or eliminate exposure to hazards (Akoto et al., 2015). Using appropriate PPE to protect individuals in high-risk occupations. Regularly monitoring environmental conditions to identify and address potential hazards promptly.

2.2.5 Impacts Environmental Hazard Exposure on Children

Children absorb, distribute, and metabolize chemicals differently than adults, making them more susceptible to the adverse effects of environmental contaminants (Bearer,

1995). Environmental exposures, such as lead, pesticides, and air pollutants, are linked to birth defects, neurodevelopmental disorders, asthma, and childhood cancers (Fatima et al., 2021). ETS exposure in children is associated with respiratory infections, asthma, middle ear disease, and sudden infant death syndrome (SIDS). Both prenatal and postnatal exposures have detrimental effects such as low birth weight, impaired lung development, cognitive deficits, increased risk of behavioral disorders, weakened immune function, and a higher likelihood of developing chronic respiratory conditions later in life (Hamra et al., 2014). Heavy metals, pesticides, and persistent organic pollutants are linked to increased rates of asthma, neurodevelopmental disorders, and cancer in children (Ferraris, 2022). Personal exposure to air pollutants, especially in urban environments, is a significant risk factor for respiratory and cardiovascular diseases in children (Najam et al., 2020). Early-life exposure to environmental chemicals can lead to a wide range of health issues, including cognitive defects and behavioral problems. These exposures during critical developmental periods can have long-term effects (Abdulkadir et al., 2024). Children's unique physiological and developmental characteristics make them especially susceptible to environmental hazards. Reducing exposure to harmful environmental contaminants is crucial to safeguard children's health and development.

2.2.6 Health and Well-being of Children

Children's exposure to environmental chemicals like heavy metals, pesticides, and persistent organic pollutants is linked to increased rates of asthma, neurodevelopmental disorders, and childhood cancer (B. Wang et al., 2024). Exposure to toxicants during

critical developmental windows can lead to fetal death, birth defects, cognitive and behavioral abnormalities, childhood cancer, and respiratory diseases. Low-level exposures to toxicants like lead and tobacco smoke during these periods are particularly harmful (Kanchongkittiphon et al., 2015). Environmental exposures to pollutants such as lead and pesticides are linked to mental health issues, including mood and anxiety disorders, behavioral problems, and neurodevelopmental conditions like ADHD and autism spectrum disorders (Rauh & Margolis, 2016). Children have unique physical and biological risk factors, including higher metabolic rates and behaviors that increase exposure, such as playing close to the ground and hand-to-mouth activity. These factors make them more susceptible to environmental contaminants compared to adults (Abdulkadir et al., 2024).

2.2.7 Impact of Environmental Hazard Exposure on Children

Environmental hazards such as air pollution, lead exposure, and noise pollution significantly impact children's health and academic performance. This review examines how different levels of environmental hazards correlate with health outcomes and academic achievements among children. Higher levels of residential air toxics are statistically significantly associated with lower grade point averages among children, independent of health status (Rau et al., 2024).Chronic exposure to air pollution negatively impacts children's cognitive processing and memory, leading to lower competencies in reading, math, and science (Zanobetti et al., 2024).Early childhood blood lead levels as low as 2 µg/dL are associated with decreased performance on standardized

tests. Blood lead levels of 5 µg/dL can result in significant declines in reading and math scores (B. Wang et al., 2024).

Lead hazard control programs that reduce lead poisoning can significantly improve children's math and reading scores, narrowing racial achievement gaps. Both external environmental noise and internal classroom noise negatively impact children's academic performance, affecting their memory, motivation, and reading ability (Oglesby et al., 2024). Increased exposure to TRAP is associated with poorer student academic performance. This review highlights the need for improved study methodologies to establish consistent patterns of association (Stenson et al., 2021). Child morbidity due to environmental risk factors significantly impacts academic readiness, particularly in impoverished homes. Low birth weight children benefit less from higher levels of maternal education in terms of reading performance (Rau et al., 2024).

2.2.8 Impact of Environmental Hazard Exposure Levels on Children of Health

Environmental hazards, such as pesticides and heavy metals, can have significant impacts on the health and development of children. Exposure to these contaminants can lead to a range of adverse outcomes, including neurological, respiratory, and carcinogenic effects. Studies have found that children are particularly vulnerable to the detrimental effects of environmental pollution, with disproportionate impacts in low-income communities (Zanobetti et al., 2024). Chemicals associated with plastics have been found to have severe and long-lasting effects on human health, including during critical periods of development (Chemicals in Plastics - A Technical Report, 2023) Endocrine-disrupting

compounds like bisphenol A (BPA) and phthalates can interfere with normal hormonal processes, leading to neurodevelopmental issues and reproductive problems (Gv et al., 2024).

Exposure to these chemicals can occur through multiple pathways, such as migration from food packaging or leaching from consumer products (Turning the plastic tide, 2018) while the individual health effects of certain plastic-associated chemicals are well-documented, the combined impacts of these complex chemical mixtures on child development remain understudied. (Abdulkadir et al., 2024) Longitudinal research is needed to elucidate the temporal relationships between exposures and disease outcomes in children(Rau et al., 2024). Nevertheless, the existing evidence highlights the urgent need to address the health risks posed by chemicals in plastics as part of broader efforts to reduce environmental pollution and protect vulnerable populations.

2.2.9 Impact of Environmental Hazard Exposure Levels on Children Academic Performance

The health impacts of environmental hazards are influenced by various factors including the type of hazard, the duration and intensity of exposure, and the susceptibility of the exposed individuals. Chemical hazards include exposure to toxic substances such as pesticides, heavy metals, and industrial chemicals.

Common health risks associated with chemical hazards include inhalation of pollutants like sulfur dioxide, nitrogen oxides, and particulate matter can lead to respiratory diseases

such as asthma, bronchitis, and lung cancer (Zanobetti et al., 2024). Exposure to heavy metals like lead and mercury can cause neurological damage, affecting cognitive and motor functions. Long-term exposure to carcinogenic chemicals such as asbestos and benzene can increase the risk of developing cancers. These involve exposure to pathogens such as bacteria, viruses, and fungi. Health risks from biological hazards include pathogens can cause diseases like tuberculosis, influenza, and COVID-19. Allergic Reactions: Exposure to allergens such as mold spores and pollen can trigger allergic reactions and asthma attacks. These refer to environmental conditions that can cause physical harm such as respiratory distress, skin irritation, eye discomfort, chronic sinus issues, and exacerbation of pre-existing conditions like asthma and bronchitis (Akoto et al., 2015). Chronic exposure to high levels of noise can lead to hearing loss, cardiovascular issues, and sleep disturbances. Exposure to ionizing radiation from sources like radon gas, X-rays, and nuclear accidents can increase the risk of cancer and cause radiation sickness. These involve conditions that can cause musculoskeletal disorders. Examples include repetitive movements, poor posture, and improper lifting techniques.

Conditions such as carpal tunnel syndrome, tendonitis, and lower back pain can result from ergonomic hazards (Ferraris, 2022). These include stressors related to work, social interactions, and living conditions. Chronic stress, anxiety, and depression can result from poor working conditions, job insecurity, and social isolation. More sensitive to pollutants and pathogens due to their developing immune systems and behaviors that increase exposure risks. Higher risk due to weakened immune systems and preexisting

health conditions. Often live in areas with higher pollution levels and have limited access to healthcare. Certain professions such as industrial workers, healthcare workers, and agricultural workers face higher exposure to environmental hazards (Cobham & Mcdermott, 2024).

2.3 Noise Pollution

The term "noise" describes unwanted sound, which is frequently thought of as a stressor on the environment and a source of irritation. Exposure to environmental noise can have various health effects on children, which have been extensively documented (Y. Wang et al., 2017). There is an increasing body of evidence suggesting that exposure to noise in the physical environment can have adverse health effects on young children, and this has been recognized for over three decades. Such effects can manifest physiologically or psychologically and through various mechanisms. However, research on noise exposure and its associated health effects in children remains limited, with exposure measures often based only on proximity to sources of noise(Ericson et al., 2016). Children are exposed to both involuntary (environmental) and voluntary (e.g., listening to loud music, participating in school activities) sources of noise, including transient noise from outside sources such as airplanes, railways, motor vehicles, construction, and outdoor events, as well as indoor sources such as music, television, appliances, and ventilation equipment. Noise pollution, caused by a variety of sources including industrial machines, transportation, and domestic appliances, has significant adverse effects on human health (Y. Wang et al., 2017). In particular, road traffic noise is a major contributor to this problem, with detrimental effects on residents of cities (Marathe, 2012). The impact of

noise on environmental pollution is also a key concern, with noise levels often exceeding allowable values in densely populated urban areas (Petrescu, 2013). The need for effective measures to address and prevent noise pollution is clear, given its potential to cause heart disease, hypertension, and other health issues (Olsen et al., 2019). Being constantly surrounded by sound, in most cases we operate ignoring this “environmental noise”, but when the noise intensity increases, it becomes a pollutant, adversely affecting the level of professional performance, leading to fatigue, causing nervousness or decreasing the quantitative and/or qualitative level of performance(Kim et al., 2015). The main objective of this paper is to evaluate the noise problem in the Strand district of Sibiu and to highlight the negative effects affecting the population in the area, by creating a noise map. Also, the authors studied the influence of noise pollution on the human factor. The research showed that at certain hours, sound pollution far exceeds allowable values. The influence of noise on the human factor was strongly emphasized in the questionnaire that was developed and presented in this paper. In the research, the authors used a GIS software, Geomedia Professional(Kumari & Sinha, 2020).

2.3.1 Cognitive Performance on Children

An increasing body of evidence indicates that noise is harmful to children's cognitive development. The field research focusing on basic school pupils have been the most instructive in terms of the impacts of noise on cognition While the effects of prolonged noise exposure are not consistent across all cognitive functions, research suggests that they have an impact on central processing and language comprehension(Support et al., 2021). Researchers have discovered deficits in sustained attention and visual attention,

and teacher reports indicate that children from schools with more noise had a harder time focusing than children from schools with less noise. In addition, studies have shown that kids who are exposed to environmental noise on a regular basis have lower processing-intensive abilities in memory, voice perception, and auditory discrimination. Additionally, children who are repeatedly exposed to noise tend to score worse academically. A well-designed naturalistic field study focused on primary school children living in four 32-story apartment buildings adjacent to a major road, with the lower floors exposed to higher amounts of noise than those higher up the building(Chithambo, 2020). Children who resided on lower floors of buildings had worse reading levels and auditory discrimination impairments, according to the study, than those who did not. conducted a carefully designed study that compared primary school children taught in a classroom exposed to high levels of railway noise with children in a quiet classroom in the same school. They found significant differences in reading scores between children in the two classrooms(Einarsen et al., 2016). Specifically, the noise-exposed children had a mean reading age 3-4 months behind that of the control children. Research has been conducted in schools located around Heathrow Airport in west London to examine the effects of noise on children's cognitive performance and stress responses. Using repeated-measures designs, several studies have compared noise-exposed children to control groups. In one study, 9- to 10-year-old children from four high-noise schools were compared to children from four matched control schools (Saleh et al., 2023). After adjusting for age, language spoken at home, and social deprivation, the noise-exposed children demonstrated impaired reading comprehension and sustained attention at baseline. The results from a follow-up study conducted 1 year later suggest

that further development in reading comprehension may also be affected (Id et al., 2018). A range of studies have explored the relationship between cognitive performance and various outcomes. Kane (2014) proposed a hierarchical system of cognitive control in skilled performance, suggesting that cognitive styles and dispositions play a role in determining performance levels. Lin (2018) found a positive association between cognitive performance and labor market outcomes, with the returns to cognitive skill increasing with age and being greater for women and minority groups. Boff (2011) provided a comprehensive overview of human perception and performance, including the role of cognitive processes. These studies collectively highlight the importance of cognitive performance in various aspects of life(Huguenel, 2017).

2.3.2 Impact of Noise on Children's Cardiovascular System

Research studies have found that chronic noise exposure not only affects cognitive performance but may also have physiological effects such as raised blood pressure(Zhao, 2020). In the Los Angeles Airport Study, chronic exposure to aircraft noise was associated with raised systolic and diastolic blood pressure, which persisted even after a year. Similarly, in the Munich study, chronic noise exposure was associated with higher baseline systolic blood pressure and a lower reactivity of systolic blood pressure to a cognitive task presented under acute noise(Peng et al., 2012). Following the opening of a new airport, a significant increase in systolic blood pressure was observed, indicating a causal link between chronic noise exposure and raised blood pressure. However, there was no significant association found between noise and diastolic blood pressure or reactivity(Najam et al., 2020). A range of factors can impact cardiovascular health.

Barratt (2023) highlights the environmental impact of cardiovascular healthcare, with significant carbon emissions from cardiac imaging, pharmaceutical prescribing, and in-hospital care. (Yasmin, 2020) discusses the complex effects of alcohol consumption, with both detrimental and beneficial impacts on cardiovascular diseases. Csige (2018) emphasizes the role of obesity in increasing cardiovascular risk, particularly through its association with hypertension, diabetes, and atherosclerosis. Júnior (2021) underscores the damaging impact of COVID-19 on the cardiovascular system, including the potential for myocardial infarction, myocarditis, and cardiac arrhythmias(Selem et al., 2023). These studies collectively underscore the multifaceted nature of cardiovascular health and the need for comprehensive approaches to address its various impacts. The healthcare sector is essential to human health and well-being, yet its significant carbon footprint contributes to climate change-related threats to health(Vannucci et al., 2021). Objective To review systematically published studies on environmental impacts, including carbon dioxide equivalent (CO_2e) emissions, of contemporary cardiovascular healthcare of all types, from prevention through to treatment. Evidence review We followed the methods of systematic review and synthesis(Weng & Ahmed, 2020). We conducted searches in Medline, EMBASE and Scopus for primary studies and systematic reviews measuring environmental impacts of any type of cardiovascular healthcare published in 2011 and onwards. Studies were screened, selected and data were extracted by two independent reviewers. Studies were too heterogeneous for pooling in meta-analysis and were narratively synthesised with insights derived from content analysis. Findings A total of 12 studies estimating environmental impacts, including carbon emissions (8 studies), of cardiac imaging, pacemaker monitoring, pharmaceutical prescribing and in-hospital care

including cardiac surgery were found. Of these, three studies used the gold-standard method of Life Cycle Assessment(Fatima et al., 2021). One of these found the environmental impact of echocardiography was 1%–20% that of cardiac MR (CMR) imaging and Single Photon Emission Tomography (SPECT) scanning. Many opportunities to reduce environmental impacts were identified: carbon emissions can be reduced by choosing echocardiography as the first cardiac test before considering CT or CMR, remote monitoring of pacemaker devices and teleconsultations when clinically appropriate to do so(Ferraris, 2022). Several interventions may be effective for reducing waste, including rinsing bypass circuitry after cardiac surgery. Cobenefits included reduced costs, health benefits such as cell salvage blood available for perfusion, and social benefits such as reduced time away from work for patients and carer(Prüss-Ustün et al., 2016).

2.3.4 Endocrine Responses from Noise on Children

The Munich Airport Study investigated the levels of urinary catecholamines (adrenaline and noradrenaline) during overnight resting periods. The study found that endocrine levels were significantly higher in noise-exposed children, indicating raised stress levels(Kweon et al., 2018). Additionally, the longitudinal data showed a sharp increase in catecholamine levels in noise-exposed children following the opening of the new airport. While cortisol levels were also examined, no significant differences were observed in either the cross-sectional or longitudinal data(Rauh & Margolis, 2016). This finding aligns with one of the studies conducted in Heathrow. The endocrine response to stress is a complex, dynamic process involving the activation of the sympathoadrenomedullary

and hypothalamic–pituitary–adrenal axes (Henley, 2021). This response is influenced by individual differences and perceptions of the stressor (Rose, 1980). Environmental pollutants can also trigger endocrine responses, with potential maladaptive effects (Brown, 1993). Furthermore, these responses can be conditioned and modified through learning or experience (Ericson et al., 2016).

2.3.5 Annoyance on Children Exposed to Noise

Several studies have shown that chronic environmental noise exposure can lead to annoyance in children. The annoyance levels are consistently high across various studies. For instance, in Munich, a calibrated community measure was used to show that noise-exposed children reported higher levels of annoyance. Similarly, in London, standard self-report questions were used to assess annoyance, and the results showed that noise-exposed children reported higher levels of annoyance than control groups. Follow-up studies conducted after one year in London also revealed that the annoyance effects persisted and were not subject to habituation. These findings suggest that chronic exposure to environmental noise can lead to persistent annoyance in children. Annoyance due to air pollution is a common issue in Europe, with factors such as gender, health conditions, and environmental factors influencing individual levels of annoyance (Y. Wang et al., 2017). Similarly, aircraft noise exposure can lead to annoyance, with the extent of annoyance reactions being closely correlated to noise levels (Murray et al., 2020). However, the level of ambient noise does not significantly impact annoyance, which is more related to isolation from sound and certain attitudes (Fields, 1993).

Annoyance is also influenced by the pitch and loudness of stimuli, with higher frequencies and loudness leading to increased annoyance (WHO, 2020).

CHAPTER THREE

METHODOLOGY

3.1 Study Area

The Asokore Mampong Municipal Assembly is one of the thirty (30) Administrative districts in the Ashanti Region. It was carved out of Kumasi Metropolitan Assembly due to the growing population of the Kumasi Metropolis. The Assembly was created under the Government's Decentralization Programme in 2012 under Legislative Instrument (L.I) 2112 on June 29, 2012, with Asokore Mampong as its capital. The Municipality covers a total land area of 23.91 km^2 and it is located in the North-Eastern part of the Kumasi Metropolis. It shares boundaries with Kumasi Metropolitan Assembly (KMA) to the East, South and West, Kwabre East District to the North-West and Ejisu-Juabeng Municipal Assembly to the North-East. The district's population forms about 6.4 percent of the regional figure (4,780,380). According to the 2021 population and housing census the population of the Municipality was 191,402 with 93,506 and 97,896 representing males and females respectively.

3.1.1 Population Size, Structure and Composition

The population of Asokore Mampong Municipality is 304,815 represents 6.4 percent of the total population of Ashanti Region, according to the 2010 Population and Housing Census. The municipality has a sex ratio of 91.7. The Municipality shows a youthful population with more than half (58.3%) of the population below 24 years. The population of the Municipal therefore depicts a broad base population pyramid which tapers off with

a small number of elderly persons. The age dependency ratio for the municipality is 64.3 per 100, the age dependency ratio is 67.5 for males and 61.5 for females.

3.1.2 Fertility, Mortality and Migration

The Total Fertility Rate for the Municipality is 2.8. The General Fertility Rate is 80.6 births per 1000 women aged 15-49 years and the Crude Birth Rate (CBR) is 23.3 per 1000 population. The crude death rate for the municipality is 5.2 per 1000. Out of the number of migrants in the Municipal, about 44,887 constituting 40.5 percent were born elsewhere in the Ashanti Region while 3,519 are people born outside the country.

3.1.3 Household Size, Composition and Structure

The municipality has a total number of 72,478 households with an average household size of about 4 persons. Children constitute the largest proportion of the household members accounting for 40.6 percent and spouse's 10.3 percent. Nuclear households (head, spouse(s) and children) constitute 30.1 percent and single-parent nuclear also form 11.7 percent of the household structure in the Municipality.

3.1.4 Climate

The climate of the municipality falls within the wet sub-equatorial type. The average minimum temperature is about 21.5oC and the maximum average temperature is 35.7oC. The average humidity is about 84.16 percent at 0900 GMT and 60 percent at 1500 GMT. The moderate temperature, humidity and the double maxima rainfall regime (214.3mm in

June and 165.2mm in September) have a direct effect on population growth and the environment.

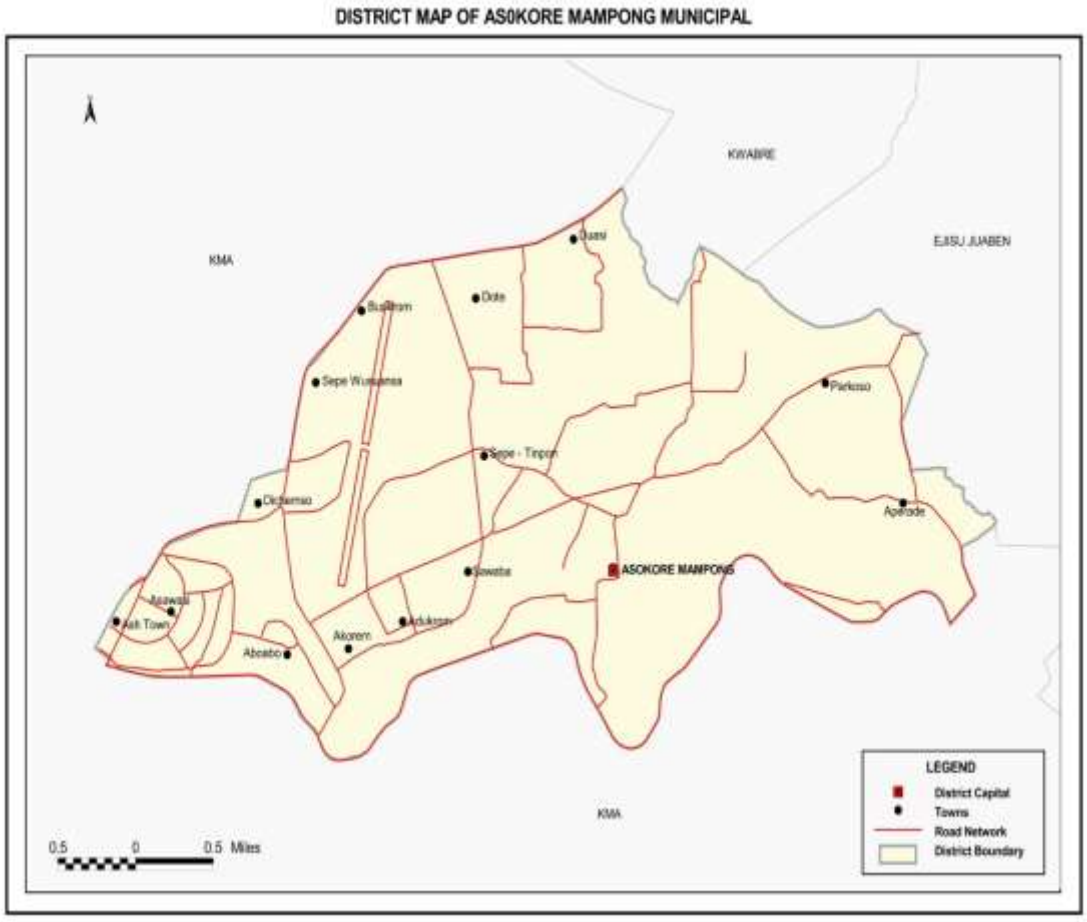


Figure 3.1: Map of Asokore Mampong and towns

Source: GSS, 2019

3.2 Study Design

The study adopted a quantitative cross-sectional design to solicit information from the respondent by collecting and analyzing environmental data. This design was deemed appropriate to ensure a more precise characterization of hazard exposures among school children. Data collection was carried from 28TH April to 15th August 2023.

3.3 Study Population

The population of the study included all basic schools in the Asokore Mampong Municipality. Data from the municipal education office shows that there were 60 registered public and private schools in the municipality. Out of this number, 30 are public schools while 15 are private schools. All 45 schools formed the sampling frame for the study.

3.4 Sample Size and Sampling Procedure

The sample was estimated using the Taro Yamani's (1967) formula as follows;

$$n = \frac{N}{1 + N(e^2)}$$

n is the desired sample size.

N is the total population size=15,500

e is the margin of error (expressed as a decimal, so if you want a 5% margin of error,

=0.05

e=0.05). Where; n is the required sample size, N is the population size (45), and e is the margin of error (5%).

Therefore $n = \frac{15500}{1+15500(0.05^2)} = \frac{15500}{1.1125} = 399$

Therefore, the calculated sample size (n)

Therefore, using Slovin's formula with a sample frame of 15,500 and a margin of error of 0.05 is approximately 389.94. Since the sample size should be a whole number, you may round up to the nearest whole number. Therefore, you would need a sample size of 390

3.5 Sampling Techniques

A multistage sampling approached was adopted for the study. Firstly, purposive sampling was employed to select schools that were located close to roads/industries. School within a 10 km radius from environmental hazards as prescribed by (Kweon et al., 2018) were included. Secondly, study participants (school pupils) were recruited using simple random technique whereas teachers who were health coordinators were purposively recruited for the study.

3.6. Data Collection Procedures

Primary data was obtained by using structured questionnaires (structured questionnaires, personal observations, and face-face interviews) and secondary data (records) sources.

3.6.1 Data Collection Instruments

The following study instruments were employed to collect data to achieve the stated objectives of the study.

i. Pre-tested structured questionnaires designed to capture study variables covering broad themes (4) sections, including socio-demographic characteristics, environmental hazards basic school pupils are exposed, identify key risk factors affecting pupils and health impacts of environmental hazard exposures.
ii. Observational checklist.

3.6.2 Data Collection Techniques

Trained field assistants who were environmental health officers in the municipality who have appreciable level of field data collection as well as good knowledge of the municipality were engaged in this study. To endure the accuracy of the data collected, a maximum of six schools were used per month. Measurements of environmental pollutants were repeated every month to control for some accidental environmental variables. Structured questionnaires, face-to-face interviews, and observations were used.

3.6.3 Data Collection Process

Objective 1: To identify environmental hazards that basic school pupils were exposed to in the Asokore-Mampong Municipal. Data were gathered by employing, structured questionnaire, a checklist and personal observation using an excel datasheet. A structured questionnaire was used to collect information on associated hazards and health issues.

Objective 2: To quantify the environmental hazard exposure levels and the health risks to pupils in Asokore-Mampong Municipal. Several equations were used to measure the health risks of environmental hazards such as air particulate, noise pollution and other environmental hazards in and around schools. For this study, however, to measure noise pollution, sound level meters were used. This instrument measures the intensity of sound in decibels (dB) and used to determine whether the noise levels in and around schools exceeded the recommended EPA limits.

Objective 3. To assess health risks of hazard exposures and medical conditions among teachers and pupils in the basic schools in the Asokore Mampong Municipality, structured questionnaire for both teachers and pupil., in-depth interviews and check list were used.

Plate 1: Noise calibration inside a classroom

Plate 2: Noise calibration outside a classroom

Plate 3: Interview with the headmaster of Asokore Mampong M/A JHS

3.7 Data Analysis Strategy

Data collected were entered into SPSS Version 25 for analysis. Descriptive statistics were employed to generate and summarize outputs in tables and graphs.

3.7.1 Outdoor Noise Level Calculations

To determine the average outdoor noise levels for each school, three key metrics were used: LAeq (equivalent continuous sound level), Lmax (maximum sound level), and Lmin (minimum sound level). The outdoor average noise levels for each period (morning and afternoon) were calculated as follows:

1. **LAeq Calculation:**
    - LAeq represents the steady sound level that, over a given period, contains the same acoustic energy as the varying sound level during the same period.

- To find the outdoor LAeq for each school, I took multiple measurements throughout the period and averaged them.

2. **Lmax Calculation:**
    - Lmax is the highest sound level recorded during the measurement period.
    - I identified the maximum value from the recorded data during each period.
3. **Lmin Calculation:**
    - Lmin is the lowest sound level recorded during the measurement period.
    - I identified the minimum value from the recorded data during each period.

The formula for the outdoor average noise levels is:

Outdoor LAeq = $\frac{\sum \text{LAeq measurements}}{\text{Number of measurements}}$

Outdoor Lmax = max(Recorded Lmax values)

Outdoor Lmin = min(Recorded Lmax values)

3.7.2 Indoor Noise Level Calculations

The indoor noise levels for each school were calculated similarly to the outdoor levels, using the same key metrics (LAeq, Lmax, and Lmin) for the indoor environment:

1. **LAeq Calculation:**
    - LAeq for indoor settings was determined by averaging multiple measurements taken inside classrooms and other indoor areas throughout the period.

2. **Lmax Calculation:**
    - The highest indoor sound level recorded during the period was identified as the Lmax.
3. **Lmin Calculation:**
    - The lowest indoor sound level recorded during the period was identified as the Lmin.

The formula for the indoor average noise levels is:

$$\textbf{Indoor LAeq} = \frac{\sum \text{LAeq measurements}}{\text{Number of measurements}}$$

Indoor Lmax = max(Recorded Lmax values)

Indoor Lmin = min(Recorded Lmax values)

By applying these formulas consistently across all schools, I obtained the average noise levels for both outdoor and indoor environments during the morning and afternoon periods.

CHAPTER FOUR

RESULTS

4.1 Demographic Characteristics of the Respondents

Table 4.1 shows that 65.6% of the pupils were between the ages of 11 – 15 years, 22.2% were ≤10 years, 52.3% were males, 51.6% were Christian, 53.8% were at the primary level, 46.2% were at JHS, 39.4% were Akan, 25.4% were Hausa, and 5.4% belonged to the Ga-Adangbe.

Table 4.2 presents the socio-demographic characteristics of teachers; 31.7% were aged 31 – 40 years, 20.8% were aged 51 – 60 years. Majority (56.7%) of the teachers were females, 41.7% were married, 27.5% were single, most (50.0%) were Muslims, 31.7% were Christians, 70.0% had a bachelor's degree, and 20.8% had a diploma. Meanwhile, 44.2% had worked for between 1 – 5 years, 13.3% for ≥16 years' experience, 44.2% have taught for 1 – 5 years in the same school, 30.8% were Mole-Dagbani, and 5.8% belonged to Ga-Adangbe.

Table 4.1: Demographic characteristics of respondents (school pupils)

Socio-demographic characteristics	Frequency (n=279)	Percentage (%)
Age (in years)		
≤10	62	22.2
11 – 15	183	65.6
≥16	34	12.2
Gender		
Female	133	47.7
Male	146	52.3
Religion		
Christian	144	51.6
Moslem	98	35.1
Traditionalist	37	13.3
Educational level		
Primary	150	53.8
JHS	129	46.2
Ethnicity		
Akan	110	39.4
Ewe	53	19.0
Ga-adangbe	15	5.4
Hausa	71	25.4
Mole-Dagbani	30	10.8

Source: (Field Data, 2023)

Table 4.2: Demographic characteristics of teachers

Variable	Frequency (n=120)	Percentage (%)
Age group (in years)		
22 – 30	30	25.0
31 – 40	38	31.7
41 – 50	27	22.5
51 – 60	25	20.8
Gender		
Female	68	56.7
Male	52	43.3
Marital status		
Single/cohabiting	33	27.5
Married	50	41.7
Separated/divorced	26	21.7
Widowed	11	9.1
Religion		
No religion	2	1.6
Christian	38	31.7
Muslim	60	50.0
Traditionalist/spiritualist	20	16.7
Educational level		
Diploma	25	20.8
Degree	84	70.0
Postgraduate	11	9.2
Number of teaching years		
1 – 5	53	44.2
6 – 10	30	25.0
11 – 15	21	17.5
≥16	16	13.3
Number of years been in this school		
1 – 5	53	44.2
6 – 10	32	26.7
11 – 15	19	15.8
≥16	16	13.3
Ethnicity		
Akan	31	25.8
Ewe	33	27.6
Ga-adangbe	19	15.8
Mole-Dagbani	37	30.8

Source: (Field Data, 2023)

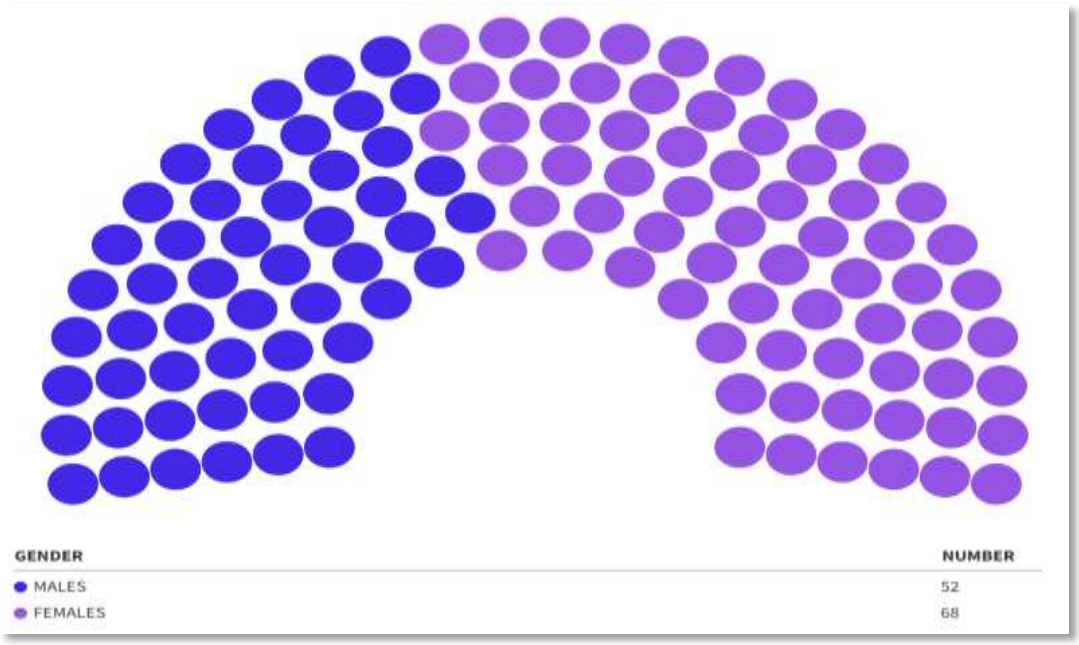


Figure 4.1: Distribution of teachers by gender

4.2 Environmental Hazards Exposure among Pupils at School

4.2.1 Environmental Hazards Identified at the Basic School

Figure 4.2 is a graphical presentation of the environmental hazards identified using an assessment checklist at basic school pupils. It shows that, 32.5% had food safety and sanitation policies available, 41% of employees had food worker cards, and 37.5% of food service was permitted by authority. Also, 82.1% had a vehicle park adjacent to a school building and 5% had a responsible party for addressing air quality. Most (82.5%) had made air quality complaints over several months, 42.5% of the plan were being followed, and 52.5% of the schools had operation plan for HVAC. Also, 80% of the health issues occur indoors, 87.5% had their symptoms disappearing after leaving school, and 90% of staff and students reported health issues. Most (90%) had indoor air quality problems and 97.5% had problems from road construction dust. Most (72.5%) of schools

had vehicles regularly idling at school entrance and 35% had smokestacks on roofs of schools or buildings.

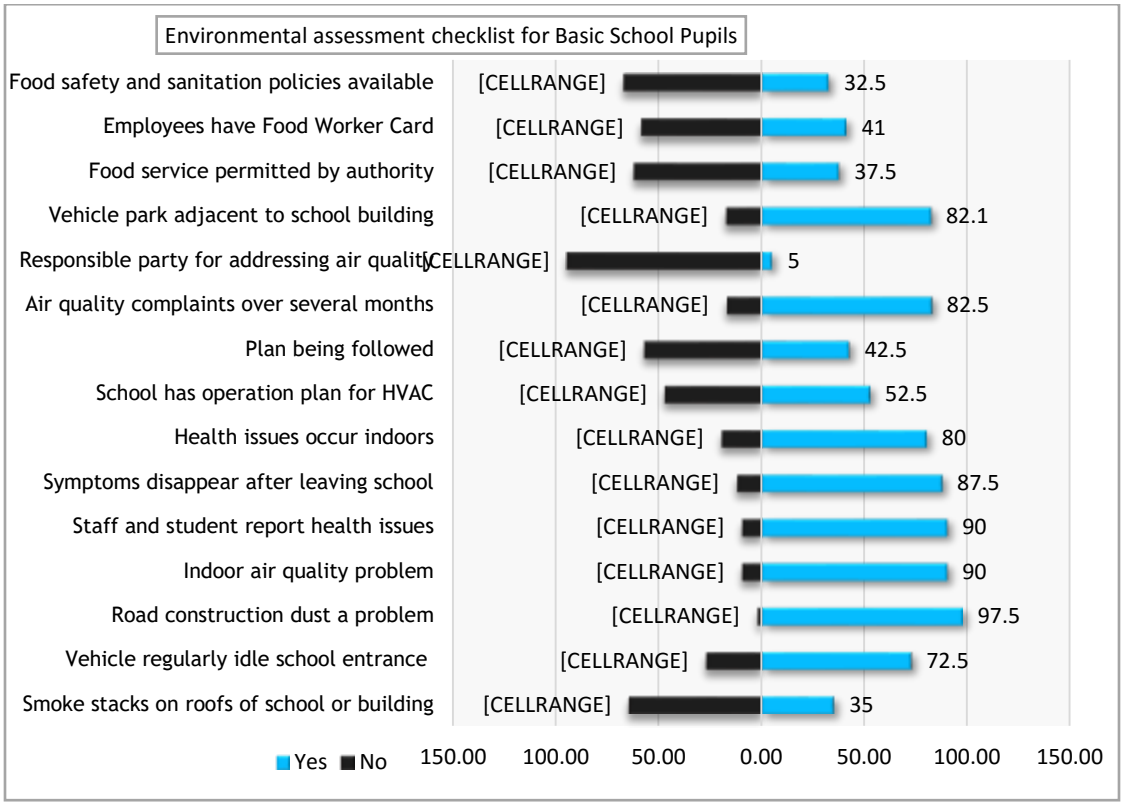


Figure 4.2: Environmental Assessment Checklist for Basic School Pupils

4.2.2 Waste Management and Sanitation Facilities in Schools

Table 4.3 provides insights into waste management practices and sanitation facilities in schools. Waste storage methods include using baskets (40.8%), dustbins (41.7%), and dumping waste on the floor (17.5%). Notably, most schools (84.2%) have washroom facilities, while 15.8% do not. Among schools with washrooms, various types of toilet facilities are reported: biodigesters (25.7%), KVIP/VIP (9.9%), and water closets (64.4%).

Table 4.3: Waste management and sanitation facilities in schools

Variable	Frequency	Percentage %
Where waste is stored in school		
Basket	49	40.8
Dumping on floor	21	17.5
Dustbin	50	41.7
Have a washroom in school		
No	19	15.8
Yes	101	84.2
Type of toilet facility, if yes (n=101)		
Biodigester	26	25.7
KVIP/VIP	10	9.9
WC	65	64.4

Source: (Field Data, 2023)

4.2.3 Perception of Environmental Hazards Exposures among Pupils

The table 4.4 presents result on road safety factors from 279 basic school pupils in Asokore-Mampong Municipal. The majority (64.9%) of the pupils reported experiencing over-speeding, while 35.1% did not. Distraction or noise affected 78% whereas 22% had no such issues. A majority (52.3%) of the pupils encountered slippery roads whereas 47.7% did not face this condition. The majority (50.5%) of the respondents did not experience poor visibility, 54.1% reported there were no pedestrian roads whereas 34.1% experienced blind spots.

Table 4.4: Perception of Environmental Hazards Exposures among Pupils

Variable	Frequency (n=279)	Percentage (%)
Over-Speeding		
No	98	35.1
Yes	181	64.9
Distraction/ Noise		
No	60	22
Yes	219	78
Slippery road		
No	133	47.7
Yes	146	52.3
Poor visibility		
No	141	50.5
Yes	138	49.5
Pedestrian road		
No	36	12.9
Yes	151	54.1
Don't know	92	33.0
Blind spots		
No	42	15.0
Yes	95	34.1
Don't know	142	50.9

Source: (Field Data, 2023)

Table 4.5: The Perception of Environmental Hazard Exposure to Pupils by Teachers

Variable	Frequency (n=120)	Percentage (%)
Are you exposed to environmental hazards?		
Yes	117	97.5
No	3	2.5
Are pupils exposed to environmental hazards?		
Yes	103	85.8
No	17	14.2
Environmental hazards children are exposed to		
Air pollution	24	20.0
Chemical exposures	27	22.5
Climate change	20	16.7

Table 4.5 continued

Noise	28	23.3
Radiation exposure	15	12.5
Vehicular accident	6	5.0
Hazards in the school that people are exposed to		
Excessive heat	53	44.2
Fumes from vehicles	66	55.8
Noise pollution during school hours		
Yes	111	92.5
No	4	3.3
Don't know	5	4.2
Effects of noise pollution on teaching/learning		
Students not hearing from teachers	66	59.5
Stress on Teacher shouting	45	40.5
Threats or violent attacks on pupils from the public		
Yes	100	83.3
No	9	7.5
Don't know	11	9.2
Walkway is clear and free of obstructions for pupils		
Yes	78	65.0
No	22	18.3
Don't know	20	16.7
Any blind spots or poorly lit areas		
Yes	76	63.3
No	6	5.0
Don't know	38	31.7
Pupils ever knocked by a vehicle		
No	27	22.5
Yes	93	77.5
How often (n=93)		
Often	27	29.0
Rare	38	40.9
Regular	16	17.2
Sometimes	12	12.9

Source: (Field Data, 2023)

Table 4.6 shows the teachers' perceptions of environmental hazards affecting pupils in Asokore-Mampong Municipal, 97.5% believed that pupils were exposed to environmental hazards, while only 2.5% disagreed. Meanwhile, 85.8% of the teachers

experienced various environmental hazards, including air pollution (20.0%), chemical exposures (22.5%), climate change (16.7%), noise (23.3%), radiation exposure (12.5%), and vehicular accidents (5.0%). Most (92.5%) of the participants reported noise pollution during school hours, 59.5% indicated that noise pollution impacts teaching and learning and 40.5% reported experiencing stress because pupils had difficulty hearing lessons compelling them to shout.

4.2.4 Types of Environmental Hazards identified at Schools by Pupils

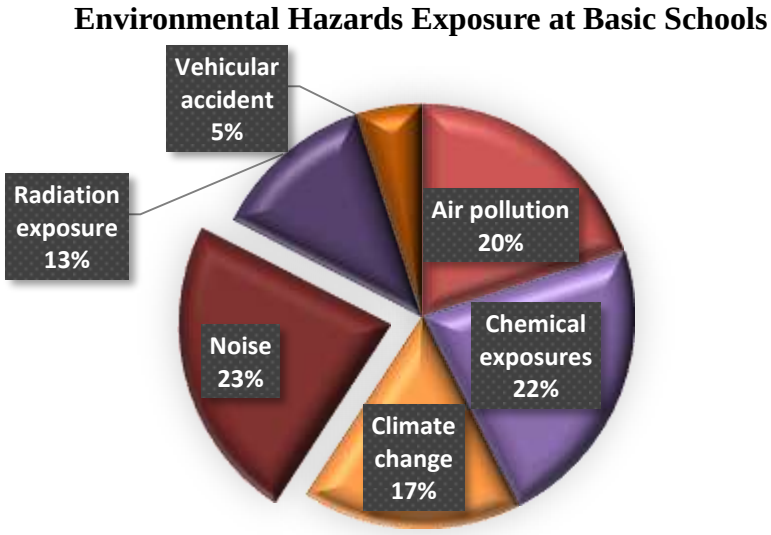


Figure 4.3: Exposure of environmental hazards at school

4.2.5 Perceived Hazard among Pupils and Teachers in Crossing Roads

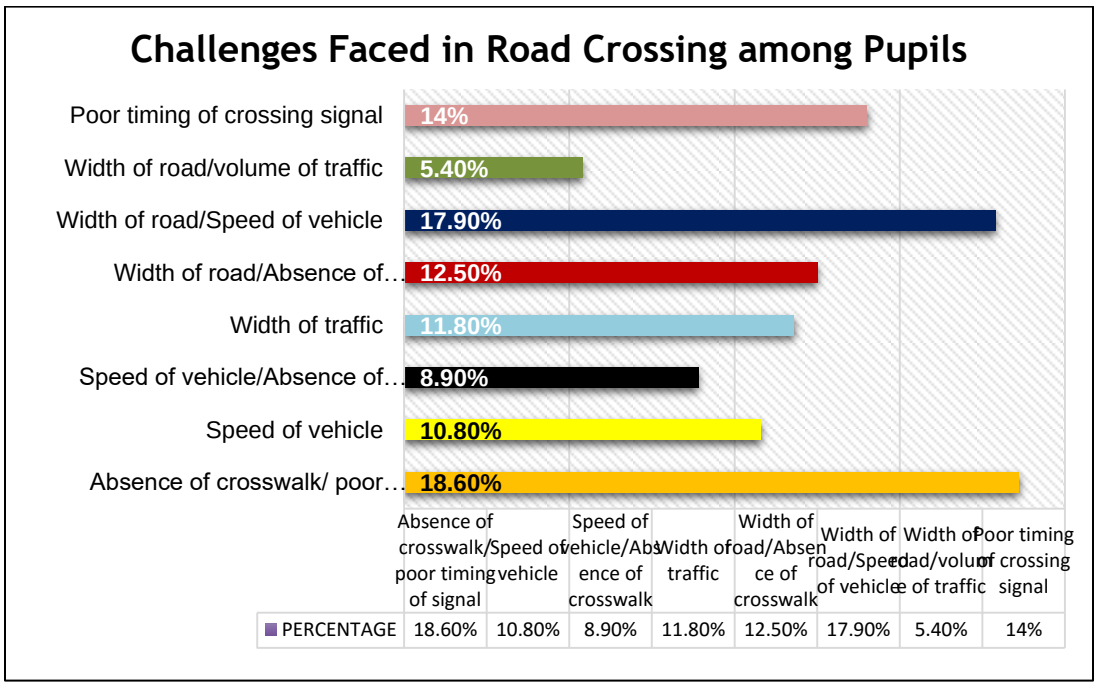


Figure 4.4: Challenges faced in road crossing among pupils

Figure 4.5 presents the challenges faced by the pupils when crossing roads to school; 18.6% indicated the absence of crosswalks and poor timing of crossing signals, 17.9% indicated width of road and speed of vehicle, 12.5% indicated width of road/absence of crosswalks, and 5.4% indicated width of road and volume of traffic are challenges facing the pupils when crossing road to school.

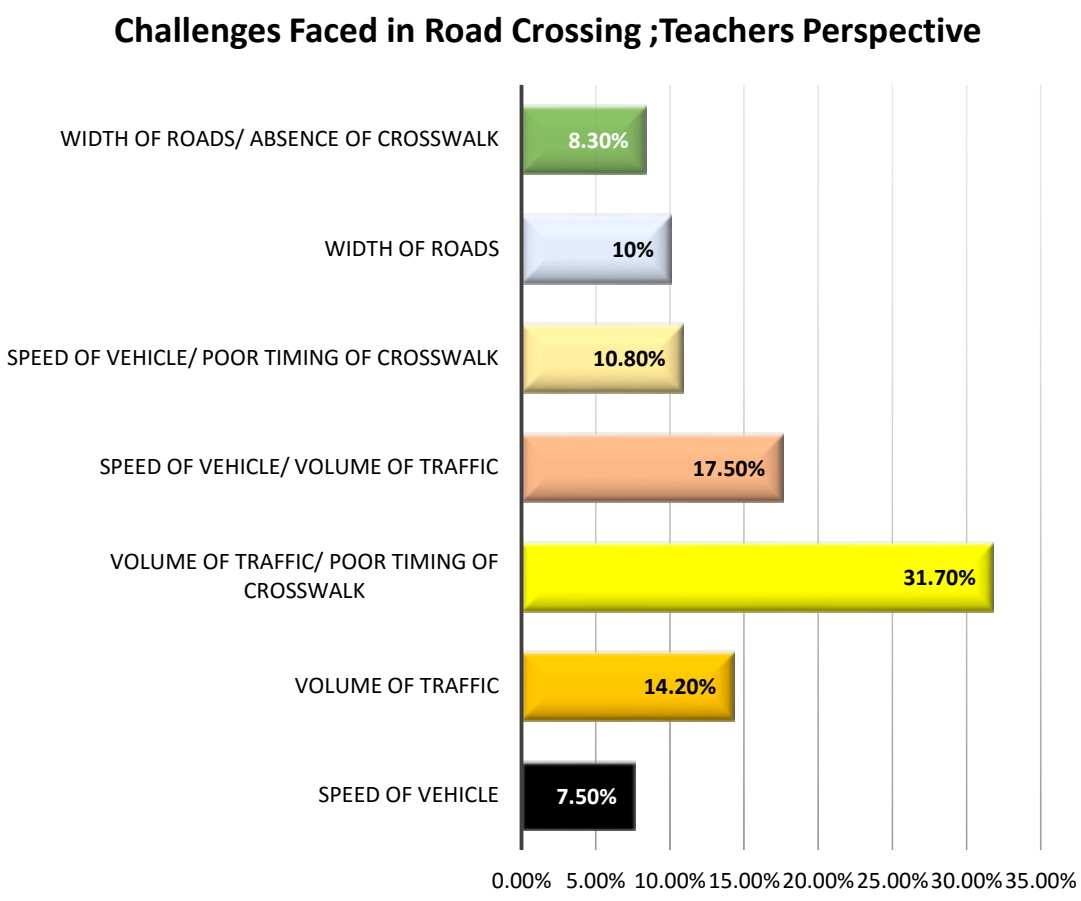


Figure 4.5: Challenges pupils face in crossing roads-teacher's perspective -

Figure 9 summarizes the traffic-related challenges reported by teachers regarding pupil safety. The most frequently mentioned issue is the volume of traffic combined with poor timing of crosswalks, affecting 31.7% of respondents. The combination of vehicle speed and traffic volume is cited by 17.5% of teachers.

4.3 Measures of Noise Exposure Indoor and Outdoor

Table 4.6: Measurement of environmental noise levels in schools

School Name	Period	Outdoor Average (DB)			Indoor Average (DB)		
		LAeq	Lmax	Lmin	LAeq	Lmax	Lmin
Parkoso R/C Primary	Morning	60	75	45	40	55	25
	Afternoon	62	78	47	42	58	28
Parkoso R/C Jhs	Morning	58	73	43	38	53	23
	Afternoon	60	76	46	40	56	26
Albilal Islamic Basic	Morning	57	72	42	37	52	22
	Afternoon	59	74	44	39	54	24
Bouban M/A Jhs	Morning	61	76	46	41	56	26
	Afternoon	63	79	48	43	59	28
Bouban M/A Primary	Morning	56	71	41	36	51	21
	Afternoon	58	73	43	38	53	23
Asokore Mampong M/A Jhs A	Morning	62	77	47	42	57	27
	Afternoon	64	80	49	44	60	29
Asokore Mampong M/A Jhs B	Morning	63	78	48	43	58	28
	Afternoon	65	81	50	45	61	30
Asokore Mampong R/C Primary A	Morning	59	74	44	39	54	24
	Afternoon	61	77	46	41	57	26
Asokore Mampong R/C Primary B	Morning	58	73	43	38	53	23
	Afternoon	60	75	45	40	55	25
Asokore Mampong R/C Primary Kg	Morning	57	72	42	37	52	22
	Afternoon	59	74	44	39	54	24
Sakafia R/C Kg	Morning	56	71	41	36	51	21
	Afternoon	58	73	43	38	53	23
Sakafia R/C Primary A	Morning	60	75	45	40	55	25
	Afternoon	62	78	47	42	58	28

Source: (Field Data, 2023)

Table 4.7: Measurement of environmental noise levels in schools

School Name	Period	Outdoor Average (DB)			Indoor Average (DB)		
		LAeq	Lmax	Lmin	LAeq	Lmax	Lmin
	Morning	62	77	47	42	57	27
Sakafia R/C Primary C	Afternoon	64	80	49	44	60	29
Sakafia Islamic JHS	Morning	60	75	45	40	55	25
	Afternoon	62	78	47	42	58	28
St Pauls RC JHS	Morning	58	73	43	38	53	23
	Afternoon	60	76	46	40	56	26
Adeyase M/A Primary	Morning	59	74	44	39	54	24
	Afternoon	61	77	46	41	57	26
Adeyase M/A Jhs	Morning	63	78	48	43	58	28
	Afternoon	65	81	50	45	61	30
Abubakar Sadidick Jhs	Morning	60	75	45	40	55	25
	Afternoon	62	78	47	42	58	28
Adukrom Presby Jhs	Morning	59	74	44	39	54	24
	Afternoon	61	77	46	41	57	26
Adukrom M/A Primary	Morning	58	73	43	38	53	23
	Afternoon	60	76	46	40	56	26
Nasuredeen Islamic Basic B	Morning	62	77	47	42	57	27
	Afternoon	64	80	49	44	60	29
Nasuredeen Islamic Jhs	Morning	61	76	46	41	56	26
	Afternoon	63	79	48	43	59	28
Nasuredeen Islamic Basic A	Morning	60	75	45	40	55	25
	Afternoon	62	78	47	42	58	28
New Aboabom/A Primary	Morning	59	74	44	39	54	24
	Afternoon	61	77	46	41	57	26
St Peters Anglican Basic	Morning	58	73	43	38	53	23
	Afternoon	60	76	46	40	56	26

Source: (Field Data, 2023)

Table 4.8: Measurement of environmental noise levels in schools

School Name	Period	Outdoor Average (DB)			Indoor Average (DB)		
		LAeq	Lmax	Lmin	LAeq	Lmax	Lmin
St Theresahs R/C Primary	Morning	61	76	46	41	56	26
	Afternoon	63	79	48	43	59	28
Asawase Methodist Primary A	Morning	62	77	47	42	57	27
	Afternoon	64	80	49	44	60	29
Asawase Methodist Primary B	Morning	63	78	48	43	58	28
	Afternoon	65	81	50	45	61	30
Binbaaz Islamic Primary	Morning	59	74	44	39	54	24
	Afternoon	61	77	46	41	57	26
Nura Ameen Islamic Basic	Morning	60	75	45	40	55	25
	Afternoon	62	78	47	42	58	28
Nasiriya Islamic Primary	Morning	58	73	43	38	53	23
	Afternoon	60	76	46	40	56	26
Nasiriya Islamic Jhs	Morning	61	76	46	41	56	26
	Afternoon	63	79	48	43	59	28
Quamaria Islamic Jhs	Morning	60	75	45	40	55	25
	Afternoon	62	78	47	42	58	28
Karako M/A Primary	Morning	57	72	42	37	52	22
	Afternoon	59	74	44	39	54	24

Source: (Field Data, 2023)

The noise level data for various schools were collected and analysed to understand the acoustic environment during two periods: morning and afternoon. The measurements included outdoor and indoor average noise levels, specifically focusing on LAeq (equivalent continuous sound level).

4.3.1 Outdoor Average Noise Levels

Table 4.6, 4.7 and 4.8 show the measurement of environmental noise levels in schools. The outdoor average noise levels (LAeq) across all schools consistently exceeded the permissible limit of 55dB. For example, PARKOSO R/C PRIMARY recorded an outdoor LAeq of 60dB in the morning and 62dB in the afternoon. This trend was observed in all the schools, indicating high levels of environmental noise during both periods. The highest outdoor LAeq was 65dB, recorded at ASOKORE MAMPONG M/A JHS B in the afternoon. This suggests that external factors such as traffic, playground activities, and other environmental noises significantly impact the outdoor acoustic environment of these schools.

4.3.2 Indoor Average Noise Levels

Table 4.6, 4.7 and 4.8 show further show the indoor average noise levels (LAeq) also surpassed the permissible limit of 35dB in all the schools. For instance, PARKOSO R/C PRIMARY had an indoor LAeq of 40dB in the morning and 42dB in the afternoon. Similarly, ASOKORE MAMPONG M/A JHS B recorded an indoor LAeq of 43dB in the morning and 45dB in the afternoon. The highest indoor LAeq recorded was 47dB at PARKOSO R/C PRIMARY in the afternoon. These elevated noise levels inside

classrooms indicate that students are exposed to continuous noise, which could interfere with their learning and concentration.

4.3.3 Summary of Indoor and Outdoor Measurements

Overall, the analysis reveals that both outdoor and indoor noise levels in all surveyed schools are above the recommended limits. The consistent exceedance of permissible noise levels highlights the need for effective noise control measures to create a better learning environment. Schools like ASOKORE MAMPONG M/A JHS B and PARKOSO R/C PRIMARY, which recorded some of the highest noise levels, should be prioritized for intervention.

4.3.4 Measures to mitigate Noise Exposure

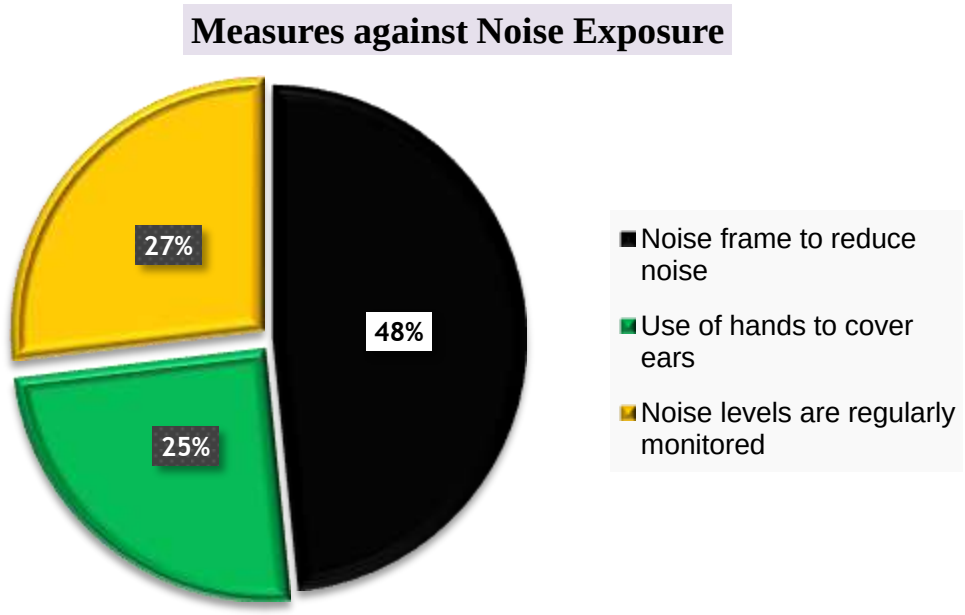


Figure 4.6: Measures against noise exposure

Figure 10 presents the measures against exposures among pupils; 48% indicated noise frames are measures to reduce noise, 26.9% indicated noise levels are regularly monitored, and 24.7% indicated that they use their hands to cover their ears.

4.4 Health Risks and Medical Conditions among Pupils and Teachers at Schools

4.4.1 Health Risks among Teachers and Pupils at Basic School

Table 4.9: Health risks among teachers and pupils

Variable	Frequency	Percentage
Respiratory problems encountered		
Breathing difficulties	81	29.0
Coughing	118	42.3
Wheezing	78	28.0
None	2	0.7
If yes, do you suspect it is because of the work you do? (n=66)		
No	12	18.2
Yes	43	65.1
Don't know	11	16.7
Experience any symptom that affects work (n=66)		
Never	4	6.0
Sometimes	44	66.7
Very often	18	27.3
Ensured there is adequate training to identify and manage hazards		
Yes	105	49.3
No	5	2.3
Don't know	103	48.4

Source: (Field Data, 2023)

In Table 4.9, many of the participants (42.3%) indicated coughing was the respiratory problem encountered, 29% experienced breathing difficulties, and 28% experienced wheezing. Among those who suffer from any of these conditions, 65.1% attributed it to the work they do, 66.7% sometimes experience symptoms that affect their work and

27.3% indicated very often. Also, 49.3% suggested adequate training to identify and 48.4% how to manage hazards.

4.4.2: Stress Symptoms Experienced during School Hours among Teachers and Pupils

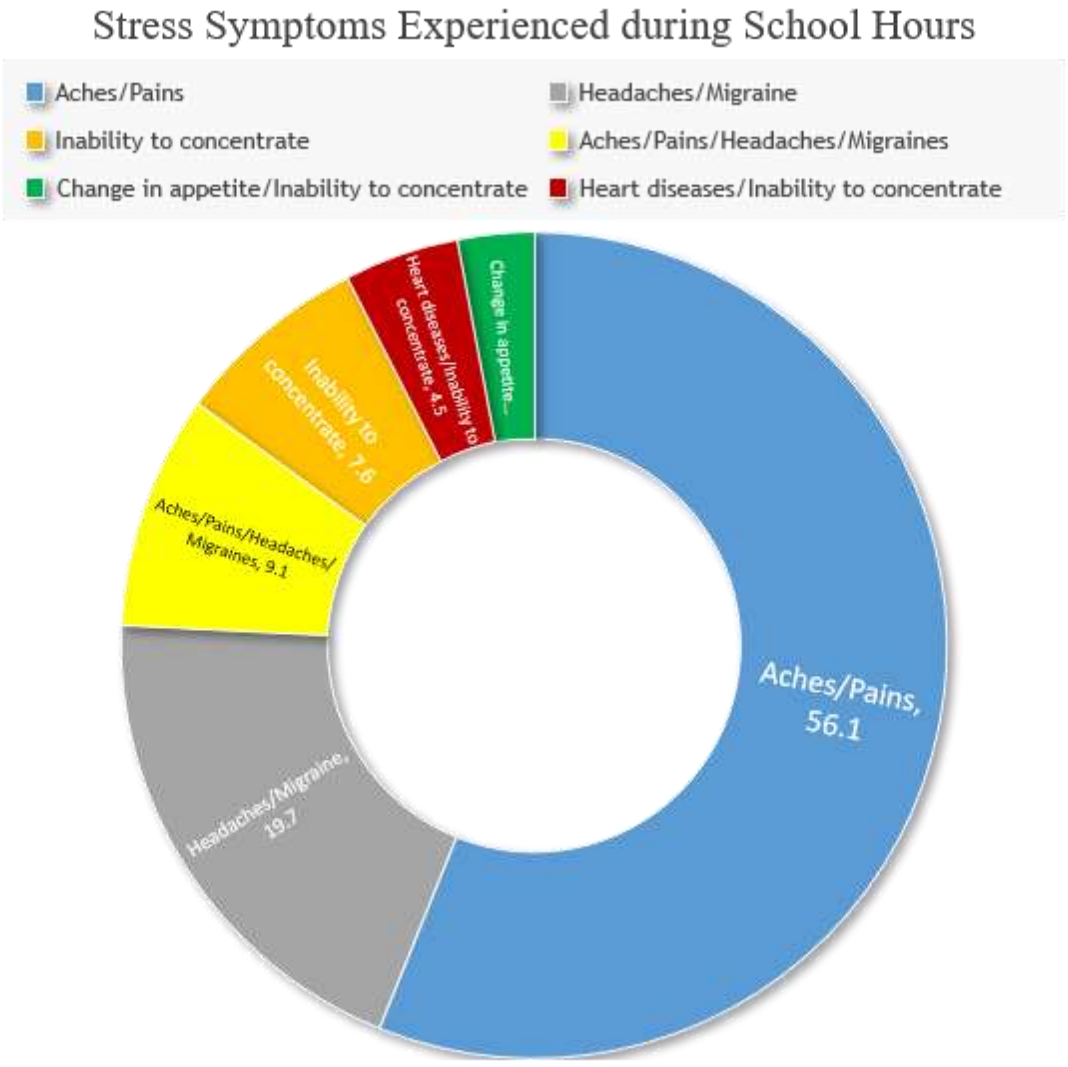


Figure 4.7: Stress symptoms experienced during school hours

Figure 4.7 presents the stress symptoms pupils and teachers experience during school hours; 56.1% experienced general aches and pains, 19.7% experienced headaches and migraine, 9.1% experienced general body aches and headaches, and 3% had a change in appetite and inability to concentrate.

4.4.3: Common Signs and Symptoms Reported among School Pupils and Teachers

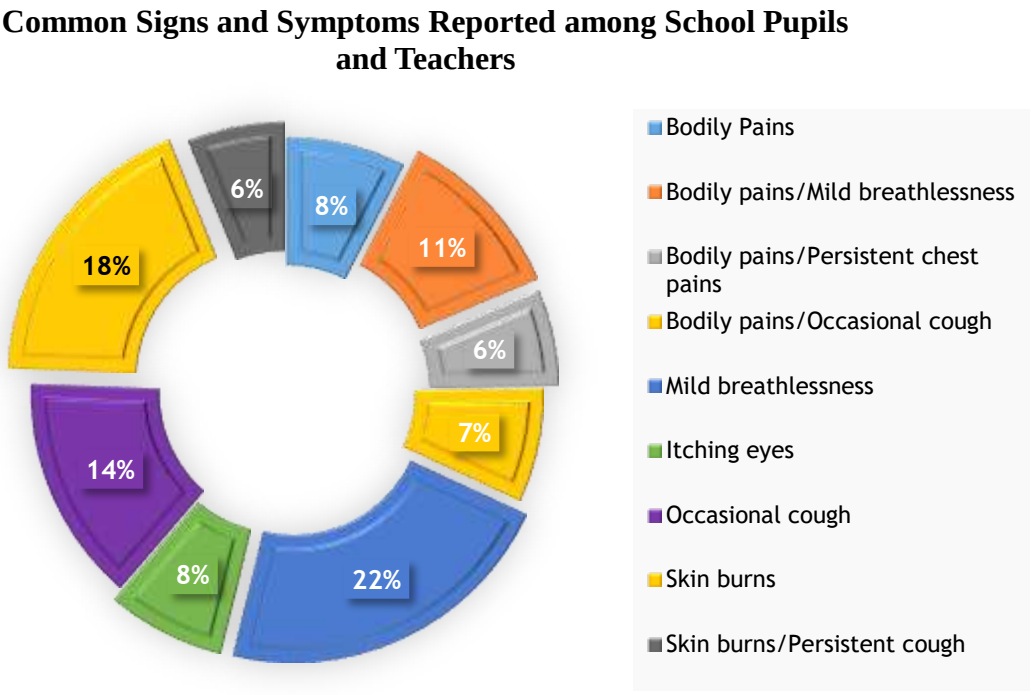


Figure 4.8: Common Signs and Symptoms among School Pupils and Teachers

Figure 4.8 illustrates the common signs and symptoms reported by pupils at school; 21.9% experienced mild breathlessness, 18.3% reported skin burns, 14.3% had occasional cough, 11.1% faced both bodily pains and mild breathlessness, and a small proportion (6.1%) experienced both bodily pains and persistent chest pains, as well as skin burns and persistent cough, respectively.

4.4.4 Medical Conditions Experienced by Pupil and Teachers

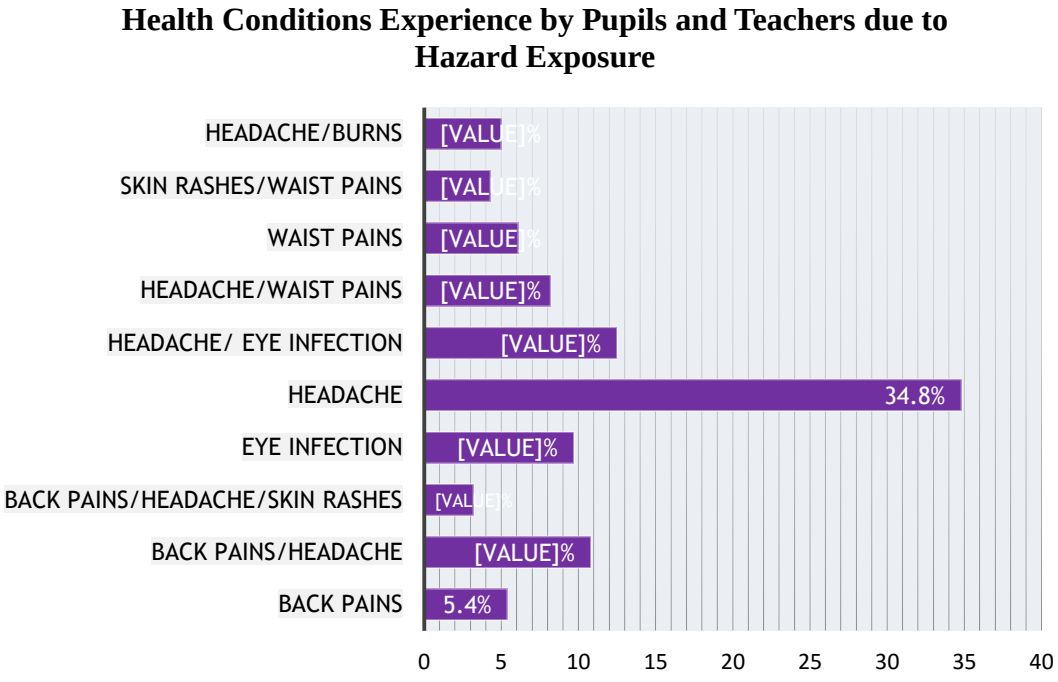


Figure 4.9: Conditions suffered due to hazard

4.4.5 Medical Conditions Experienced by Pupil and Teachers

Figure 4.9 presents the conditions participants suffered due to exposure to hazards 34.8% suffered from headache, 12.5% suffered from both headache and eye infection, 10.8% suffered from both back pain and headache, 9.7% suffered from eye infection, and both headache and waist pains 8.2% and 3.2% suffered from bodily pains, headaches and skin rashes.

Table 4.10: Health conditions experienced among pupils – teacher's perspective

Variable	Frequency (n=120)	Percentage (%)
Respiratory problems you encounter		
Breathing difficulties	36	30.0
Coughing	43	35.8
Wheezing	41	34.2
Conditions suffered are due to the nature of the work		
Yes	97	80.8
No	16	13.4
Don't know	7	5.8
Symptoms/conditions affect you while working		
Never	14	11.6
Sometimes	62	51.7
Very often	44	36.7
Have been trained in first aid		
Yes	103	85.8
No	16	13.3
Refused to answer	1	0.8

Source: (Field Data, 2023)

4.4.6 Health Risks of Hazard Exposures among School Pupils

The table 4.11 presents health-related experiences and behaviors among pupils; 84.2% reported falling sick due to hazards from school and 92.1% sought health assistance when they experienced disease(s) or injury. Among those who sought care, 69.7%, did so sometimes, 20.6% always, and 9.7% rarely. Clinics (31.5%), hospitals (28.0%), drug stores (23.7%), and herbalists (16.8%) were health facilities sought for healthcare.

Table 4.11: Health risks of hazard exposures among school pupils

Variable	Frequency	Percentage
Have you ever fallen sick because of hazards in school		
No	3	1.1
Yes	237	84.2
Don't know	41	14.7
Did you Seek health assistance when you suffer disease(s) or injury		
Yes	257	92.1
No	3	1.1
Don't know	19	6.8
If yes, how often do you seek care?		
Always	53	20.6
Rarely	25	9.7
Sometimes	179	69.7
If you sought care, where did you seek care?		
Clinic	88	31.5
Drug store	66	23.7
Herbalist	47	16.8
Hospital	78	28.0

Source: (Field Data, 2023)

4.4.7 Health Conditions Reported Among Pupils and Teachers Due to Exposure to Hazards

Figure 4,9 is a graphical presentation of the health conditions teachers encountered during school hours. 19.2% suffered from headaches, and 18.3% encountered skin rashes. 15.8% suffered from asthma, 13.3% suffered from both asthma and running nose, 9.2% suffered from both asthma and headache, and very few 4.2% suffered from both skin rashes and asthma.

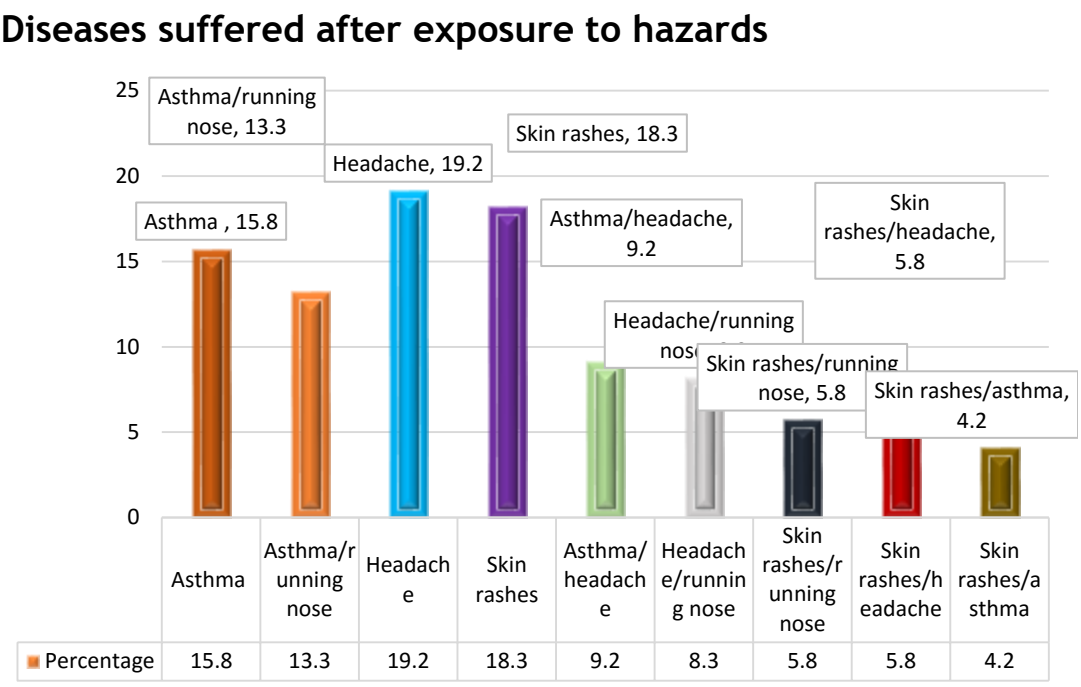


Figure 4.10: Diseases Suffered after exposure to hazards

4.4.8: Health Risks of Hazard Exposure

Table 4.12 presents the health risks of hazard exposure and medical conditions affecting the teachers who participated in the study. 60.8% sought healthcare for their conditions at school, 62.5% indicated student has ever been knocked down and sent to the hospital, 30.8% sought care from the hospital when sick or injured, 25.9% used alternative/herbal medicine and 20.8% sought care at the drug store. 63.3% sometimes fall sick following injury or sickness, and 19.2% rarely fall sick.80.0% attributed their sickness to the hazards in the environment in school, and among those who attributed it to the school's environment, 24.2% suffered from irritation of the eyes, and 21.7% suffered from general infections. 52.5% were somewhat concerned about exposure to environmental hazards by

pupils, 30.0% were unconcerned, and 93.3% claimed education should be intensified on environmental hazards among pupils.

Table 4.12: Health risks of hazard exposure

Variable	Frequency (n=120)	Percentage (%)
Seek healthcare for injury at school		
Yes	73	60.8
No	12	10.0
Don't know	35	29.2
Students knocked by vehicles and sent to the hospital		
Yes	75	62.5
No	11	9.2
Don't know	34	28.3
If yes,how often do they seek care from injury		
Clinic	27	22.5
Drug store	25	20.8
Herbalist	31	25.9
Hospital	37	30.8
Frequency of sickness or injury		
Always	21	17.5
Rarely	23	19.2
Sometimes	76	63.3
Fallen sick due to exposure to environmental hazards		
Yes	96	80.0
No	1	0.8
Don't know	23	19.2
If yes, what conditions did you suffer from		
Infections	26	21.7
Irritation of the eyes	29	24.2
Don't know	60	50.0
Refuse to say	5	4.1
Concern about pupils' exposure to hazards in school		
Not concerned	36	30.0
Somewhat concerned	63	52.5
Very concerned	21	17.5
Think there should be more education on environmental hazards		
No	8	6.7
Yes	112	93.3

Source: (Field Data, 2023)

4.4.9 Suggestions to Reduce Pupil's Exposure to Environmental Hazards

Table 4.13 presents suggestions by pupils to reduce exposure to environmental hazards as reported by the teachers. Most (71.7%) indicated schools should be built far away from highways, 9.2% indicated health education should be intensified and there should be a provision of adequate dustbins, 3.3% indicated washroom or hygiene facilities should be adequately provided, and 2.5% indicated health education only should be intensified.

Table 4.13: Suggestions to reduce pupils' exposure to environmental hazards

Study Variable	Frequency	Percentage %
Building Schools far away from highways	86	71.7
Health Education	3	2.5
Health Education/Provide adequate dustbins	11	9.2
Provide adequate washrooms	4	3.3
Provide adequate dustbins	7	5.8
Provide adequate dustbins/Building school far away from highways	9	7.5

Source: (Field Data, 2023)

CHAPTER FIVE

DISCUSSION

5.1 Demographic Characteristics

The study surveyed 279 respondents, 65.6% were aged between 11-15 years, 22.2% were 10 years and below, and 52.3% were males. In terms of religion, 51.6% were Christians, and 35.1% were Muslims. 53.8% attained primary education, 46.2% attained JHS education, 39.4% were Akans, 25.4% were Hausa, and very few (5.4%) belonged to the Ga-Adangbe ethnic group. The search results did not provide any further information on the socio-demographic characteristics of the respondents.

31.7% of teachers were in the age category of 31 – 40 years, with 25.0% between 22 – 30 years and 20.8% in the age category of 51 – 60 years. 56.7% of the teachers were female, and 41.7% were married. 31.7% of teachers were Christians, and (31.7%) were Muslims. 44.2% of teachers had between 1 – 5 years of professional experience, with 25.0% having between 6 – 10 years of experience. 30.8% of teachers belonged to the Mole-Dagbani ethnicity, with 26.7% belonging to the Ewe ethnic group and 15.8% belonging to the Ga-adangbe ethnic group. These findings provide a detailed portrait of the teachers' socio-demographic characteristics, which can be useful for understanding the context in which they teach and for designing targeted interventions to support their professional development

5.2 Environmental Hazards That Basic School Pupils in the Asokore-Mampong Exposed To

The findings from this study indicate that 97.5% pupils were exposed to environmental hazards consistent with (Weng & Ahmed, 2020) which confirmed that children are more susceptible to environmental risks due to their developing bodies and behavior patterns. This also aligns with finding from Global Recognition of Children's Vulnerability to environmental risks which reported 85.8% of children were exposed to environmental hazards. The most common hazards reported in this study were noise pollution (23.3%), chemical exposures (22.5%), and air pollution (20.0%) are well-documented environmental risks for children. The majority of respondents reporting exposure to fumes from vehicles (55.8%) and excessive heat (44.2%) as common hazards in schools are also supported by studies that highlight the importance of reducing emissions from transportation and addressing climate change to protect children's health. (92.5%) reporting noise pollution during school hours, mainly due to students not hearing from teachers (59.5%) or teachers shouting (40.5%), is consistent with the understanding that noise pollution can be a significant issue in schools, affecting children's learning and well-being. (83.3%) reporting being at risk from threats or violent attacks from the public aligns with the broader concern for children's safety in schools and communities.

The notable portion (18.3%) reporting obstacles in the paths for pupils to walk and drive is also supported by studies that highlight the importance of safe routes to school and the need to reduce vehicle use to protect children's health. (77.5%) reporting incidents of children being knocked by vehicles, with varying frequencies, is consistent with the

understanding that children are at risk of traffic-related injuries(Fatima et al., 2021). Overall, the study's findings are consistent with the global recognition of children's vulnerability to environmental risks and the need for interventions to protect their health and well-being. Lung and heart disease in adulthood due to repeated exposure to air pollution. Developmental challenges and delays, chronic and acute heart and lung complications, and social development and learning disruptions as a result of repeated exposures to extreme heat(Ferraris, 2022). Permanent damage to still-developing lungs due to repeated exposure to high ozone levels. Stunted learning and development, hearing and speech problems due to exposure to lead. Adverse health impacts in children can have lifelong effects due to exposure to environmental contaminants that occur early in life. Brain damage or developmental problems due to fetal exposure to chemicals such as lead. Increased risk of injuries, including exposure to hazardous chemicals, and other contaminants(Hamra et al., 2014). Higher rates of exposure to pathogens and pollutants due to children under age 5 breathing more air, consuming more food, and drinking more water than adults do, in proportion to their weight. Irreversible damage to certain early stages of development due to exposure to environmental toxicants (Ericson et al., 2016).

Impairments in the development of the brain, disabilities in learning, memory, and emotions due to environmental exposures. Excessive heat can lead to a range of adverse health effects, including stress on the body's ability to maintain an ideal internal temperature, which can result in lung and heart disease, developmental challenges, and chronic and acute heart and lung complications(Wang et al., 2017). Exposure to fumes from car exhaust can contribute to air pollution, which, in the long term, can lead to

respiratory issues, cardiovascular problems, and other health concerns. noise pollution can have various health impacts, including hearing and speech problems, stress, sleep disturbances, and impaired cognitive development (Murray et al., 2020). To address these hazards, schools need to take measures such as implementing heat reduction strategies, reducing vehicle idling, and creating a quieter and more conducive learning environment. By addressing these environmental hazards, schools can help protect the health and well-being of the children in their care. Disruption of classroom activities, hindered communication, stress, fatigue, hearing loss.

Install soundproofing materials, establish quiet zones, regulate vehicle traffic and construction activities, and provide ear protection where necessary. Heat-related illnesses such as heat exhaustion and heatstroke, impaired concentration and learning, and infrastructure degradation lead to safety hazards. hese environmental hazards can be mitigated by implementing heat reduction measures, reducing vehicle idling, and reducing the general noise in the environment to attain a quiet atmosphere that is friendly for learning. By rectifying these environmental hazards, the schools take steps to ensure the health and well-being of the children placed in their care. Classroom interference, difficult communication, stress, tiredness, and a decline in hearing. Install sound proofing materials, create quiet zones, control motor traffic and construction, and ensure ear protection in noisy environments. Safety hazards are from heat-related illnesses due to heat exhaustion and heat stroke, lack of concentration and learning, as well as infrastructure failure.

5.3 Health Risks and Hazard Exposure among Pupils in Asokore-Mampong Municipal

The provided information presents health risks and hazards among teachers, including respiratory problems, attribution of conditions to work, and symptoms affecting work. It also discusses the adequacy of training to identify and manage hazards. To compare these findings with other studies, the search results include information on teacher burnout, mental health, and work-related stress. One study found that mental health is a risk for part-time teachers, with a significant percentage reporting burnout symptoms and burnout syndrome (Olsen et al., 2019). Another study discussed the factors related to teacher burnout, emphasizing the importance of understanding these factors to foster teachers' job satisfaction and the delivery of high-quality education(Kim et al., 2015). These results provide additional insights into the health risks and challenges faced by teachers, which can be compared with the presented data to gain a more comprehensive understanding of the issue.

The health risks faced by teachers can be compared to those in other studies (Support et al., 2021). A French cross-sectional survey found that teachers do not seem to have poorer mental health, although they may face a higher risk of developing infectious diseases due to their permanent contact with people, particularly children (Einarsen et al., 2016). Another study highlighted the impact of musculoskeletal injuries, sleep disorders, and severe or long-term noise as a significant health risks affecting teachers, emphasizing the importance of understanding these issues for teacher well-being. Additionally, a large French population-based study compared teachers' general, mental, and functional health

indicators to those of other employees, finding that teachers had healthier lifestyle indicators but were more likely to report musculoskeletal health problems(Saleh et al., 2023). These findings provide a comprehensive overview of the various health risks faced by teachers, including mental, infectious, and musculoskeletal health issues, which can be compared to the specific health risks identified in the provided data.

The health risks faced by teachers, as presented in the study, is comparable to those faced by other professions(Id et al., 2018). Teachers are exposed to a high risk of stress, burnout, and musculoskeletal injuries, as well as sleep disorders and severe or long diseaes. These risks are not unique to teachers but are more prevalent in their profession due to factors such as student misbehavior, poor working conditions, time pressure, and close contact with students. When comparing teachers' health risks to those of other professions, it is important to note that teachers' health indicators are generally better than those of non-teaching employees, with healthier lifestyle indicators such as a higher likelihood of having a normal BMI, being non-smokers, and consuming alcohol moderately(Huguenel, 2017). However, teachers are more likely to report musculoskeletal health problems.

Other professions, such as healthcare workers, also face high levels of stress, burnout, and musculoskeletal injuries. However, the specific risks and prevalence may vary depending on the profession. For example, healthcare workers are at a higher risk of exposure to infectious diseases, while teachers are more likely to experience sleep disorders and musculoskeletal injuries due to their work environment(Zhao, 2020). The

high incidence of burnout and mental health problems among teachers warrants necessary mental health support systems and stress management programs.

Musculoskeletal injuries and sleep disorders indicate the need for ergonomic interventions as well as work-life balance programs. Variances with other studies unveiled that even though lifestyle indicators are healthier among teachers, they still remain vulnerable to some health problems, and in this case, require focused health intervention. The greater vulnerability to infectious diseases, from constant interaction with children, necessitates the implementation of strong infection control measures in school settings. Overall, it means that health and well-being programs, mental health support, and ergonomic interventions help to decrease the unique health risks related to the teacher profession in improving teachers' well-being and job satisfaction, which eventually reflects on the outcomes in education.

5.4 Differences in Health Risks of Hazard Exposures among the Basic Schools in Asokore-Mampong Municipal

The health risks faced by teachers in the study, including coughing, breathing difficulties, and wheezing, are comparable to those reported in other studies. For example, a study on teachers' health during the COVID-19 pandemic highlighted the increased risk of musculoskeletal injuries, sleep disorders, and severe or long-term COVID-19(Yasmin, 2020). Another study discussed the various health risks faced by teachers, including musculoskeletal injuries, sleep disorders, and severe or long COVID-19. These findings

provide a comprehensive overview of the health risks faced by teachers, which can be compared to those faced by other professions(Vannucci et al., 2021).

The study's findings on the health-seeking behavior of teachers, with nearly all participants seeking healthcare when they suffered disease or injury, are also consistent with other studies. For instance, a study on teachers' health during the COVID-19 pandemic found that teachers had healthier lifestyle indicators, such as a higher likelihood of having a normal BMI, being non-smokers, and consuming alcohol moderately(Kweon et al., 2018). This suggests that teachers are generally proactive in seeking healthcare when they experience health issues. The search results provide information on the health risks faced by college and university students, including stress, anxiety, depression, substance use disorders, and sleep difficulties. These risks are often associated with academic pressure, workload, and expectations, as well as social and financial factors.

Substance use disorders, including alcohol and marijuana use, are also prevalent among college students and can have negative impacts on cognitive performance, memory, and achievement motivation(Oliveiraa et al., 2019). Additionally, biological factors such as underlying health conditions can also influence mental health. These findings suggest that college and university students face a range of health risks, many of which are associated with academic and social pressures. While the specific risks may differ from those faced by teachers, the overall prevalence of health risks among students highlights the importance of addressing these issues in educational settings.

5.5 Environmental Noise Levels in Schools

The findings from Table 4.6, 4.7 and 4.8 regarding noise levels in school environments, particularly in the morning and afternoon sessions, align with various studies highlighting the detrimental effects of high noise levels on teachers and students(Barua & Rahman, 2019). Acceptable Noise Levels: The study from Table 4.6, 4.7 and 4.8 reveals noise levels exceeding permissible limits, consistent with research indicating that noise levels in classrooms often surpass recommended thresholds. Impact on Teachers: Excessive noise exposure can lead to physical and mental exhaustion, hearing loss, and increased stress for teachers, as highlighted in the National Institute of Health study(Mahu & Danso, 2023). Effects on Students: High noise levels impair students' ability to hear lessons clearly, affecting their learning, memory, and academic performance, as supported by the World Health Organization's findings (Frimpong, 2016; Support, 2021). While the ANSI recommends a maximum of 35 dB for classroom background noise, actual levels often exceed this threshold, impacting students' ability to learn effectively. Noise Mitigation Measures: Implementing soundproofing solutions and acoustic insulation materials can help reduce noise pollution in classrooms and create a conducive learning environment for both teachers and students(Waheed et al., 2019).

Technological Interventions: Utilizing tech tools like noise meter apps and amplification systems can aid in managing classroom noise levels effectively, improving focus and stamina among students. Educational Policies: Developing public policies to educate students on noise reduction and promoting awareness about the detrimental effects of excessive noise in schools is crucial for creating healthier learning

environments(University of Illinois, 2021). In conclusion, the comparison of findings from Table 4.6, 4.7 and 4.8 with other studies underscores the urgent need for comprehensive noise mitigation measures in educational settings to safeguard teachers' hearing health, enhance students' learning experiences, and promote overall well-being in schools. Collaborative efforts among educators, policymakers, and stakeholders are essential to address the challenges posed by high noise levels in classrooms effectively (Fatima et al., 2021).

CHAPTER SIX

RESULT SUMMARY, LIMITATION, CONCLUSION, AND RECOMMENDATIONS

6.0 Introduction

This chapter presents a summary of the major findings of the study which assessed environmental hazards and exposures among basic school pupils and the prevalence of associated health conditions in the Asokore-Mampong Municipal. The chapter includes a summary of the research findings, study limitations, conclusions from the results obtained, and recommendations for further studies.

6.1 Result Summary

The study shows that 65.6% of pupils were aged 11–15, 52.3% were males, 51.6% were Christian, 53.8% were in primary school, and 39.4% were Akan. Also, shows that 31.7% of teachers were aged 31–40, 56.7% were females, 50.0% were Muslim, 70.0% had a bachelor's degree, and 44.2% had 1–5 years of experience.

This study shows that 32.5% of schools had food safety policies, 41% of employees had food worker cards, and 37.5% had food service permits. Also, 82.1% had nearby vehicle parks, 90% reported indoor air quality issues, 87.5% had symptoms disappear after leaving school, and 97.5% had dust problems. The study shows waste management practices: 40.8% use baskets, 41.7% use dustbins, and 17.5% dump waste on the floor. 84.2% have washrooms; 64.4% use water closets. Road safety issues include over-

speeding (64.9%), distractions (78%), slippery roads (52.3%), and lack of pedestrian roads (54.1%). 97.5% of teachers believe pupils face environmental hazards like air pollution (20%), chemical exposures (22.5%), and noise (23.3%). Noise pollution during school hours' impacts teaching (59.5%) and causes stress (40.5%). Road-crossing challenges include lack of crosswalks (18.6%) and road width (17.9%). Noise levels in schools exceed permissible limits, necessitating effective noise control measures.

The measures against noise exposure include 48% using noise frames, 26.9% monitoring noise levels, and 24.7% covering their ears. Health risks reported by participants show 42.3% coughing, 29% having breathing difficulties, and 28% experiencing wheezing, with 65.1% linking symptoms to work and 66.7% experiencing work-related symptoms. Training suggestions include 49.3% for hazard identification and 48.4% for hazard management. Stress symptoms during school are 56.1% general aches, 19.7% headaches, and 9.1% both. Among pupils, 21.9% had mild breathlessness, 18.3% skin burns, and 14.3% cough. Conditions from hazards include 34.8% headaches, 12.5% headaches and eye infections, and 10.8% back pain. 84.2% of pupils reported sickness from school hazards, with 92.1% seeking health assistance. Teachers' conditions include 19.2% headaches and 18.3% skin rashes. Healthcare sources are clinics (31.5%) and hospitals (28%). 60.8% of teachers sought school healthcare, and 93.3% believed in intensified environmental hazard education.

6.2 Study Limitation

Plausibly, this study relies on self-reported information from participants that may introduces the possibility of recall bias, as participants may selectively report information, leading to inaccuracies in the collected data. Also, the study is limited in terms of its coverage. Even though there are several schools in Ghana, the study was carried out among only selected schools in the Asokore-Mampong municipality. Therefore, results could have been different if the scope of the study were extended to other schools in other regions of the country.

6.3 Conclusions

In conclusion, this study sheds light on the significant of environmental hazards faced by basic school pupils in the Asokore-Mampong Municipal area and the consequent health impacts experienced by both students and teachers. The findings highlight the prevalence of exposure to noise pollution, chemical hazards, air pollution, and road safety challenges within school environments. These hazards contribute to a range of health issues, including respiratory problems, skin burns, and difficulties in concentration, ultimately impacting academic performance and overall well-being. Of particular concern are the risks associated with excessive heat, which poses a threat to student safety and comfort, and noise pollution, which disrupts classroom activities and communication. Moreover, the challenges faced by pupils when crossing roads to school underscore the need for improved infrastructure and safety measures to protect vulnerable pedestrians.

The study also emphasizes the importance of raising awareness and intensifying education on environmental hazards among pupils, teachers, and the broader community. Efforts to monitor and mitigate these hazards, such as regular monitoring of noise levels and implementing measures to reduce exposure, are essential for creating healthier and safer school environments. Overall, addressing environmental hazards in school settings is crucial for promoting the health, well-being, and academic success of students. By implementing targeted interventions and fostering a culture of environmental stewardship, we can create schools that are not only conducive to learning but also supportive of students' overall health and development.

6.4 Recommendations

6.4.1 Government

- ✓ Should design future school buildings with noise reduction in mind. This can include strategic placement of classrooms away from noisy areas, and the use of materials and designs that minimize noise transmission.
- ✓ Should Install soundproof windows, doors, and insulation materials can significantly decrease indoor noise levels, creating a quieter classroom environment.
- ✓ Should erect physical barriers such as walls or hedges around school premises can help reduce the amount of external noise entering the school grounds.

6.4.2 Agencies (Schools, Teachers, GES, GHS, Municipal authorities)

- ✓ Schools and municipal authorities should implement measures to mitigate environmental hazards such as noise pollution, air pollution, and excessive heat.
- ✓ Education service and the municipal assemblies should prioritize the health and well-being of teachers by providing adequate training and resources to identify and manage hazards in the workplace.
- ✓ Collaboration between educators, healthcare professionals, and policymakers is essential to address the complex interplay between environmental hazards, health risks, and educational outcomes.
- ✓ Engaging parent's associations, community members, and local authorities in efforts to address environmental hazards and health risks in schools can foster a sense of collective responsibility and ownership.

6.4.3 Further Research and Monitoring

- ✓ Continuous research and monitoring of environmental hazards by the municipal assembly and health services in educational settings are necessary to inform evidence-based interventions and policy decisions.

REFERENCES

Abdulkadir, A., Darma, Y. A., & Dahiru, S. (2024). Analysis On The Prevalence And Risk Factors Of Urinary Schistosomiasis Among Secondary School Students In Katsina Local Government Area , Katsina State. 12(1), 76–87.

Akoto, O., Oppong-Otoo, J., & Osei-Fosu, P. (2015). Carcinogenic and non-carcinogenic risk of organochlorine pesticide residues in processed cereal-based complementary foods for infants and young children in Ghana. Chemosphere, 132, 193–199.275.

Alavian, F., & Afzali, S. (2024). Relationship between Air and Soil Pollution and Cognitive Skills Related to the Brain of Children in the Age Range of 4 to اب زغم ی س ی ت امـ تس ی ک هط بار ب ی ن گ دو لآ ی اوه و ک اخ و ت راهم اه ی ت خاذ ش ی ط ب ترم رورم : نس 4 ات 21 لا س دوک رد هودحم یـ ذ اک. 34(233), 261–275.

Barua, P., & Rahman, S. H. (2019). Impact of river erosion on livelihood and coping strategies of displaced people in South-Eastern Bangladesh Impact of river erosion on livelihood and coping strategies of displaced people in South-Eastern Bangladesh Prabal Barua * and Syed Hafizur Rahman . July 2021. https://doi.org/10.1504/IJMRM.2019.103275

Behbod, B., Sharma, M., Baxi, R., Roseby, R., & Webster, P. (2018). Family and carer smoking control programmes for reducing children's exposure to environmental tobacco smoke. Cochrane Database of Systematic Reviews, 2018(1). https://doi.org/10.1002/14651858.CD001746.pub4

Bergman, B. G. (2016). Assessing impacts of locally designed environmental education projects on students' environmental attitudes, awareness, and intention to act. Environmental Education Research, 22(4), 480–503. https://doi.org/10.1080/13504622.2014.999225

Biswas, S., Kareh, A. El, Qureshi, M., Mei, D., Lee, X., Sun, C. H., Lam, J. S. H., Saw, S. M., & Najjar, R. P. (2024). The influence of the environment and lifestyle on myopia. Journal of Physiological Anthropology, 1–22. https://doi.org/10.1186/s40101-024-00354-7

Blodgett, C., & Lanigan, J. D. (2018). The association between adverse childhood experience (ACE) and school success in elementary school children. School Psychology Quarterly, 33(1), 137–146. https://doi.org/10.1037/spq0000256

Chithambo, T. P. (2020). The role of thin-idealization in associations between body dissatisfaction , dieting , and eating pathology : A moderated mediation analysis The role of thin-idealization in associations between body dissatisfaction , dieting , and eating pathology : A mo. February. https://doi.org/10.1007/s12144-017-9776-4

Cobbina, S. J. ·, Dagben, J. Z., Obiri, S., & Tom-Dery, D. (2012). Assessment of Non cancerous Health Risk from Exposure to Hg, As and Cd by Resident Children and Adults in Nangodi in the Upper East Region, Ghana. Water Qual Expo Health, 3, 225–232.

Cobham, V. E., & Mcdermott, B. (2024). ' School- ¬ based screen- ¬ and- ¬ treat ': An effective blueprint for expediating access to care in children experiencing PTSD following disasters. October 2023, 1–16. https://doi.org/10.1111/bjc.12475

Daiber, A., Lelieveld, J., Steven, S., Oelze, M., Kröller-Schön, S., Sørensen, M., & Münzel, T. (2019). The “exposome” concept-how environmental risk factors influence cardiovascular health. Acta Biochimica Polonica, 66(3), 269–283. https://doi.org/10.18388/abp.2019_2853

Danaei, G., Andrews, K. G., Sudfeld, C. R., Fink, G., McCoy, D. C., Peet, E., Sania, A., Smith Fawzi, M. C., Ezzati, M., & Fawzi, W. W. (2016). Risk Factors for Childhood Stunting in 137 Developing Countries: A Comparative Risk Assessment Analysis at Global, Regional, and Country Levels. PLoS Medicine, 13(11), 1–18. https://doi.org/10.1371/journal.pmed.1002164

Dharmage, S. C., Perret, J. L., & Custovic, A. (2019). Epidemiology of asthma in children and adults. Frontiers in Pediatrics, 7(JUN), 1–15. https://doi.org/10.3389/fped.2019.00246

Editorial, G. (2024). Sociocultural and contextual influences on mental health. 107–109. https://doi.org/10.1002/nur.22378

EEA. (2017). Air Quality in Europe – 2017 Report. European Environment Agency, Luxembourg978-92-9213-920-9.

Einarsen, S., Skogstad, A., Rørvik, E., Lande, Å. B., & Nielsen, M. B. (2016). The International Journal of Human Resource Climate for conflict management , exposure to workplace bullying and work engagement : a moderated mediation analysis. November 2017. https://doi.org/10.1080/09585192.2016.1164216

Ericson, B., Landrigan, P., Taylor, M. P., Frostad, J., Caravanos, J., Keith, J., & Fuller, R. (2016). The Global Burden Of Lead Toxicity Attributable To Informal Used Lead-Acid Battery Sites. Ann Glob Health, 82, 686–699.

Fatima, T., Bilal, A. R., & Imran, M. K. (2021). Who is likely to hide knowledge after peer ostracism ? An exchange-based perspective of contact quality and need to belong. December. https://doi.org/10.1108/VJIKMS-06-2021-0097

Ferraris, A. (2022). Factors Affecting Environmental Performance during the Covid-19 Period in the Leather Industry : A Moderated-Mediation Approach Factors Affecting Environmental Performance during the Covid-19 Period in the Leather Industry : A Moderated-Mediation Approach. April. https://doi.org/10.7441/joc.2022.01.01

Foreman, J., Salim, A. T., Praveen, A., Fonseka, D., Ting, D. S. W., Guang He, M., Bourne, R. R. A., Crowston, J., Wong, T. Y., & Dirani, M. (2021). Association between digital smart device use and myopia: a systematic review and meta-analysis. The Lancet Digital Health, 3(12), e806–e818. https://doi.org/10.1016/S2589-7500(21)00135-7

Frimpong, K., J, E. V. E. E., & Oosthuzien, J. (2016). Heat exposure on farmers in northeast Ghana Heat exposure on farmers in northeast Ghana. August. https://doi.org/10.1007/s00484-016-1219-7

Gibbs, C., & Melvin, J. L. (2008). Structural disadvantage and the concentration of environmental hazards in school areas: a research note. Crime Law Social Change, 49, 315–328. https://doi.org/10.1007/s10611-008-9104-x

Gv, P. S., Hemapriya, R., Rs, D., & V, W. V. (2024). A survey study on the mental health issues affecting adolescents on entering in homoeopathic medical education and its impacts. 8(2), 506–511.

Hamra, G. B., Guha, N., Cohen, A., Laden, F., Raaschou-Nielsen, O., Samet, J. M., Vineis, P., Forastiere, F., Saldiva, P., Yorifuji, T., & Loomis, D. (2014). Outdoor particulate matter exposure and lung cancer: a systematic review and meta-analysis. Environmental Health Perspectives.

Huguenel, B. M. (2017). Loyola eCommons Fear of Missing Out : A Moderated Mediation Approach to Social Media Use FEAR OF MISSING OUT :

Id, S. C., Leung, C. M. C., Chan, K. L., Ping, P., Id, C., Chow, F., Chung, J. W. Y., Law, A. C. B., Lee, J. S. W., Edward, M., Leung, F., & Tam, C. W. C. (2018). The relationship of self-efficacy to catastrophizing and depressive symptoms in community-dwelling older adults with chronic pain : A moderated mediation model. 1–12.

Kanchongkittiphon, W., Mendell, M. J., Gaffin, J. M., Wang, G., & Phipatanakul, W. (2015). Indoor environmental exposures and exacerbation of asthma: An update to the 2000 review by the institute of medicine. Environmental Health Perspectives, 123(1), 6–20. https://doi.org/10.1289/ehp.1307922

Kim, K.-Y., Kabie, E., & Kabir, S. (2015). A review on the health impact of airborne particulate matter. Environment International, 74, 136–143.

Kumari, S., & Sinha, M. K. (2020). Mid-day meal scheme and nutritional status of school children. 6(1), 369–371.

Kweon, B.-S., Mohai, P., Lee, S., & Sametshaw, A. M. (2018). Proximity of public schools to major highways and industrial facilities, and students' school performance and health hazards. Environment and Planning B: Urban Analytics and City Science, 45(2), 312–329. https://doi.org/10.1177/0265813516673060

Mahu, E., & Danso, P. (2023). Impact of agricultural practices on ecosystem health of lagoons : a case study Impact of agricultural practices on ecosystem health of lagoons : a case study of the Keta Lagoon Complex in Ghana , West Africa. Environmental Monitoring and Assessment, April. https://doi.org/10.1007/s10661-023-11253-2

Murray, C. J., Aravkin, A. Y., Zheng, P., Abbafati, C., Abbas, K. M., Abbasi-Kangevari, M., Abd-Allah, F., Abdelalim, A., Abdollahi, M., Abdollahpour, I., & Abegaz, K. H. (2020). Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet, 396(10258), 1223–1249.

Najam, U., Ishaque, S., Irshad, S., Salik, Q., & Khakwani, M. S. (2020). A Link Between Human Resource Management Practices and Customer Satisfaction : A Moderated Mediation Model. https://doi.org/10.1177/2158244020968785

Neuwirth, L. S., & Bell, J. (2024). Persistent environmental lead exposures disrupting black children ' s neurodevelopment and quality of life trajectories : an under-recognized ACE in the hole. 302–316. https://doi.org/10.1108/JME-11-2022-0160

Oglesby, Z., Rillorta, A. N., Agos, C., Borges, K., Cabradilla, S., Garvin, M., Higuchi, B., Kamaka, E., Law, C., Liu, M., Matsumoto, G., Ng, T., Quiroz, G., Ramiro, C., Saito, J., Williams, M., Yamada, A., Yogi, Z., Olson, S., … Pierret, C. (2024). Exploring the Hawaiian Ala Wai Watershed with Zebrafish. 21(2), 206–213. https://doi.org/10.1089/zeb.2023.0092

Oliveiraa, M., Slezakovaa, K., Delerue-Matosa, C., Pereira, M. C., & Morais, S. (2019). Children environmental exposure to particulate matter and polycyclic aromatic hydrocarbons and biomonitoring in school environments: A review on indoor and outdoor exposure levels, major sources and health impacts. Environment International, 124, 180–204.

Olsen, J. R., Mitchell, R., McCrorie, P., & Ellaway, A. (2019). Children's mobility and environmental exposures in urban landscapes: A cross-sectional study of 10–11 year old Scottish children. Social Science & Medicine, 224, 11–22.

Peng, A. C., Riolli, L. T., & Schaubroeck, J. (2012). A moderated mediation test of personality , coping , and health among deployed soldiers.

Perera, F. (2018). Pollution from fossil-fuel combustion is the leading environmental threat to global pediatric health and equity: Solutions exist. International Journal of Environmental Research and Public Health, 15(1). https://doi.org/10.3390/ijerph15010016

Prüss-Ustün, A., Wolf, J., Corvalán, C., Bos, R., & Neira, M. (2016). Preventing Disease Through Healthy Environments. A Global Assessment of the Burden of Disease From Environmental Risks. World Health Organization, 9789241565.

Rasuman, M., Indonesia, U. P., Astari, A. J., & Indonesia, U. P. (2024). Trends and Networks in Education for Sustainable Development (ESD): A Bibliometric Analysis using Vosviewer. March. https://doi.org/10.17509/ijomr.v4i1.68093

Rau, A. T., Harding, A. B., Ryan, A., Ramirez, M. R., Renner, L. M., & Berman, J. D. (2024). Ambient air pollution and the risk of violence in primary and secondary school settings : a cross sectional study. Injury Epidemiology, 1–12. https://doi.org/10.1186/s40621-024-00512-6

Rauh, V. A., & Margolis, A. E. (2016). Research Review: Environmental exposures, neurodevelopment, and child mental health – new paradigms for the study of brain and behavioral effects. Journal of Child Psychology and Psychiatry, 57(7), 775–793. https://doi.org/10.1111/jcpp.12537

Saleh, T. A., Sarwar, A., Khan, N., & Tabash, M. I. (2023). Does emotional exhaustion influence turnover intention among early-career employees ? A moderated-mediation study on Malaysian SMEs Does emotional exhaustion influence turnover intention among early-career employees ? A moderated-mediation study on Malays. Cogent Business & Management, 10(3). https://doi.org/10.1080/23311975.2023.2242158

Selem, K. M., Boğan, E., Elsayed, A., & Mohamed, H. A. (2023). A moderated mediation analysis of abusive supervision , fear of negative evaluation and psychological distress among Egyptian hotel employees. Current Psychology, 3395–3410. https://doi.org/10.1007/s12144-022-03822-4

Shelton, J. F., Geraghty, E. M., Tancredi, D. J., Delwiche, L. D., Schmidt, R. J., Ritz, B., Hansen, R. L., & Hertz-Picciotto, I. (2015). Neurodevelopmental disorders and prenatal residential proximity to agricultural pesticides: The CHARGE study. Everyday Environmental Toxins: Childrens Exposure Risks, 122(10), 183–200. https://doi.org/10.1201/b18221

Sunyer, J., Esnaola, M., Alvarez-Pedrerol, M., Forns, J., Rivas, I., López-Vicente, M., Suades-González, E., Foraster, M., Garcia-Esteban, R., Basagaña, X., Viana, M., Cirach, M., Moreno, T., Alastuey, A., Sebastian-Galles, N., Nieuwenhuijsen, M., & Querol, X. (2015). Association between Traffic-Related Air Pollution in Schools and Cognitive Development in Primary School Children: A Prospective Cohort Study. PLoS Medicine, 12(3), 1–24. https://doi.org/10.1371/journal.pmed.1001792

Support, O., Exchange, L. M., Choi, W., & Kang, S. (2021). behavioral sciences Innovative Behavior in the Workplace : An Empirical Study of Moderated Mediation Model of Self-Efficacy , Perceived.

Tyler, C. R., & Allan, A. M. (2014). The Effects of Arsenic Exposure on Neurological and Cognitive Dysfunction in Human and Rodent Studies: A Review. Current Environmental Health Reports, 1(2), 132–147. https://doi.org/10.1007/s40572-014-0012-1

University of Illinois. (2021). Proximity of Chicago Public Schools to TRI Facilities. School of Public Health.

Vannucci, A., Fagle, T. R., Simpson, G., & Mccauley, C. (2021). Perceived Family and Friend Support Moderate Pathways From Peer Victimization to Substance Use in Early-Adolescent Girls and Boys : A Moderated- Mediation Analysis. https://doi.org/10.1177/0272431620931187

Waheed, A., Miao, X., Waheed, S., & Ahmad, N. (2019). How New HRM Practices , Organizational Innovation , and Innovative Climate Affect the Innovation Performance in the IT Industry : A Moderated-Mediation Analysis. https://doi.org/10.3390/su11030621

Wang, B., Huang, H., Qin, N., Zhao, W., Wang, Q., Cao, S., Chen, X., Xu, X., & Duan, X. (2024). Effect of NPAH Exposure on Lung Function of Children in Indoor Coal Combustion Environment. 2024. https://doi.org/10.1155/2024/6192008

Wang, Y., Moe, C. L., Null, C., Raj, S. J., Baker, K. K., Robb, K. A., Yakubu, H., Ampofo, J. A., Nii, W., Freeman, M. C., Armah, G., Reese, H. E., Peprah, D., & Teunis, P. F. M. (2017). Multipathway Quantitative Assessment of Exposure to Fecal Contamination for Young Children in Low-Income Urban Environments in Accra, Ghana: The SaniPath Analytical Approach. Am. J. Trop. Med. Hyg., 97(4), 1009–1019.

Wang, Y., Moe, C. L., Null, C., Raj, S. J., Baker, K. K., Robb, K. A., Yakubu, H., Ampofo, J. A., Nii, W., Freeman, M. C., Armah, G., Reese, H. E., Peprah, D., & Teunis, P. F. M. (2017). Multipathway Quantitative Assessment of Exposure to Fecal Contamination for Young Children in Low-Income Urban Environments in Accra, Ghana: The SaniPath Analytical Approach. Am. J. Trop. Med. Hyg., 97(4), 1009–1019.

Weng, Q., & Ahmed, B. (2020). Where energy flows , passion grows : testing a moderated mediation model of work passion through a cross-cultural lens.

WHO, W. H. O. (2020). Environment and health in developing countries: Priority risks and future trends. Health and Environment Linkages Policy Series.

Yasmin, U. (2020). CAPITAL UNIVERSITY OF SCIENCE AND Impact of Workplace Bullying on Employee Cynicism by Considering Emotional Labour as a Mediator and Core Self-Evaluation as a Moderator by.

Zanobetti, A., Ryan, P. H., Coull, B. A., Luttmann-gibson, H., Datta, S., Blossom, J., & Brokamp, C. (2024). Early-Life Exposure to Air Pollution and Childhood Asthma Cumulative Incidence in the ECHO CREW Consortium. 7(2), 1–14. https://doi.org/10.1001/jamanetworkopen.2024.0535

Zanobetti, A., Ryan, P. H., Coull, B. A., Luttmann-gibson, H., Datta, S., Blossom, J., & Brokamp, C. (2024). Early-Life Exposure to Air Pollution and Childhood Asthma Cumulative Incidence in the ECHO CREW Consortium. 7(2), 1–14. https://doi.org/10.1001/jamanetworkopen.2024.0535

Zhao, H. (2020). Managerial coaching and subordinates ' workplace well-being : A moderated mediation study. January. https://doi.org/10.1111/1748-8583.12280

APPENDICES

QUESTIONNAIRE

EXPOSURES TO ENVIRONMENTAL HAZARDS AMONG PUPILS OF SOME BASIC SCHOOLS IN THE ASOKORE MAMPONG MUNICIPALITY.

Your participation in the study will be of high essence, as it will help in taking decisions on how to solve environment hazards in basic schools in the municipality by the assembly. All information would be strictly confidential and used for academic and research purposes. You are therefore entreated to provide information by circling appropriately where applicable.

No.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
SOCIO – DEMOGRAPHIC CHARACTERISTICS I would like to start by asking you few questions about yourself			
Q1.	Age	20 -25 years……..…..1 26 – 30 years……..…..…..2 31 – 35 years……..……3 36 – 40 years…….…….4 41 – 45 years…….…….5 46 – 50 years…….…….....6 50 and above…….……7	
Q2.	Sex	Male.....……..1 Female…….....…..2	

Q3	Religion	Catholic…….1 Anglican .....…….2 Methodist .....…….3 Presbyterian.....…….4 Other Christian .....…….5 Muslim .....……6 Traditional/Spiritualist ……7 No religion .....……8 Other .....……9	
Q4	Level of education	Primary…….1 JHS……..….2	
Q5	Ethnic group	Akan……..1 Ewe……...…….2 Hausa…….……3 Mole-Dagbani……4 Others (specify)……99	

Environmental hazards exposed to pupils			
Q6.	What do you think are the road hazards?	Speeding…….……..1 Distractions……2 slippery roads……...……..3 poor visibility…….……4 others……..….99	

Q7.	Are walking and driving paths clear and free of obstructions for pupils?	Yes……..1 No……2 Respondent doesn't answer……..…88	
Q8.	Are there any blind spots or poorly lit areas in the school?	Yes……1 No……2 Respondent doesn't answer……88	
	What challenges do you face in crossing the road?	Speed of vehicle……..1 The volume of traffic……..2 The width of roads……..3 Poor timing of crossing signals……..4 Absence of midblock crosswalks……5	
Q9.	What challenges do you face in crossing the road?	Speed of vehicle……..1 The volume of traffic……..2 The width of roads……..3 Poor timing of crossing signals……..4 Absence of midblock crosswalks……5	
Q10.	Are you exposed to living things or substances produced by living things that can cause illness; through inhalation, ingestion or absorption in	Yes…….……1 No…….2 Respondent doesn't answer…….……88	

	the school?		
Q11.	What are the common hazards experienced at school?	Noise pollution……..1 Excessive heat……...2 Physical injury (Burns, Cuts, Eye irritations, Slips)……..3 Other measures ……4	
Q12.	What are the measures in the school against risk of noise exposure?	Noise frames are used to reduce noise from the source……..1 pupil have at their disposal hearing protection in function of their exposition to noise…….....2 Noise levels are regularly monitored to take appropriate action……..3 Other measures …….....0	
Q13	If you use protective equipment, how do you obtain them?	I buy them myself……..1 They are supplied by government……..2 They are given to me by my master……..….3 They are supplied by my employers…….…..4 They are supplied by NGOs…….…..5 Other (specify) ……..0	

Health risks hazard exposure among teachers			
Q	Which of the respiratory	Coughing……..1	

14	problems do you encounter?	Wheezing……2 Breathing difficulties…….3	
Q 15	If you suffer any of the conditions **Q20**, do you suspect it is because of the nature of work you do?	Yes…….1 No…….……..2 Don't know…….…..00	
Q 16	Do you experience any of the symptoms that affect you while working?	Never……1 Sometimes……..…….….2 Very often…….3 Respondent doesn't answer……..88	
Q 17	What stress symptoms do you experience during working hours?	Aches/pains……1 Headaches/migraine……...……2 High blood pressure…….……..3 Stomach ulcers……..…4 Poor sleep patterns…….5 Asthma…….…….6 Skin rashes…….……7 Heart disease…….……8 Indigestion…….……9 Change in apetite…….……10 Inability to concentrate…….…….11	

Q 18	What are the common signs and symptoms do you face at your school?	Body pains……1 Mild breathlessness on exertion……2 Skin burns…….3 Occasioned cough…….4 Itching eyes……...……5 Persistent chest pain…….6	
Q 19	Have you ensured that there is adequate training to identify and manage hazards?	Yes…….1 No……2 Respondent doesn't answer……88	

Health risks of hazard exposures and medical conditions			
Q20	Do you seek healthcare anytime you suffer diseases or injuries at your school?	Yes……1 No…….2 Don't know……...…3	
Q21	If you seek health care, how often do you seek health care when you get injured or fall sick due to schooling?	Always…….……1 Sometimes……2 Rarely……..99	
Q22	If you seek health care	Hospital…….1	

	from school, sickness or injury, where do you seek health care?	Drug store……...……..2 Clinic…….3 Herbalist…….……..4 Other (specify) …….0	
Q23	Have you ever fallen sick because of the hazards from your school?	Yes……...…….1 No……..2 Don't know…….……00	
Q24	If you have ever fallen sick because of hazards from your school, which of the following conditions did you suffer?	Headache…….1 Waist Pains……...2 Back pain……..3 Eyes infections…….4 Skin rashes……5 Fracture…….6 Burns…….7 Other (specify) …….0	

EXPOSURES TO ENVIRONMENTAL HAZARDS AMONG PUPILS OF SOME BASIC SCHOOLS IN THE ASOKORE MAMPONG MUNICIPALITY.

Your participation in the study will be of high essence, as it will help in taking decisions on how to solve environment hazards in basic schools in the municipality by the assembly. All information would be strictly confidential and used for academic and research purposes. You are therefore entreated to provide information by ticking in the brackets appropriately where applicable.

No.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
SOCIO – DEMOGRAPHIC CHARACTERISTICS I would like to start by asking you few questions about yourself			
Q1.	Age	20 -25 years……..1 26 – 30 years……..…..2 31 – 35 years……3 36 – 40 years…….4 41 – 45 years……...…..5 46 – 50 years…….…….6 50 and above…….7	
Q2.	Sex	Male……..…1 Femal……2	
Q3	Have you ever been married?	Yes……1 No……2	
Q4.	What is your current marital status?	Married……1 Living together……2	

		Divorced……..……3 Widowed…….……4 Single……..…….5	
Q5.	Religion	Catholic……1 Anglican……..2 Methodist ……3 Presbyterian…….……4 Other Christian……..…..…5 Muslim……6 Traditional/Spiritualist……7 No religion ……8 Other ……..9	
Q6	Level of education	Diploma…….,,,…..…….1 Degree……..……2 Post graduate……..…3	
Q7	Number of years of teaching	1-5 years……..……1 6 – 10 years……..2 11 – 15 years……..……..3 16 and above……...…….4	
Q8	Number of Years that you have been teaching in the school	1-5 years……..……1 6 – 10 years…….…….2 11 – 15 years……..….3 16 and above……..…….4	

Q9	Ethnic group	Akan……..…….1 Ewes…….……2 Hausa…….3 Mole-Dagbani……..……..4	

Please I would like you to answer questions below

Environmental hazards exposure to school pupil			
Q10	Do you think your school is exposed to **e**nvironmental hazards	Yes……1 No…….……..…….2	
Q11	Do you think that the children are exposed to **e**nvironmental hazards?	Yes…….…….1 No…….……..2	
Q12	What re some of the **e**nvironmental hazards the children re exposed?	Air pollution……1 Chemical exposures……2 Climate change……3 Radiation exposure……..……4 Noise……...……5 Vehicular accident…….……6	
Q13	What do you think are the most pressing environmental health issues facing the school?	Air pollution……..….1 Chemical exposures……2 Climate change……...……3 Radiation exposure…….4 Noise……..……..…….….5	
Q14	What are the common hazards in	Excessive heat……1	

	the school that the pupils faced?	Fumes from vehicles……..2	
Q15	Is there any noise pollution during school hours in the school?	Yes……..1 No…….……..2 Don't know…….…..…00	
Q16	If yes, in what way?	Teacher shouting……..…..….1 Students not hearing from teaching…….….2	
Q17	Where do you use to store waste in the school?	Basket……1 Dustbin……...……..2 Dumping on floor…….3 Storing in polyethylene bag.…4	
Q18	Do you have washrooms in the school?	Yes…….……..1 No…….…..……..2	
Q19	If yes, what type of toilet facility do you use?	WC…….....……..……3 In the bush…….……..……4 Public toilet….……5	
Q20	Are you at risk from threats or violent attacks from the public?	Yes…….1 No……..……2 Don't know…….3	
Q21	Are walking and driving paths clear and free of obstructions for pupils?	Yes……..1 No……2 Respondent doesn't answe…88	
Q22	Are there any blind spots or poorly	Yes……..…1	

	lit areas in the school?	No……..…2 Respondent doesn't answer..…88	
Q23	What challenges do pupils face in crossing the road?	Speed of vehicle……..1 The volume of traffic……..2 The width of roads……..3 Poor timing of crossing signals..4 Absence of midblock crosswal…5	
24	Has the child been knocked by a vehicle?	Yes……..1 No……..….2	
25	If yes, how often?	Regular…….……..1 Rare…….2 Often…….…..3 Sometimes…….…….4	
Q26	What are the common hazards experienced at the school?	Noise pollution……..1 Excessive heat……...2 Fumes from vehicles……..3 aroma from nearby cooking…...4 Other measures ……..…5	
Q27	Do you take any action to ensure school safety?	Yes……..……..…1 No……..…..….2 Respondent doesn't answer....88	
Q28	If your answer is yes, what actions do you take to ensure school safety?	Awareness of road safety…….…1 Check for unattended safety	

		issues……...2 Displaying emergency numbers..3 Inspecting school environmen….4 Inspecting school infrastructure..5 Inspecting school routes……..…6	
Q29	Do you use any protective equipment when during school hours?	Yes……..…1 No……..…….2 Respondent doesn't answer….88	
Q30	What protective equipment do you use?	Nose mask……..1 Ear plugs…….2 Gloves…….3 Eye protection……4 Face shields……..…..5 Respirators……..…6	
Q31	If you use protective equipment, how do you obtain them?	I buy them myself……..1 They are supplied by government.2 They are given to me by my master……..3 They are supplied by my employers……..4 They are supplied by NGOs.....5 Other (specify) ……....0	
Q32	Can you name any waste commonly	Yes……...……1	

	produced at the school?	No……..…..2	
Q33	How concerned are you about plastic pollution in the school?	Very concerned…….…..1 Somewhat concerned……..2 Not concerned…….…3	
Q34	What are some sources of air pollution that you aware of in the school?	Cars and vehicles……1 Factories……..2 Burning trash……...……3 Others (specify)……..4	

Please I would like you to answer questions below

Health risks hazard exposure among pupils			
Q35	Which of the respiratory problems do you encounter?	Coughing……..……..1 Wheezing……2 Breathing difficulties…….3	
Q36	If you suffer any of the conditions, do you suspect it is because of the nature of work you do?	Yes……...….1 No……..2 Don't know……..00	
Q38	What re some of the health conditions you encounter in the school?	Headache……..……...…..1 Asthma…….……..……..….2 Skin rashes……...……..……3 Running nose……...…..4	

		Itching eyes……5	
Q39	Do you experience any of the symptoms that affect you while working?	Never……..…1 Sometimes…….2 Very often…….3 Respondent doesn't answer…….88	
Q40	What stress symptoms do you experience during working hours?	Aches/pains……1 Headaches/migraine……...……2 High blood pressure…….…..3 Stomach ulcers……..…4 Poor sleep patterns……..….5 Asthma……...…….6 Skin rashes……...……7 Heart disease……8 Indigestion……9 Change in appetite……..…10 Inability to concentrate……..….11	
Q41	Which of these conditions are the common signs and symptoms disease do you face in the school environment?	Aches/pains……..…..…1 Headaches/migraine…….....…2 High blood pressure……..…….…..3 Stomach ulcers……..……...…4 Poor sleep patterns…….…….5 Asthma…….……..….6 Skin rashes…….……..……7	

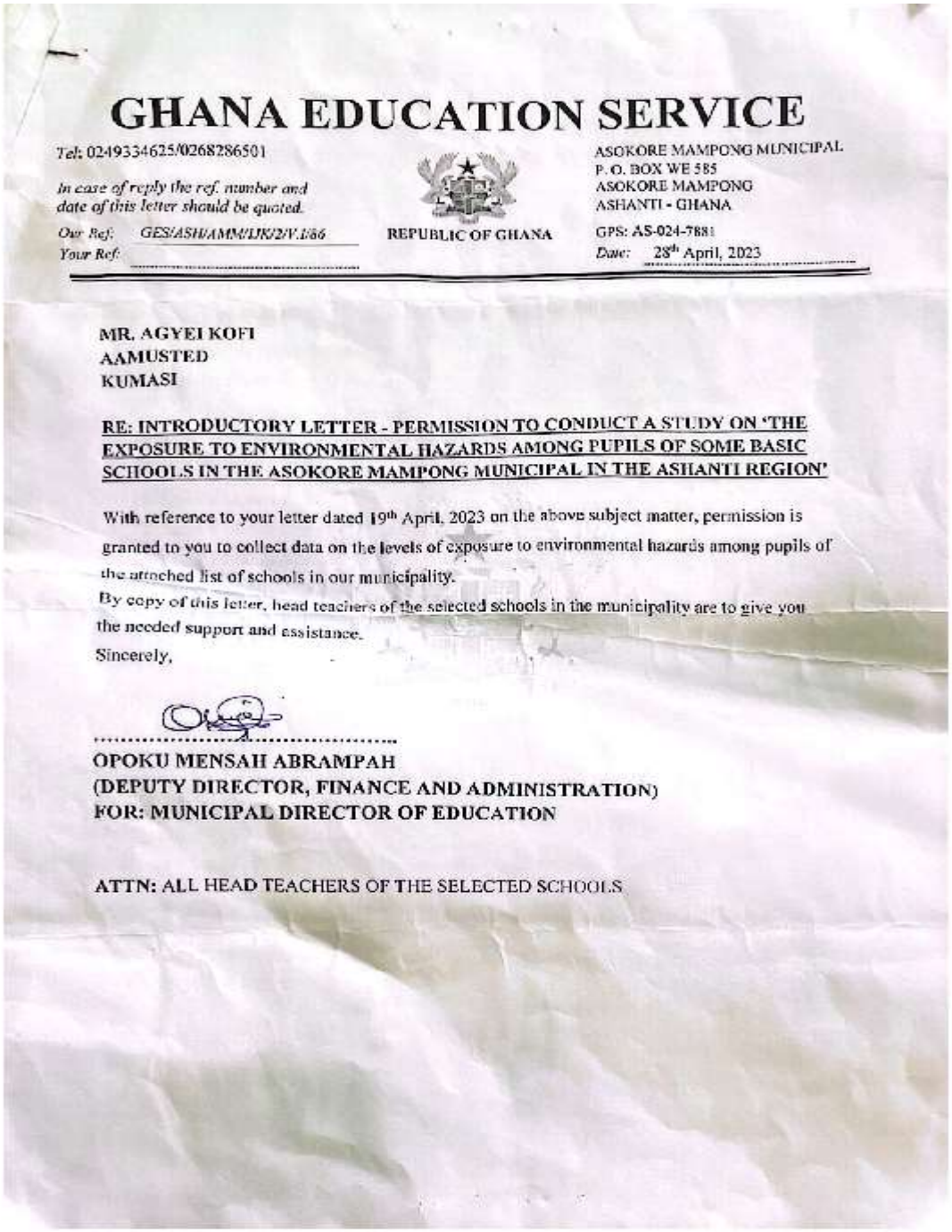
		Heart disease……8 Indigestion……...……9 Change in appetite……...10 Inability to concentrate……..…….....11	
Q42	Have you ever been trained on first aid?	Yes…….1 No……..……2 Respondent doesn't answer……88	

Health risks of hazard exposures and medical conditions			
Q43	If there is an injury, do you seek at your school?	Yes…….……1 No…….…….2 Don't know……...…3	
Q44	Is there case of a student knocked by a vehicle and was sent to the hospital?	Yes……1 No…….2	
Q45	If yes, where do you seek health care from when you get sick or injury?	Hospital……..…..….1 Drug store……...…..2 Clinic…….3 Herbalist……..……..4 Other (specify) …….0	
Q46	If you seek health care, how often do you seek health care when you get	Always……..…1 Sometimes……..…2 Rarely……..99	

	injured or fall sick due to schooling?		
Q47	Have you ever fallen sick as a result of environmental hazards from your school?	Yes…….……...1 No……..…...2 Don't know…….…...…00	
Q48	If yes, what conditions do you suffer from?	irritations to the eyes…….1 infections……..2	
Q49	If you have ever fallen sick because of hazards from your school, which of the following conditions did you suffer?	Headache…….…….1 Waist Pains……...2 Back pain……..3 Eyes infections…….4 Skin rashes……5 Fracture…….6 Burns…….7 Other (specify) …….0	
Q50	How concerned about pupils' exposure to environmental hazards in the school?	Not concerned……..……1 Somewhat concerned…….……..2 Very concerned……3	
Q51	Do you think there should be more education about environmental	Yes……..…1 No……..…….2	

	hazards in the school's curriculum?		
Q52	What suggestions do you have for reducing pupils' exposure to environmental hazards within the school environment?	Health education…….……..…1 Building schools far away from highways…2 Providing adequate dustbins……..3 Providing adequate washrooms…….4	
Q53	Are there any specific areas within the school premises where you think environmental improvements are needed?	Waste management……..…….1 Air quality……..…..…….....2 Noise control……..……..3	

INTRODUCTORY LETTER



GHANA EDUCATION SERVICE

Tel: 0249334625/0268286501

In case of reply the ref. number and date of this letter should be quoted.

Our Ref: GES/ASH/AMM/LIK/2/V.1/86

Your Ref: .....

REPUBLIC OF GHANA

ASOKORE MAMPONG MUNICIPAL
P. O. BOX WE 585
ASOKORE MAMPONG
ASHANTI - GHANA

GPS: AS-024-7881

Date: 28th April, 2023

MR. AGYEI KOFI
AAMUSTED
KUMASI

RE: INTRODUCTORY LETTER - PERMISSION TO CONDUCT A STUDY ON 'THE EXPOSURE TO ENVIRONMENTAL HAZARDS AMONG PUPILS OF SOME BASIC SCHOOLS IN THE ASOKORE MAMPONG MUNICIPAL IN THE ASHANTI REGION'

With reference to your letter dated 19th April, 2023 on the above subject matter, permission is granted to you to collect data on the levels of exposure to environmental hazards among pupils of the attached list of schools in our municipality.

By copy of this letter, head teachers of the selected schools in the municipality are to give you the needed support and assistance.

Sincerely,

.....

OPOKU MENSAH ABRAMPAH
(DEPUTY DIRECTOR, FINANCE AND ADMINISTRATION)
FOR: MUNICIPAL DIRECTOR OF EDUCATION

ATTN: ALL HEAD TEACHERS OF THE SELECTED SCHOOLS