UNIVERSITY OF CAPE COAST

PERCEPTION OF TRADERS ON NOISE LEVELS AND ITS RELATED HEALTH EFFECTS IN THE KOTOKURABA MARKET, CAPE COAST, GHANA

JOE ADDAI APPIAH AKWASI

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BY

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JULY 2023

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my original research, and no part of it has been presented for another degree at this university or elsewhere.

Candidate's Signature …… Date …….

Name: Joe Addai Appiah Akwasi

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised per the guidelines on supervision of the thesis laid down by the University of Cape Coast.

Supervisor's Signature …… Date ……

Name: Dr. Thomas Kolawole Ojo

ABSTRACT

Noise pollution is primarily high in low- and middle-income countries in commercial areas, including Ghana. However, preventive measures are not well established because of insufficient knowledge of exposure and effect relationships. Noise pollution has become a significant concern for traders' health because it can cause auditory and non-auditory problems. The study investigated the perception of traders concerning noise levels and health-related issues in the Kotokuraba market, Cape Coast, Ghana. Three hundred and thirty-seven respondents were sampled for the study. Questionnaires, an Interview guide, Sound Level Meter, and a GPS device were employed for data collection. Descriptive analysis, thematic analysis, and spatial analysis were conducted. The results revealed that traders consider noise levels a nuisance. Factors such as age, gender, education level, working condition and income of traders were found to influence their sensitivity to noise pollution levels. Noise levels were discovered to be high on Sundays and in the afternoon, peaking at 97 dB (A), with daytime average noise levels exceeding the EPA recommended limit for commercial areas by 1 to 19 dB(A). The study also revealed that traders in the Kotokuraba market suffer from health problems such as noise-induced hearing loss, tinnitus, headaches, sleep disorders, and loss of concentration. Actions implemented to reduce noise pollution in the market were discovered to be unsuccessful. The study recommends that the Environmental Protection Agency and the Cape Coast Metropolitan Assembly enforce noise control regulations in the Kotokuraba market.

KEY WORDS

Noise

Noise Pollution

Decibels

Traders

Perceptions

Health Effects

Kotokuraba Market

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DEDICATION

To traders in the Kotokuraba market

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LIST OF ACRONYMS

KMA	Kumasi Metropolitan Assembly
CCMA	Cape Coast Metropolitan Assembly
MMDAs	Metropolitan, Municipal, and District Assemblies
GPS	Global Positioning System device
WHO	World Health Organization
EPA	Environmental Protection Agency
dB(A)	Decibels (A-weighting)
TTS	Temporal Threshold Shift
PTS	Persistent Threshold Shift
NIHL	Noise-Induced Hearing Loss
GSS	Ghana Statistical Service
KNUST	Kwame Nkrumah University of Science and Technology
CDC	Centre for Disease Control
IEC	The International Electrotechnical Commission
ISO	International Organization for Standardization
ICAO	International Civil Aviation Organization
OSHA	The Occupational Safety and Health Administration
HBM	Health Belief Model
SLM	Sound Level Meter
GLSS	Ghana Living Standard Survey
HPD	Hearing Protection Devices
NCCE	National Commission on Civic Education
LMICS	Low- and Middle-Income Countries
GDP	Gross Domestic Product
HMS	Herbal Medicine Sellers

CHAPTER ONE

INTRODUCTION

Background of the Study

Environmental noise pollution has been defined as including undesirable or harmful noise in the atmosphere and is often created by human activities (Stansfeld, Haines & Brown, 2000). Some studies recently indicate that noise pollution affects not only high-income countries such as the USA, Canada, and Japan but also has an imprint on low- and middle-income countries such as Nigeria, Kenya, and Ghana. Noise has affected about 70% of the world's population in Low- and Middle-income countries (Mehdi, Kim, Seong, & Arsalan, 2011).

About 430 million people worldwide had hearing loss in 2019, expected to double by 2050 (Chadha & Cieza,2017; Olusanya, Davis, & Hoffman, 2019; WHO, 2021). Exposure to sound with intensity over 85 decibels(A-weighting) is known to cause Noise-induced hearing loss in adults, with a prevalence of 12% to 19% among US workers (Kerns, Masterson, Themann & Calvert, 2018), 15% to 34% in Canada (Feder, Michaud, McNamee, Fitzpatrick, Davies & Leroux, 2017), and 10% in Japan (WHO, 2018). In Kolhapur, India, transport-related noise is one of the most prevalent and growing pollutants. However, the lowest priority is managing noise in Kolhapur (Mangalekar, Jadhav & Raut, 2012). A survey published by Eurobarometer in 2010 showed that 80% of Europeans believed noise significantly affects human health to some extent (Cobzeanu et al., 2019). Using strategies and guidelines, the European Union has provided management tools for reducing noise pollution in urban planning. As a result, each member of the Union has devised its directives to solve noise

pollution at the local and national levels. Most common suggestions target high-priority noise areas and where mitigation actions are necessary (Fasolino, Grimaldi, Zarra & Naddeo, 2016).

In Africa, noise has become a problem because of rapid industrialization, population increase, and urbanization (Essandoh & Armah, 2011; Agyapong & Ojo, 2018). In Kenya and Nigeria, hearing loss from noise exposure in the community has become an issue of concern, with behavioural and psychological effects on people (Asuquo, Onuu & Asuquo, 2009). For example, Nairobi, the capital city of Kenya, is plagued with disturbing noise from loud music from vehicles, which puts passengers and city dwellers at risk of developing health problems such as hearing loss, sleep disorder, and social and behavioural disorders (Onyango, Kanali & Kaluli, 2015). In Nigeria, sound from advertisements, musical instruments, and the automobile has become a wellspring of noise pollution in the Ibadan Metropolis, which has led to numerous chronic effects on its victims, including headaches, fatigue, communication, behavioural problems, elevated blood pressure, and stress level (Ogar *et al*., 2020). Also, about 33 % of people living in Calabar, Nigeria, experienced hearing problems (Asuquo *et al.*, 2009). Noise pollution is widespread in Nigeria's expanding cities, such as Calabar, Jos, and Ibadan, where ineffective controls are exercised (Asuquo *et al.*, 2009; Ogar *et al.*, 2020; Maton *et al.*, 2021).

Ghana's Environmental Protection Agency (EPA) regards noise pollution as an environmental danger next to air and water pollution (EPA, 2008). In Ghana, the EPA receives noise complaints almost daily. As per the 2011 Annual Report of the EPA, noise accounts for 71% of all complaints (EPA,

2011). Because of the country's alarming noise pollution, the EPA has jingles on radio stations to educate people about noise reduction. Every year, the EPA celebrates International Noise Awareness Day every last Wednesday of April, during which programs are launched to educate the masses about the adverse consequences of noise.

Table 1: Ghana EPA guidelines on ambient noise levels

Zone	Description of the area of Noise Reception	Permissible Noise Level (dB(A))	
		Day 06:00-22:00	Night 22:00-06:00
A	Residential areas with negligible or infrequent transportation	55	48
B1	Educational (school) and health (hospital) facilities	55	50
B2	Area with some commercial or light industry	60	55
C1	Area with some light industry, places of entertainment or public assembly and place of worship like churches and mosques	65	60
C2	Predominantly commercial areas	75	65
D	Light industrial areas	70	60
E	Predominantly heavy industrial areas	70	70

Source: EPA Ghana (EPA, 2008)

Noise is considered an offence under the Criminal Offense Act 792 of 2009 under the 1992 constitution. Act 792 specifies that individuals who make unauthorized noise between eight and six o'clock at night should be fined above Gh¢20.00. Also, there is a noise by-law in various MMDAs to regulate noise in their communities. For instance, the Tema West Municipal Assembly in 2021 fined the Head Pastor of God's Shield Gospel Ministry Gh₵ 600- or three-months imprisonment with hard labour if he failed to pay for making loud noise during religious service to the annoyance of residents in the neighbourhood (Kamasah, 2021).

Noise varies depending on duration, range, intensity, and distance from the noise source (Hildebrand, 2009). Excessive noise can trigger a startle

response in people, disrupt their sleep, induce physiological stress and cause hearing loss (Hansen & Wei, 2014; Knudson & Melcher, 2016; Hahad, Prochaska, Daiber & Muenzel, 2019). Noise has auditory and non-auditory effects on people (Rueter, 2010). Noise levels beyond 85dB with an average exposure of 8 hours or 100dB for more than 15 minutes may cause hearing loss and other health problems (Occupational Safety and Health Administration, 1910). Noise impairs the body both physically and mentally. Auditory discomfort and hearing loss are two auditory impacts of noise exposure.

Noise-induced hearing loss usually develops over time. It can take time before it becomes visible. Early warning indicators include tinnitus and impaired hearing. Tinnitus is so common in India that 74.2 % of Ahmedabad inhabitants suffer (Goswami & Swain, 2017). Temporary Threshold Shift (TTS) develops when a person is subjected to extreme noise levels for a short period. After a few hours in a calm environment, hearing can be restored. PTS (Persistent Threshold Shift) is a permanent hearing loss after months or years of exposure to loud noise. The harm accumulates until it impacts the individual's daily lifestyle. It cannot be reversed (Rueter, 2010), and according to Chiras (2001), persons consistently exposed to noise levels as low as 55dB might develop PTS.

The other effects of noise exposure are physiological and psychological impacts (Wright, Peters, Ettinger, Kuipers, & Kumari, 2014). Some of these changes include sleep disturbances to chronic weariness. Noise is also connected to several diseases, including headaches, neuroses, and seizures. As a result, conversation, attention, capacity to study, relaxation, and leisure are all impacted (Smith, 1989; Moszynski, 2011). Noise can damage growing fetuses

and prevent the formation of the central nervous system in unborn babies, according to Murthy (2008). It also causes dilatation of the eye pupil and poor eyesight and colour vision. Noise also causes tachycardia (Berglund, Lindvall & Schwela, 1999; Sobotova, Jurkovicova, Stefanikova, Sevcikova, & Aghova, 2010)

The concern is whether people have adapted their actions to minimize the health impacts caused by noise emissions. Most pollution-related preventive behaviour studies link these activities to objective emission calculations. However, such an approach overlooks the reality that avoiding behaviour requires environmental awareness about emissions and risks (Egondi *et al*., 2013). Egondi *et al.* (2013) further assert that information concerning noise pollution is used in making decisions on behavioural change, environmental awareness, and understanding. Therefore, the likelihood of illness regarding pollution occurring is tied to the behaviour and perception of individuals (Li, Folmer & Xue, 2016). Another significant reason for individual's opinions and experiences instead of relying on objective evidence is that experimental studies have shown that people tend to misjudge and react differently to noise pressure levels (Ji, Koo & Kim, 2016; Vandasova, Vencálek, & Puklová et al., 2016; Sari, Utami & Sarwono, 2018; Nowak & Kokowski, 2019).

Noise pollution, as indicated above, has both health and psychological effects on urban dwellers, primarily in commercial, industrial and residential areas, mainly to noise from commercial activities and religious activities (Braj & Jain, 1995; Zakpala, Armah, Sackey, & Pabi, 2014). However, environmental noise control is difficult due to the lack of data regarding the human and dose-

effect relationship, as it affects the long-term health of residents as compared to other forms of pollution.

Statement of the Problem

Noise pollution is not only an issue in affluent nations and a problem in the developing world, such as Ghana and Nigeria (Mehdi, Kim, Seong, & Arsalan, 2011). Furthermore, 70 % of people in developing countries live and work in cities (Cohen,2006; Mehdi, Kim, Seong & Arsalan, 2011). Many of these city dwellers, particularly those in commercial districts, are exposed to noise pollution's physiological and psychological impacts.

In Nigeria, Olusanya, Bamigboye and Somefun (2012) discovered that operations in commercial areas, especially market mills, are associated with high workplace noise levels during working hours. Ugbebor et al. (2017) also conducted a noise assessment at the oil mill market and Eleme Junction in Port Harcourt, Rivers State, Nigeria. They reported a noise level of 108.6 dB for East-West Road, Eleme Junction has a cumulative noise level of 105.4 dB, and Elelenwo by the Oil Mill Market had a noise level of 103.8 dB (A). The Oil Mill Market had a cumulative noise level of 108.2 dB(A), indicating a high noise pollution level in the market area. The study identified mobile sellers, herbal medicine sellers, telecom equipment sellers, vehicle horns and sirens, grinding machines, and generators as noise sources in the market. They discovered that noise pollution in the Oil Mill market and its environs could harm the health of traders and the public (Ugbebor et al., 2017). Oyedepo and Saadu (2010) also assessed and studied the noise pollution level in Ilorin to determine the level of noise pollution and its causes. They discovered that the highest levels of noise pollution were found at road intersections, followed by shopping malls. They

also discovered that the noise level in the municipality of Ilorin exceeded the permissible level of 82 dB in 30 out of 42 measurement points, with values from 1 to 27 dB.

Several studies, such as Boateng and Amedofu (2004), Abankwa (2014) and Essandor and Armah (2011), have also assessed noise pollution in Ghana. Specifically, Boateng and Amedofu (2004) also reported NIHL among Kumasi's local sawmills, printing press, and corn mill workers. Sowah, Alfred, Carboo and Adaboh (2014) measured noise levels in Teshie-Nungua Schools, with the study located in a mixed commercial and semi-commercial area. They reported relatively high daily noise levels, with elevated commercial activities recording over 75 dB(A). Kitcher, Ocansey, Abaidoo and Atule (2014) also observed a prevalence of hearing loss in market mill workers in Accra. A study conducted by Abankwa (2014) in Kumasi indicated that bus terminals in Kejetia have noise levels exceeding 70 dB(A). Abankwa, Agyemang and Tawiah (2017) also assessed Kumasi's industrial and commercial sector noise effects. They measured daytime noise levels at Kejetia, Anloga, Kwame Nkrumah University of Science and Technology (KNUST) Junction bus stations and two timber companies. They reported 78.8 dB, 72.1 dB, and 78.3 dB daytime noise levels. The daytime noise levels recorded by the two timber companies, A and B, were 84.1 dB and 82.4 dB, respectively. Comparing the results with the Ghana Environmental Protection Agency (EPA) standard, they discovered that the daytime noise levels of the three bus stations are above the permissible level by 8.8 dB, 2.1 dB, and 8.3dB, respectively. The daytime noise levels from the timber industries were also 14.1 dB and 12.4 dB above the allowable level, respectively (Abankwa et al., 2017). Also, according to a study in the main

commercial centres on Cape Coast, noise levels in commercial centres exceeded both limits set by the EPA for 70dB for daytime noise and 65dB by 1 to 15dB (Essandor & Armah,2011).

These existing studies primarily concentrate on measuring and assessing noise levels in certain areas and their potential to cause hearing loss. However, there is a significant gap in research regarding understanding the experiences and opinions of traders exposed to such noise levels. This oversight is crucial because the impact of noise on individuals can vary significantly due to differences in vulnerability thresholds.

Moreover, the noise pollution situation in commercial areas in Cape Coast Metropolis is not different from that of many urban areas. The increase in commercial activities in the city because of its expansion and industrialization has increased noise pollution in Kotokuraba, its main commercial area. Urban development projects such as market development have been observed to alter noise levels (Robinson et al., 2012; Geng, Bao & Liang, 2015). According to Tong and Kang (2021), urban development patterns can affect noise levels in urban areas leading to more noise complaints. Recent reports confirmed an expansion of the Kotokuraba market (Nkwalor, 2016; Asante, 2020), which can influence the level of noise in the market. Given the gaps above, this study aims to measure and investigate the effects of noise pollution on the health of traders in the Kotokuraba market.

Purpose of the Study

The study investigated traders' perceptions of noise levels and health-related issues in the Kotokuraba market, Cape Coast, Ghana.

Objectives of the Study

Specifically, the study sought to achieve the following objectives;

1. Identify noise exposure zones in the Kotokuraba market,
2. Examine the perception of traders about noise pollution in the Kotokuraba market,
3. Analyse the relationship between traders' sociodemographic characteristics and noise sensitivity in the Kotokuraba market,
4. Analyse the perception of traders on health issues resulting from noise exposure in the Kotokuraba market, and
5. Examine the actions taken to manage noise in the Kotokuraba market.

Research Questions

The research questions that guided the study are;

1. Where is the noise exposure zones in the Kotokuraba market?
2. How do traders perceive noise in the Kotokuraba market?
3. What is the relationship between traders' sociodemographic characteristics and noise sensitivity in the Kotokuraba market?
4. How does the perception of noise pollution affect the health of traders in the Kotokuraba market? and
5. What are the ways of managing noise levels in the Kotokuraba market?

Significance of the Study

This study can help raise public awareness concerning the causes, effects, and policies regarding noise pollution in the metropolis. The study will shed light on this pressing issue, as it aims to inform and educate the general public about the various sources of noise pollution, the detrimental effects it can have on human health and well-being, and the necessary steps that can be taken

to mitigate and control it. As people become more cognizant of the negative consequences of noise pollution, they are likely to adopt responsible practices and support policies to reduce noise levels in their surroundings. This behavioural shift can contribute significantly to the overall reduction of noise pollution in the metropolis.

Moreover, the study's findings and insights will contribute to the existing literature on noise pollution. It will serve as valuable reference material for students, researchers, and professionals in various fields related to environmental science, public health, urban planning, and policy development. This research will provide a comprehensive overview of the causes, effects, and potential solutions for noise pollution, offering a solid foundation for further exploration and investigation into this critical issue.

Delimitation of the Study

This study focuses on quantifying noise and obtaining the perception of traders in the Kotokuraba market about noise levels and its implication for their health. Significantly, the study's goal is to investigate traders' perceptions of noise, analyze the levels of noise created, and determine if the noise produced is within Ghana's EPA's legal limits. Additionally, the noise maps highlight the research area's exposure zones. The focused area was the Kotokuraba market. The study covered market areas, roads, and passenger loading stations. These areas are within the market and were selected due to noise density in those areas.

Definition of Terms

In this study,

Noise is an unwanted sound.

Noise pollution includes undesirable or harmful noise in the atmosphere and is often created by human activities.

Perception is how something is regarded, understood, or interpreted.

Traders are usually people who buy and sell items. This study refers to individuals in the market who trade in the shops and those selling on table-tops.

Vulnerability refers to being susceptible to the risk of being injured by noise levels, either physically or emotionally.

Barriers mean precautions to safeguard oneself from the impacts of noise pollution.

Organization of the Study

This study is in five chapters. The First Chapter introduces the study, which provides the study's background, problem statement, objectives and questions, the scope of the investigation, study limitations, and study organization. The Second Chapter is devoted to the literature review, including a conceptual foundation for the thesis. The Methodology section of Chapter Three describes the research region and the various data-gathering methods used in the study. The Fourth Chapter examines and discusses the data collection outcomes. Chapter Five offers the study's summary, conclusions, and suggestions for future research and policymakers.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter reviewed the literature on noise pollution as postulated by scholars in different academic fields. Issues examined include the overview of noise pollution, the effects, perception of noise, measurement of noise, and preventive actions. The chapter also looks at the conceptual model employed in this study.

Noise and Sound

Any vibrating body produces a sound typically transmitted only as a longitudinal wave movement in the air (Berglund & Lindvall, 1995). Physically, sound usually induces physiological responses to the ear and auditory pathways. As a product of biological processes in the auditory portion of the brain, sound is a sensory perception emanating from the brain. It is challenging to distinguish noise from sound, but the distinction lies with the human listener. Noise is simply an unwanted sound. Noise can affect people's well-being and health in some instances.

Physical criteria should not characterize noise but the functionality of noise as it affects an individual's physiological and psychological well-being (Melnick, 1979). A sound's physical magnitude is provided by its amplitude and is called loudness as it is subjectively perceived. Loudness depends primarily on the amount, rate, and length of exposure, so laboratory experiment information cannot always be associated with environmental conditions (Berglund & Lindvall, 1995). As a result of the complexity of the human hearing system, objective estimations are not always in line with subjective outcomes.

Decibels (dB) and Hertz (Hz) measure sound levels and frequency. A slight increase in decibels can signify an astonishing rise in energy. The human ear perceives 1dB of sound as not audible. Noise levels at 5 dB are noticeable; above 20dB is a loudness level (Claridge, 2013). The human ear does not equally sense the frequency and pressure of sound (Fletcher & Munson, 1933), which means that what a person may perceive as noise is not always the same as what is measured on the decibel scale. Sounds with high frequencies are more damaging to the ear than sounds of low frequencies. The ability of the ear to recover during quiet periods makes low-frequency noises much less intrusive to the ear than repeated sounds. However, their unpredictability means weird and impulsive sounds are more disruptive (Suter, 1991).

Sources of Noise

There are many sources of noise pollution, including road traffic, aircraft, rail, industry, manufacturing, consumer goods, and other sources. Therefore, knowing where the noise comes from is essential to understand noise pollution better.

Road Traffic Noise

Road traffic is the primary source of noise pollution in urban centres (Grubesa & Suhanek, 2020). Noise generated from vehicles is from the engines, exhaust and tire-ground contact. The other elements of traffic noise are significant factors. The noise produced by a vehicle's exhaust and the engine is the most common vehicular noise, mainly in cars made in Japan. Moreover, the noise produced by vehicles during acceleration is more than what the car has during speeding up to levels higher than 20 dB (Mao & Koorey, 2010; Asensio et al., 2021).

Alongside cars, buses, trucks, and motorcycles also significantly impact traffic noise. One reason for trucks and buses is their automobile diesel engines. Diesel engine automobiles produce high airborne vibration emissions due to ignition at a high pressure contributing to traffic noise. Motorcycles are known to be partially noisy (72-83dB), whereas cars generate noise levels within 67-75 decibels (Abankwa, 2014; Asensio et al., 2021).

Retail Environment

In urban centres, music from retailers forms part of how we interact with various social environments. Music plays an essential role in consumerism. Traders play music in shops, bars, and restaurants, affecting consumer spending. Consumer behaviour often appears to be influenced in retail environments in the presence of music. According to Mattila and Wirtz (2001), music played in shops influences consumer impulse buying behaviour. The most exciting part is the trend of video screens in shops, which adds to the in-store audio mix, serving as an additional distraction to consumers. Music from retail spaces attracts positive sensory responses from shoppers. Music from vendors attracts consumers to purchase items from their shops. Sounds from electronic shops, compact disk/cassette sellers, and other supermarkets form part of the marketing strategy to attract customers.

Churches/ Preachers

During worship, preachers in the market may be generating noise above the permissible level. With the increasing number of churches and preachers in the market, the degree of noise they cause is not just on Sundays. However, a weekly basis during their activities may be unbearable to the human ear. Music from churches and preachers at the market is loud and could threaten humans.

Herbal Medicine Sellers

According to Van Andel, Myren and Van Onselen (2012), Ghana herbal medicine is sold predominantly in significant markets in Ghana, such as Kejetia, Makola, Kaneshie, Cape Coast, and other major market centres in the country. Major brands such as "Taabea" and "Givers Koo Capsules" are sold in vehicles using public address systems to advertise their drugs in market centres. Most herbal medicine sellers play loud, non-stop music to the discomfort of others. According to Bediako-Akoto (2018), herbal medicine sellers are one of the leading culprits of noise making in commercial areas in Ghana. The sound produced by these herbal medicine sellers' vehicles is sometimes unbearable and can threaten traders in the market.

Effects of Noise on Health

According to the WHO (2009), it is difficult to measure noise's impact on quality of life due to its diverse effects. The effects of noise are complex, subtle, and indirect, including changes in behaviour and social indicators (Goines & Hagler, 2007; Zakpala et al., 2014). However, studies have shown that long-term noise exposure can cause various health problems such as hearing loss, stress, poor concentration, production issues, communication difficulties, and more severe cardiovascular diseases (Sliwinska-Kowalska & Davis, 2012; Kurabi, Keithley, Housley, Ryan, & Wong, 2017).

According to Ugbebor, Yorkor and Nwogu (2017), market noise levels cause health problems for traders. He further explained that the health effects extend to noise-induced hearing loss and other non-auditory effects of noise. Ogunseye, Jibiri, and Akanni (2018) also revealed similar results of traders having health-related issues because of continuous noise exposure. Their

findings further showed noise's harmful effects on individuals' health when continuously exposed. Some of the identified impacts of noise exposure on health are explained below.

Noise-induced Hearing Loss (NIHL)

Hearing loss caused by noise pollution is the most common health problem (Rabinowitz, Slade, Galusha, Dixon-Ernst, & Cullen, 2006). Prolonged exposure to intense noise with sound pressure levels above 75-85 dB can damage the sensitive structure of the inner ear and cause hearing loss, also known as Noise-Induced Hearing Loss (NIHL).

Based on the CDC study of hearing tests between 2011 and 2012, NIHL affects about 24% of adults and about 17% of teens, which indicates that NIHL affects individuals regardless of age (Sliwinska-Kowalska & Davis, 2012). NHIL can take a long time before someone notices it or can be immediate. As a result, one can experience temporary or permanent hearing loss in one or both ears. It is common for the consequences to last the rest of the person's life.

Headache

Higher noise levels can cause headaches. In headache research, 79% of participants exposed to 50 decibels of white noise got a headache, and 82% said the headache was the same or comparable to their regular headaches (Kim et al., 2017). Increased noise levels in the workplace can also cause headaches (Martin, Reece & Forsyth, 2006). Ugbebor et al. (2017) discovered a greater prevalence of headaches due to higher noise levels in market areas. Moreover, individuals who suffer from underlying headaches tend to be more sensitive to loud noise, which can often trigger them (Ishikawa, Tatsumoto, Maki, Mitsui, Hasegawa, & Hirata, 2019).

Tinnitus

From people's experience, Tinnitus is a ringing sound in the ears (Asuquo et al., 2009). However, it can also sound like screaming, clicking, hissing, or buzzing. It can be quiet or boisterous, high or low in pitch. Often, these sounds signify early signs of hearing loss when one experiences it. According to Flores et al. (2016), an individual exposed to higher noise levels is more likely to show signs of tinnitus and hearing loss. Wang et al. (2020) also observed that people with Tinnitus might experience noise-induced hearing loss.

Even though Tinnitus is a complicated disorder, exposure to loud noise, stress, anxiety, antibiotics, and inflammatory drugs are some of the known causes (Lockwood, Salvi & Burkard, 2002; Mahmoudian-Sani, Hashemzadeh-Chaleshtori, Asadi-Samani, & Luther, 2017, WHO, 2018). Ugbebor et al. (2017) observed that market traders often develop Tinnitus due to their exposure to high noise pollution.

Physiological Effects of Noise

Noise pollution can have physiological consequences on people (Kanade, 2019). People suffer from blood pressure related to the changing heart-beat rate due to high noise levels (Tsaloglidou et al., 2015). Noise also causes nervous system disorders, respiratory problems, cardiovascular problems, and other physical problems relating to health (Anees, Qasin & Bashir, 2017).

Psychological Effects of Noise

The psychological effects of noise exposure in people often appear gradually. They include aggressive behaviour, mental exhaustion, increased isolation, physical harm, anger, and lack of concentration (Nassiri et al.,2013;

Hammer, Swinburn & Neitzel, 2014; Saedpanah, Saedpanah & Salari, 2017; Alimohammadi, Kanrash, Abolaghasemi, Afrazandeh, & Rahmani, 2018). One needs to consider the noise level, individual, and reaction to understand the psychological impact of noise on an individual. Only by looking at these can the psychological effects be fully understood. Some of the psychological consequences of noise exposure are as follows.

Interference with Human Performance, Concentration, and Behaviour

According to Nassiri et al. (2013), noise reduces human performance, especially high-pressure noise. High noise levels affect performance negatively by affecting an individual's logical and verbal reasoning. Errett, Bowden, Choiniere and Wang (2006) observe that scores of individuals typing, math, and verbal reasoning tend to decrease when they are more annoyed by noise. Nassiri et al. (2013) observed similar results, which indicated a decline in factory workers' level of performance when affected by high noise levels, leading to several errors.

Noise as a sensory input raises stress, which reduces an individual's attention span (Jafari, Khosrowabadi, Khodakarim, & Mohammadian, 2019). Smith (2012) considers the characteristics of exposed noise to be essential in determining how it affects mental performance. Thus, noise can alter cognitive performance based on features such as pitch and duration. Hockey (1970) observed that noise levels above 70 dB(A) reduce one's concentration ability. Environmental noise at these levels and above is known to cause stress which negatively affects the cognitive performance of individuals in areas such as attention, working memory, and episodic recall (Wright, Peters, Ettinger, Kuipers & Kumari, 2014).

Lastly, exposure to noise in the work environment can lead to tension and inappropriate behaviour, such as aggression (Alimohammadi et al., 2018). According to Stansfield and Crombie (2011), extreme noise levels can lead to a nervous breakdown in an individual, causing an emotional outburst of anger expressed by the affected person. According to Constantinou et al. (2011) and Saedpanah et al. (2017), noise levels above 55 dB are mental stressors and may cause irritability and aggression in people.

Physical Wellbeing, Nuisance, and Annoyance

Sound activities that give rise to frustration undermine people's wellbeing. Because of the acoustic characteristics of noise, it can directly or indirectly have a startle or defensive response on man. Direct effects can be due to the information characteristics of the noise source, while indirect effects can be the impairment of people's psychological wellbeing during relaxation.

Higher noise levels, especially in commercial areas, are seen as a nuisance or annoyance. Many traders view noise in the market as a nuisance to them. Many authors have confirmed that traders consider noise levels from shops and vehicles in the market a hassle (Oyedepo & Saadu, 2010; Essandoh & Armah, 2011).

Annoyance can also result from being compelled to close the window or raise one's voice to reduce or drown the music from the outdoors (Rohrmann, Finke & Guski, 1980). People's reactions show the extent of continuous annoyance because of noise. The degree of annoyance and sound pressure or level may always differ based on the individual (Jansen & Gros, 1986). The noise level can annoy (Abankwa, 2014). For example, loud noise is usually

more stimulating than quiet noise. Thus, two noises of similar intensity can also cause varying annoyance.

Continuous sounds are less noisy than random sounds (Bragdon, 1972). Noise is more distracting with a higher pitch than those with a lower pitch. Furthermore, discomfort depends on the regularity of the noise. Noises of pitch and intensity that remain constant (Bragdon, 1972) and intense (Molino, 1979) are less disruptive than noises of pitch or intensity that change. Another cause of annoyance tends to be the source of the noise. For instance, the noise created by road traffic seems less distracting than the similarly extreme noise produced by aircraft (Kryter, 1970). As a result, much of the study of noise-induced annoyance focuses on aircraft noise (Miller, 1979; Abel, 1990).

Sleep Disturbance

It is common knowledge that sleep can be disturbed by noise. For example, a study published by McKennell in 1963 found that aircraft noise had awakened 40% of London residents interviewed. Because air traffic has undoubtedly risen dramatically since then, many more individuals may be affected (McKennell, 1963). However, disturbance thresholds vary widely across individuals. For example, levels as low as 35 dB are disturbed by some individuals, while others can sleep at 90 dB, and an individual's threshold also depends on the stimulus. For example, people sleep with 60 dB of aircraft noise, but 40dB of road traffic noise can affect their sleep (Bugliarello, Alexandre, Barnes & Wakstein., 1976). Sleep disruption is associated with declining health, and rising evidence points to exposure to noise (Halperin, 2014). It is still unclear whether these noise-induced sleep disruptions correlate with exposure to ambient noise and adverse health outcomes. However, recent studies suggest

that environmental noise can have serious health consequences on an individual when it disturbs sleep and tends to influence the biological system (Halperin, 2014; Madhu & Deepak, 2020).

Control of Noise Pollution

Eliminating noise pollution in market centres is impossible, but various methods can reduce it to an acceptable level. Harrison (1974) outlined some measures to help deal with noise pollution, such as reducing impact factors, controlling noise at the source and transmission path, and providing mufflers and silencers. Other measures proffered to address noise pollution are;

Restriction on the Use of Loudspeakers/Public Address Systems

Public address systems should only be allowed in the market after obtaining permission. Moreover, there should be dedicated times when these can be used and closed premises for communication and special occasions. Authorities should confiscate public address systems and loudspeakers if they produce sounds beyond acceptable limits (Poddar, 2017).

Enforcement of Noise Pollution Control Measures and Regulation

The noise levels in the market should not exceed the ambient noise standards specified by the EPA for 75dB for daytime and 65 for night time. The authorities should enforce noise control measures, especially in commercial areas. In addition, the EPA should exercise its legal right under Act 490 to ensure that all individuals who abuse the directive on noise control are punished (EPA, 1994).

Ban and Fines

Individuals who violate the noise control measures should be fined or banned by the authorities in charge of the market. For instance, the Tema West

Municipal Assembly charges offenders a fine of Gh ¢600.00 for breaking the bye-laws on noise pollution (Kamasah, 2022).

Regulation of Road Traffic

Controlling noise in commercial areas can be done by limiting vehicular activities on the roads in markets during the daytime, managing traffic, and ensuring the smooth flow of vehicles to prevent traffic congestion in the market, which produces a loud noise. Regulating road traffic help reduce noise in the market since it is one of the significant causes of noise pollution (Essandoh & Armah, 2011; Agyapong & Ojo, 2018).

Public Education

Educating the traders and the general public on the exposure, effects, and regulations of noise pollution in the market can help reduce pollution levels. Studies by Zakpala et al. (2014), Halperin (2014), and Ugbebor et al. (2017) recommend counselling and educating the public on the detrimental effects of noise pollution by the state and local Governments through awareness campaigns will help traders protect themselves and detect signs of noise-related illness.

Perception of Noise

Just like annoyance or nuisance, the perception of noise is both a psychological and subjective phenomenon (Koprowska, Łaszkiewicz, Kronenberg, & Marcińczak, 2018). Perceptually, noise can cause nervous excitation and generate a mental image of sound when these sounds reach the human ear, as long as they are within detectable frequencies (Mendonça, 2012).

Many underlying actions determine how a person perceives noise, including adaptation, attention, and masking (Hede & Bullen, 1981). First,

people get used to noising over time, especially in a constant steady state of noise level (Hede & Bullen, 1981). Second, people adjust to predictable noises as long as they are not excessively high. For instance, when people move to a noisy area, they find it difficult to sleep, but with time, they adjust to the noise and can sleep while it continues. Third, when people become aware of a particular noise, they adapt. This attention process is also known as filtering out significant background noise. Finally, masking uses one noise to cancel the other. It usually happens when people use acceptable noise to mask other unwanted noise.

The last physical attribute of the perception of noise is sound amplitude (Hede & Bullen, 1981; Ishikawa et al., 2019). The greater the sound amplitude, the higher the frequency and how people perceive it. Noise levels are perceived differently by people due to characteristics of the auditory systems.

Factors Influencing People's Perception of Noise

When exposed to high noise levels, individuals do not always view themselves as significantly affected by noise (Miedema & Vos, 1998; Birk et al., 2011) due to the subjective nature of noise perception (Koprowska et al., 2018). However, its effects can be positive or negative on an individual based on the identified underlying factors. Human perception of ambient noise can vary depending on the underlying factor such as age, individual sensitivity, health conditions, socio-economic variables, and housing conditions (Kohlhuber, Mielck, Weiland, & Bolte, 2006; Miedema, 2007).

In general, females are more sensitive to environmental phenomena. According to a regional study in Finland, Canada, and Sweden, women are more susceptible to noise (Björk, Ardo, Stroh, Lovkvist, Ostergren, & Albin, 2006;

Michaud, 2015; Okokon, Turunen, Ung-Lanki, Vartiainen, Tiittanen & Lanki, 2015). Their sensitivity may be related to their high level of responsibility and its associated stress.

Middle-aged people are more prone to noise annoyance because of their higher sensitivity (Okokon et al., 2015). Education, income, and occupation can influence an individual's sensitivity to noise pollution. The sensitivity relates not only to these factors but also to one's behaviour towards noise avoidance.

Working conditions can affect an individual's perception of noise pollution. Individuals' satisfaction level regarding working and housing conditions forms how they perceive environmental noise pollution. Riedel, Scheiner, Müller, and Köckler (2014) indicated that this factor best explains the objective measurement of noise exposure and road traffic noise.

Noise Preventive Actions

People take different steps to protect themselves from noise pollution: wear earplugs, limit outdoor activities, enact legislation, create isolation, and noise barriers, control traffic, and increase public awareness (Berglund et al., 1999; Baboo, 2015). Taking these preventive barriers or steps helps protect their health from being harmed by noise, which resembles measures taken to avoid public health service pollution.

Theoretical Perspective of the Study

In this area, studies investigating factors influencing people's health-protective behaviours generated some well-recognized models to explain such behaviours, such as the Health Belief Model (HBM) (Rosenstock, 1974a, 1974b), Safety Motivation Theory (Rogers, 1975), and Planned Behaviour Theory (Ajzen, 1991).

Threat perception and behavioural assessment are representations of an individual's health behaviour studied in the HBM. Perceived vulnerability to disease or health difficulties and predicted severity of illness repercussions explain threat perception. There were two types of beliefs in behavioural evaluation: those regarding the benefits or efficacy of prescribed health activity and the cost or challenges to carrying out the habit. Furthermore, the concept argued that cues to action might activate healthy behaviour when an individual holds his moral beliefs. Triggers included psychological characteristics and social-demographic influences.

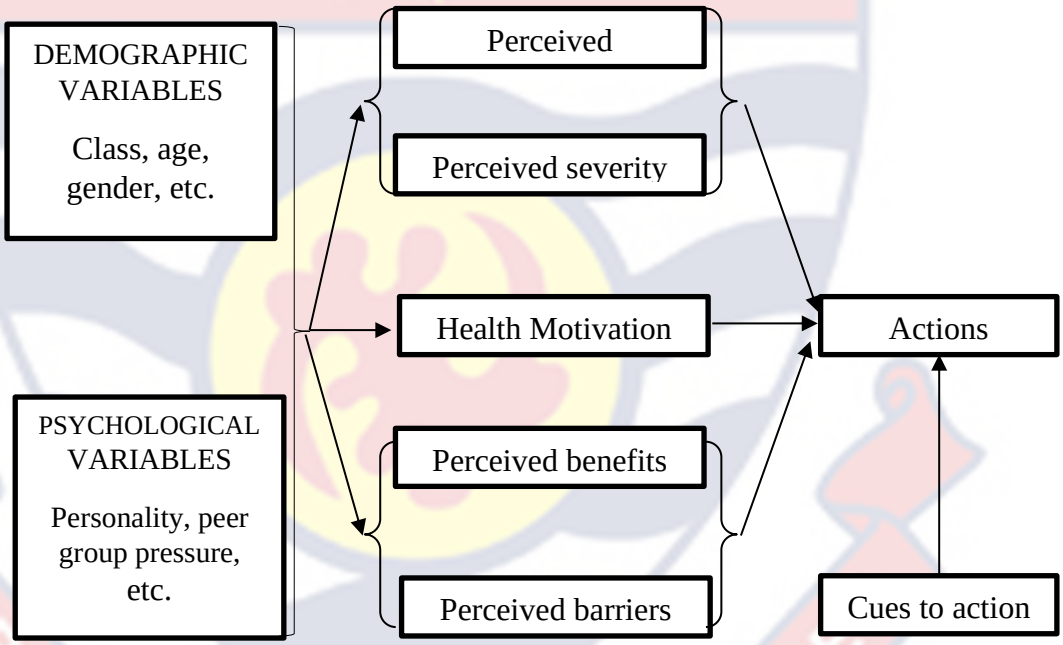

Figure 1: The Health Belief Model (HBM) (Rosenstock, 1974a, 1974b)

Moreover, in 1975, Rogers proposed the Safety Motivation Theory, which explains how people are motivated to act self-defensively in the face of a perceived health concern. The Safety Motivation theory contains several different structures. They have something to do with threat and coping assessments. The risk is related to the severity of the illness and the likelihood of contracting it. Self-efficacy, or confidence in one's ability to alter a related

health behaviour, was mirrored in coping and the effectiveness of understanding what to change. Assessing threat and response mechanisms is translated into behavioural intention and helps determine a person's actual behaviour in dealing with a threat.

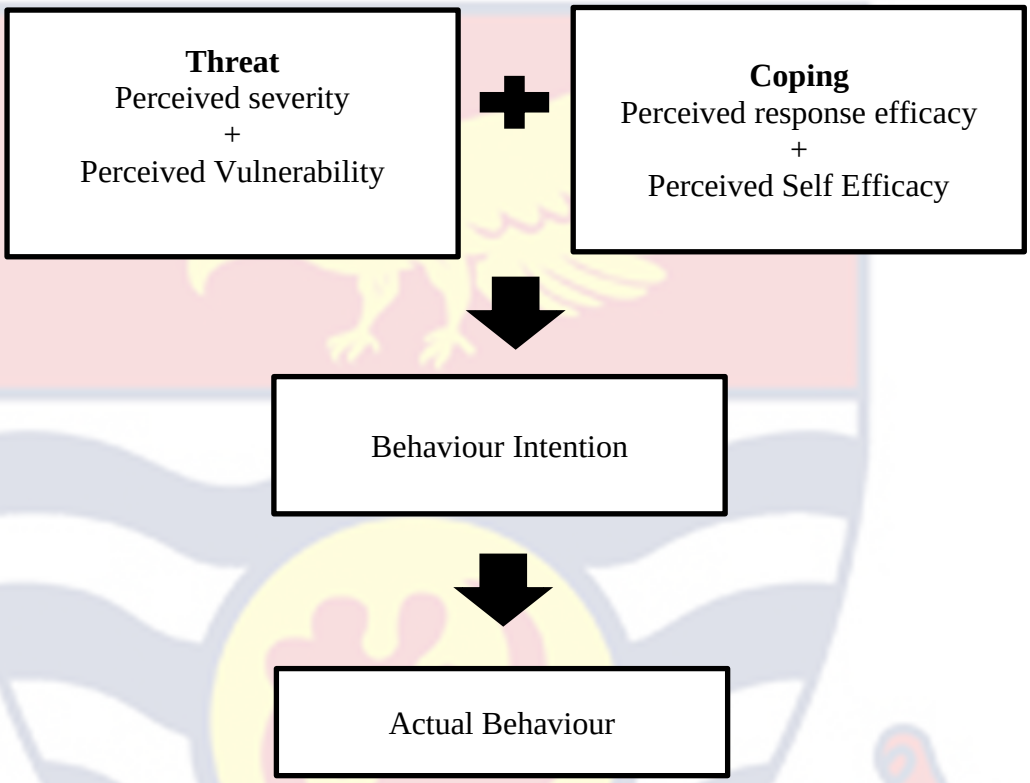

Figure 2: The Safety (Protection) Motivation theory (Rogers, 1975)

Lastly, there is the Planned Behaviour theory. The planned behavioural theory is a theory that suggests that behaviour is determined immediately by goals and, under certain conditions, by perceived behavioural control. Subjective norms, attitude towards conduct, and perceived behavioural control are the essential elements that usually determine a person's behavioural intent. Measuring the attitude based on the activity is necessary to predict attitude using intent. Subjective norms are the second predictor of behavioural intention. Subjective norms are decisions a person makes based on many people's opinions, which is essential to determining whether they should or should not

act on an issue. His perception, however, may or may not match what his significant others genuinely believe. Normative norms or attitudes influence Subjective norms and remind them to conform to a particular norm. Finally, perceived behavioural control is people's perceptions of how easy or difficult it is to do the desired activity.

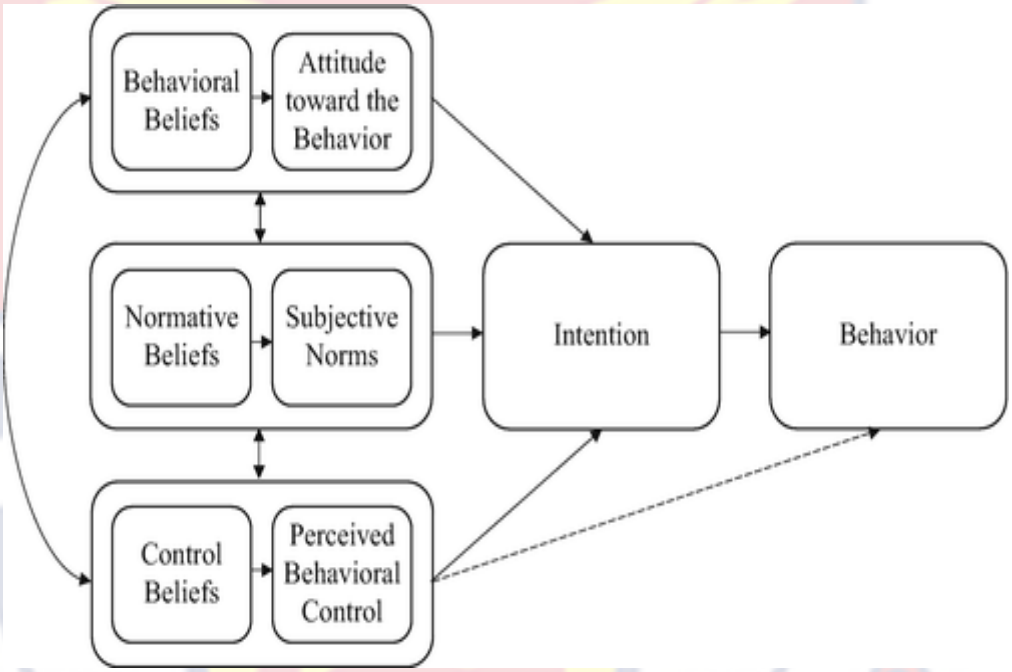

Figure 3: Theory of Planned Behaviour (Ajzen & Madden, 1986; Ajzen,1991*)*

Conceptual Model

The conceptual model is a graphical representation of the relationship between variables. The conceptual model comprises information from planned behavioural theories, health belief models, and safety motivation theories (Figure 4). These theories differ in formulation but share similarities in their attempts to capture the mechanism of cognitive weighting when deciding whether to act to protect one's health with three underlying components: risk, cost, and gain (Weinstein, 1993). Their explanation and linkages to the conceptual model are explained below.

The Theory of Planned Behaviour suggests that attitudes, subjective norms, and perceived behavioural control influence individuals' intentions. In the conceptual model, socio-demographic variables can affect perceived barriers, perceived effectiveness, and protective barriers. This implies that traders' attitudes, norms, and perceived control of noise levels can shape their perception of barriers and effectiveness related to noise pollution. Moreover, the Health Belief Model focuses on individuals' beliefs about health threats and the perceived benefits and hindrances of adopting health-promoting behaviours. In the model, perceived noise health effects are an outcome variable influenced by the measured noise pollution levels, perceived noise levels and vulnerability. This suggests that traders' beliefs about the health effects of noise pollution, their perception of noise levels, and their vulnerability can shape their overall perception of the health consequences of noise pollution. Furthermore, the Safety Motivational Theory suggests that individuals' safety-related behaviours are influenced by their motivation to avoid adverse outcomes and the presence of protective barriers. In the model, the perceived noise health effects influence protective barriers, indicating that traders' perceptions of the health consequences of noise pollution can affect their motivation to adopt protective measures.

In addition, the model includes knowledge and awareness of noise pollution as intervening variables. Socio-demographic variables influence traders' knowledge and awareness, which, in turn, affect perceived barriers and perceived effectiveness. This suggests that traders' knowledge and awareness about noise pollution and its health effects can mediate the relationship between socio-demographic variables and their perception of barriers and effectiveness.

Overall, these theories provide a comprehensive framework to understand the complex relationships between socio-demographic variables, knowledge and awareness, noise pollution, perceived health effects, perceived barriers and effectiveness, and protective barriers. Considering these theoretical perspectives, the model helps explain how various factors influence traders' behaviour regarding noise pollution and its health effects.

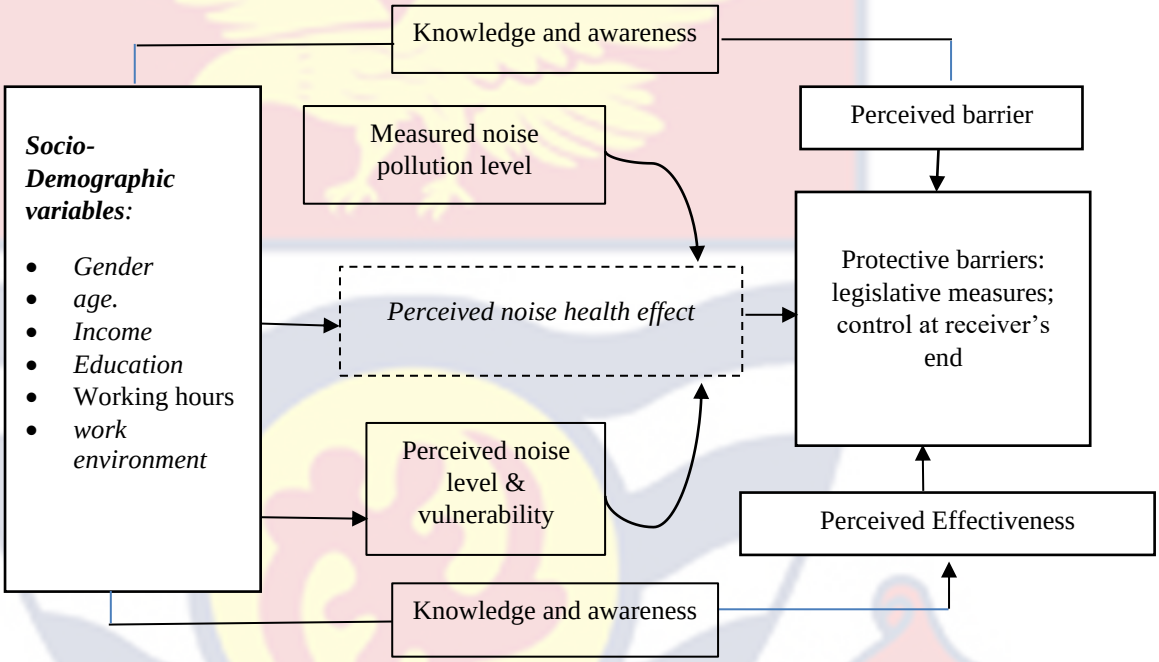

Figure 4: Conceptual model of the perception of noise pollution
Source: Adapted from Rosenstock (1974a:1974b); Rogers (1975); Ajzen and Madden (1986); Ajzen (1991).

Measurement of Noise

Various noise level measurement tools include a Sound Level meter, Integrated Sound Level Meter (ISLM), Noise Dosimeter, and Smartphones. However, this study used a Sound Level meter to measure noise.

Sound Level Meter (SLM)

Sound levels are usually measured using Sound Level Meter. It records noise levels from 26 dB onwards (Asfiati, Riky & Rajagukguk., 2020). The sound level meter comprises a microphone, amplifier, and signal processing.

The sound signal is converted into an electrical signal by the microphone. The electric microphone signal is shallow, so a preamplifier makes it stronger until the central processor processes it before displaying it on the monitor. The processing of signals requires the application of frequency and time weightings to the signal as specified by international standards such as IEC 61672-1, which are in sound level meters.

Measurement using SLM

Using A-frequency weighting for all sound level meters is specified in IEC 61672-1:2003. Frequency weighting for B, C, D, and Z (zero) is also defined. However, the B and D frequency weighting is no longer in use. Globally, A-frequency weighting is in use. A-weighting in noise measurement ensures that the recorded noise level is the same that humans hear.

The A-frequency curve largely depends on historically compared contours indicating loudness. However, it is not ideal for scientific purposes. However, it is still the legal standard used in all measurements because it makes comparing old and new data easy. As a result, it is the only internationally prescribed standard with optional 'C' and 'Z' frequency weightings. The A-frequency weighting was initially optimized for quiet sounds within the 40-dB sound pressure range but is now mandatory for all levels.

The C-frequency weighting in some legislation can measure the peak noise level. However, B-frequency weighting is practically unworkable. D-frequency weighting helps track aircraft noise after testing non-bypass planes quantitatively, and after Concord's death, they were all used for military operations. As per the ISO and ICAO standards, the civil aviation industry also applies A-frequency weighting in its noise measurement.

Analysis of Noise Level

Measured noise can be used to determine daytime and night-time noise levels. The equations for the calculations are described as follows (Saadu, Onyeonwu, Ayorinde, & Ogisi 1998):

$$L_{Aeq} = 10\log\left(\frac{1}{2}\sum_{i=1}^{N}\left(\frac{antilog L_{Ai}}{10}\right)n_i\right)$$

$$L_D = 10log\left(\frac{1}{2}\left(antilog\frac{L_{AeqM}}{10} + antilog\frac{L_{AeqA}}{10}\right)\right)$$

$$L_{DN} = 10log\left(\frac{1}{2}\left(antilog\frac{L_{AeqE}}{10} + antilog\frac{L_{AeqN}}{10}\right)\right)$$

$$L_N = 10log\left(\frac{1}{2}\left(15 \times antilog\left(\frac{L_N}{10} + 9\right) + antilog\left(\frac{L_D}{10} + 9\right)\right)\right)$$

$$L_{NP} = L_{Aeq} + (L_{90} - L_{10})$$

$$TNI = (L_{90} - L_{10}) + (L_{90} - 30)$$

where;L_{Ai} is the A-weighted sound pressure level reading decibels, N is the total number of readings, L_{Aeq} is the A-weighted equivalent sound pressure level, L_{AeqM} is the equivalent sound pressure for the morning measurement, L_{AeqA} is the equivalent sound pressure level for the afternoon measurement, L_{AeqE} is the equivalent sound pressure level for the evening recordings, L_{AeqN} is the equivalent sound pressure level for the night recordings, L_N is the night-time noise level, L_D is the daytime noise level, L_{10} is the noise level that exceeds 10% of the time, L_{90} is the noise level exceeding 90% of the cases, L_{NP} is the noise level, L_{DN} is the day-night noise level, and TNI is the traffic noise index.

Relationship between Socio-demographic Variables and Noise Sensitivity

Studies have shown that socio-demographic variables affect a person's noise sensitivity (Okokon et al., 2015; Sung et al., 2017; Sieber et al., 2018;

Beheshti et al., 2019). Beheshti et al. (2019) discovered a connection between gender and noise sensitivity. Beheshti et al. (2019) found a substantial variation in noise sensitivity and annoyance between male and female subjects. Females were more sensitive to noise levels at 4000 Hz, while males were most sensitive, with the highest annoyance levels at 8000 Hz. Furthermore, as the frequency grows, so does the annoyance level (Beheshti et al., 2019).

Sieber et al. (2018) compared sensitivity and annoyance to road traffic and community noise in a sample of a South African and a Swiss population. It was shown that males had lesser sensitivity to noise than females. Furthermore, in South Africa, sensitivity tended to decrease with rising education levels, although age showed a significantly increasing tendency with noise sensitivity. In Switzerland, educational level was not connected with noise irritation, while South Africa had a notable trend. The trend was complex as noise sensitivity rose with educational levels in those exposed to high noise levels but reduced in those exposed to low noise levels.

Park, Chung, Lee, Sung, Cho and Sim (2017) observed that participants' age, education level, and marital status significantly relate to noise sensitivity in their study to predict the non-auditory effects of noise in community samples in Seoul, South Korea. Park et al. (2018) conducted a study to examine whether income level is associated with noise exposure and insomnia in Seoul, South Korea. They observed that low-income individuals may be vulnerable and sensitive to the effects of noise exposure on their health.

Noise sensitivity was substantially linked with socio-demographic characteristics such as gender and occupational status in Finnish research (Okokon et al., 2015). The study, however, revealed no link between age and

noise sensitivity in the Finnish population. Noise sensitivity rises with age and income in Korea (Sung et al., 2017).

Related Studies on Noise in Commercial Areas

Noise in the market area can concern vendors and other nearby neighbours. In addition, excessive noise can affect individuals negatively. Ugbebor et al. (2017) conducted a noise assessment at the oil mill market and Eleme Junction in Port Harcourt, Rivers State, Nigeria. The study reported a noise level of 108.6 dB for East-West Road, Eleme Junction has a cumulative noise level of 105.4 dB, and Elelenwo by the Oil Mill Market had a noise level of 103.8 dB (A). The Oil Mill Market had a cumulative noise level of 108.2 dB(A), indicating a high noise pollution level in the market area. The study identified mobile sellers, herbal medicine sellers, telecom equipment sellers, vehicle horns and sirens, grinding machines, and generators as noise sources in the market. The study further showed that using grinders and generators in the market accounts for 27% of the noise; mobile merchants provide 26%, and car traffic along East-West Avenue and the Eleme junction account for 19% of the noise generated nearby. The level of noise pollution in the Oil Mill market and its environs can harm the health of traders and the public (Ugbebor et al., 2017). To determine the level of noise pollution and its causes, Oyedepo and Saadu (2010) assessed and studied the noise pollution level in Ilorin. Noise level recordings were taken in the morning, afternoon, evening, and night. The highest levels of noise pollution were found at road intersections, followed by shopping malls. There was a significant difference between noise pollution levels and traffic noise index ($p<0.05$). The survey results showed that the noise level in the municipality of Ilorin exceeded the permissible level of 82 dB in 30

out of 42 measurement points, with values from 1 to 27 dB (Oyedepo & Saadu, 2010).

The increasing use of generators in commercial areas is due to Nigeria's inadequate and unpredictable electricity supply. Generators emit noise and gaseous pollutants during operation, exposing users to health risks. A study was conducted in Ibadan to assess generator users' knowledge and perceptions of the noise health risks posed by generator usage (Yesufu, Ana & Umar, 2013). The sample was from generator users in the two villages (Agbowo: 304; Ajibode: 211). The results indicate that most respondents in the two shopping areas (Agbowo: 82.9% and Ajibode: 86.7%) agree that generator noise can cause hearing damage. However, none of the respondents knew about the noise level that could cause it. In Agbowo and Ajibode, respondents with an unfavourable opinion were 51.3% and 82%, respectively ($p < 0.05$). Compared with other health issues, 7.7% of respondents in Agbowo and 5.0% in Ajibode recognized noise-induced hearing loss as a severe health problem. However, 80.3% and 26.1% of Agbowo and Ajibode respondents find their workplaces loud. Just 11.5% and 6.6% in Agbowo and Ajibode wants to leave their jobs. Despite their knowledge of noise pollution, neither the residents of Agbowo nor Ajibode know how harmful noise levels are to their health.

Industrial and commercial sector noise effects were studied in the Kumasi municipality by Abankwa, Agyemang and Tawiah (2017). The precision digital sound level meter (DT8852) measured daytime noise levels at Kejetia, Anloga, Kwame Nkrumah University of Science and Technology (KNUST) Junction bus stations as timber companies. They reported 78.8 dB, 72.1 dB, and 78.3 dB daytime noise levels. The daytime noise levels recorded

by the two timber companies, A and B, were 84.1 dB and 82.4 dB, respectively. Comparing the results with the Ghana Environmental Protection Agency (EPA) standard, the daytime noise levels of the three bus stations are above the permissible level by 8.8 dB, 2.1 dB, and 8.3dB, respectively. While daytime noise levels from the timber industries were 14.1 dB and 12.4 dB above the allowable level, respectively (Abankwa et al., 2017)

Lastly, Essandoh and Armah (2011) focused on quantifying noise and obtaining residents' perceptions of the leading commercial area of Cape Coast, Ghana. Ten measurement points: commercial areas, busy intersections/roads, passenger terminals, high-density residential areas, and low-density residential areas were selected. Noise pollution levels in high-density residential areas range from 58 to 68 decibels, while noise pollution levels in low-density residential areas range from 53 to 72 decibels. The TNI for high-density residential regions ranges from 34 to 107 decibels, while the TNI for low-density residential areas ranges from 27 to 65 decibels. Subjective responses indicated that about 82.1% of noise sources generated in these areas were from music stores and road traffic. In addition, the noise levels sampled at the measurement points exceeded the upper limit recommended by the Ghana EPA with a value between 1 and 15 dB(A).

Summary of Chapter

In summary, this chapter of the thesis reviewed issues of noise pollution. This chapter examined the literature based on the research objectives. The empirical review ended with related studies on noise in commercial areas. The review showed a gap in people's knowledge concerning the level of noise, its effects, and the measures that regulate noise pollution. Finally, the chapter

discusses the conceptual framework employed in the thesis. Significant similarities and variations existed between these reviewed works and other essential comments. These reviewed works were extremely useful to the study since they allowed the researcher to determine whether the thesis conclusions aligned with the literature review results and any necessary discussions.

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

This chapter focused on the various methods and techniques used by the study to collect and analyse data. This chapter is grouped into research design, study area, target population, sampling and sample procedure, research instrument, data collection procedure, and data analysis. Lastly, ethical issues concerning the work are explained under ethical consideration.

Research Philosophy

Research philosophy is "a set of shared beliefs, values, and techniques among members of a scientific community that serves as a guide for determining the types of research problems scientists should address and the types of explorations they are willing to undertake" (Boateng, 2014). The importance of identifying philosophical ideas in research is enormous. Even though it is largely hidden, it can potentially affect studies.

The study adopted both the positivist and interpretivism philosophies. Positivism is a philosophy that is heavily reliant on empirical evidence. Positive paradigm studies are founded on facts and the assumption that the world is objective and external (Wilson, 2010). Positivism asserts that factual knowledge is authentic information and that such types of knowledge result from the positive affirmation of hypotheses constructed by rigorously scientific processes. Furthermore, interpretivism holds that there is no singular, observable reality; instead, multiple facts or interpretations of the same event exist (Merriam & Tisdell, 2016).

According to Hennink, Hutter, and Bailey (2020), interpretative researchers attempt to comprehend people's experiences from their viewpoints. The researchers accept that people's perceptions and reality experiences are subjectively determined. By employing both positivist and interpretivism philosophies, the study can capture a broader range of insights and data. Positivism focuses on quantifiable and objective data, such as measuring noise levels, providing a systematic and scientific understanding of the issue. On the other hand, interpretivism allows for a more nuanced exploration of subjective experiences and perceptions through qualitative methods like interviews (Daymon & Holloway, 2010; Merriam & Tisdell, 2016). This comprehensive approach of integrating positivist and interpretivism philosophies in a study on traders' perceptions of noise levels and health-related issues in the Kotokuraba market offers a balanced and nuanced understanding of the phenomenon.

Research Approach

The study used the mixed-method research approach. The mixed method approach allows for using qualitative and quantitative research methods in a study (Creswell & Clark, 2011; Creswell, 2012). The study's quantitative data were collected using a questionnaire, field record sheets, a DT-8852 sound level meter, and a Garmin eTrex 10 GPS device. The data was focused on the measurement of noise levels in the Kotokuraba market and the perception of traders on noise pollution in the market and its resultant health problems.

The qualitative data in this study were obtained using an interview schedule for traders who experience health problems in the market due to noise exposure. Here participants shared their thoughts and experiences on how the noise levels in the market affect their health. Qualitative data was also elicited

from the key informants, focusing on their role in noise pollution management in the Kotokuraba market and Cape Coast Metropolis. This data helped to identify the discrepancies in noise pollution management in the Kotokuraba market and complemented the participants' views.

In using a mixed-method approach, the strength of one research method complements the weakness of the other. Using both enhances the degree of validity and reliability in the data since both assist the researcher in cross-checking the data he collected from the field. The result of a mixed-method could be a convergence or contradictions of both methods. In Bryman (2014), a mutual confirmation from both ways indicates a higher degree of validity since there is a significant reduction of information, loss of data, or incomplete information.

Research Design

A research design is an overall strategy or plan that guides the study's process (Abutabenjeh & Jaradat, 2018). For research projects, research designs function as models. The sorts of data, procedures, and judgments that researchers must make during their investigations and the systematic approaches by which researchers draw interpretations from their studies are all influenced by research designs (Creswell & Clark, 2017).

A sequential explanatory design was used for the study. The sequential explanatory design involved the follow-up of quantitative analysis with qualitative data collection and analysis in two consecutive periods during the study (Creswell, Clark, Gutmann & Hanson, 2003). The purpose of the designs is to confirm the results produced by each method with the evidence provided by the other method (Kroll & Neri, 2009).

Therefore, the positivist and interpretivism philosophy, in connection with sequential explanatory research design, helped use multiple methods, assumptions, and different data collection and analysis (Creswell & Creswell, 2018). This study design was adopted since it facilitated the data collection by collecting data from multiple sources to enrich the findings. Besides, it offered the opportunity to compare and contrast the results and ensure a comprehensive discussion of the issues that emerge from the research (Creswell & Clark, 2017). This design entails researchers implementing, upholding each thread independently during analysis, and mixing the results conjointly to portray a clear picture of the underlying phenomenon.

Study Area – Cape Coast

Cape Coast is the capital of Ghana's Central Region, with approximately 189,925 people (Ghana Statistical Service, 2021). Kotokuraba is a suburb or community within the Cape Coast Metropolis. In this area, most settlers are traders, drivers, and workers in various institutions, where the main commercial activity occurs within the metropolis. The primary study area is the Kotokuraba market, Cape Coast's main Central Business District. The Kotokuraba market covers an area of about 54,199.86 m^2. Kotokuraba Market is a vibrant commercial centre comprising a sprawling complex of interconnected stalls and shops. The market is divided into sections, each specializing in different types of products. From fresh produce, meat, and fish to clothing, textiles, and household items, Kotokuraba offers a wide variety of goods to cater to the diverse needs of its visitors. The market is known for its lively atmosphere and bustling activity. Vendors enthusiastically showcase their wares, calling out to

passers-by and engaging in positive negotiations. The vibrant colours of fabrics, fruits, and crafts add to the visual spectacle, creating a feast for the senses.

While Kotokuraba is primarily a marketplace, it also serves as a social and cultural hub for the local community. It is a place where people come together to connect, share stories, and exchange ideas. The market is a microcosm of Ghanaian society, reflecting the country's rich cultural heritage and ethnic diversity. Kotokuraba Market is also an important economic centre, supporting the livelihoods of countless traders and small-scale entrepreneurs. It plays a significant role in the local economy, providing employment opportunities and fostering entrepreneurship. In recent years, efforts have been made to improve the infrastructure and facilities at Kotokuraba. In 2019, an ultra-modern Kotokuraba Market was constructed for $31.75 million. The new market is expected to boost economic activities in the region and provide a better trading environment for traders and customers. Also, renovations have been undertaken to enhance the market's appearance, promote hygiene, and ensure a more organized shopping experience for visitors. Overall, Kotokuraba Market is an important economic centre on Cape Coast, attracting both locals and tourists alike. Despite its challenges, the market remains a vital part of the region's economy and a must-visit destination for anyone visiting Cape Coast.

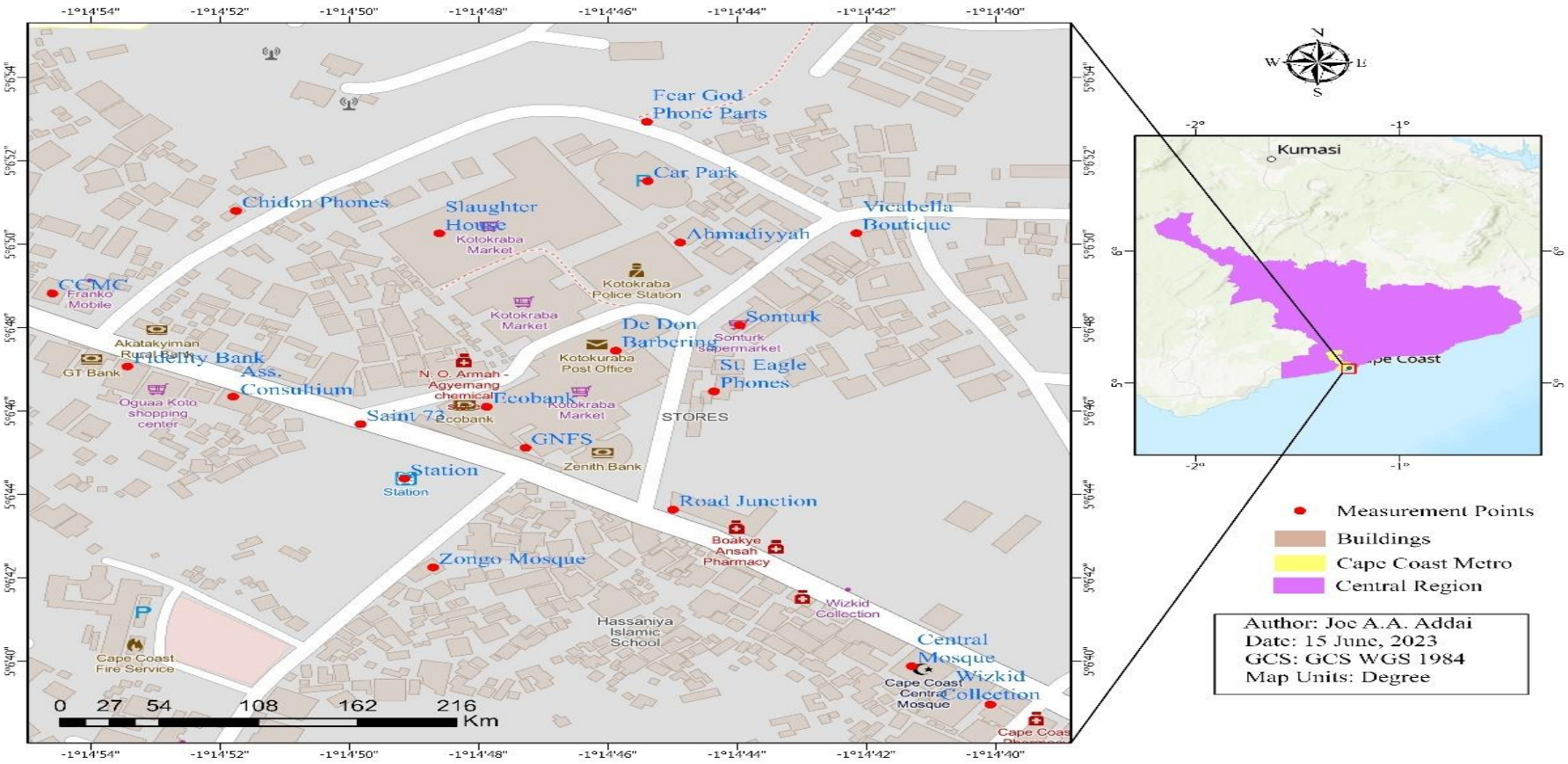

Figure 5: Study Area Map of Kotokuraba Market
Source: Authors Construct (2021)

Population

A *target population* for a research study can be defined as the entire set of units, thus individuals, groups of persons, or organizations, through whom the research data are collected and used to make interpretations (Cox & Lavrakas, 2008; Asiamah, Mensah & Oteng-Abayie, 2017). A target population is a group of individuals or organizations with characteristics that interest researchers for a particular study (Asiamah et al., 2017). A well-defined target population is significant because it helps others assess the sample's reliability, sampling technique(s), and study findings (Asiamah et al., 2017).

The target population for the study included traders (in stores and table-top sellers) in the Kotokuraba market and other key informants. The traders were chosen because they sell in the open, are exposed to noise for several hours, and have knowledge of noise pollution in the market. The target population included traders of both sexes. The study population for traders included people of both sexes ranging from 15 to 60+ years based on the Ghana living standard survey (GLSS 7) age classification for employable age in the informal sector (GSS, 2019). The Key informants were chosen based on their experience, involvement, and knowledge of noise pollution management in the Kotokuraba market.

Traders in the market are grouped into various associations based on the commodity they sell. In the Kotokuraba market, the largest market association is the Kotokuraba Concern Union Association, an umbrella for all market groups. The largest market union used to be the Cape Coast (Oguaa) Women's Trading Association, which the Kotokuraba Concern Union Association now eclipses. Other traders' groups under the Kotokuraba Concern Union

Association include Associations of traders selling tomatoes, Plantain, Yam, Fish, Cassava, Provisions, Eggs, and other commodities. The Kotokuraba Concern Union Association has a total population of 1,670 members of traders having stalls and tables in the market.

Sampling and Sampling Procedure

Sample Size Calculation for survey respondents

Using the Yamane sample size calculation formula (Yamane, 1967);

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

Where:

n = Number of samples

N = Total population (total population of traders in Kotokuraba Concern Union Association) = 1670

e= Confidence interval = 0.05

$$n = \frac{1670}{\left(1 + 1670(0.05^2)\right)}$$

$$n = 322.7$$

Therefore, the sample of respondents for the survey is 323.

Sampling Procedure for the Selection of Survey Respondents

With the sample size of 323 determined, the researcher identified the sources of noise location in the market and made measurements using the sound level meter (SLM). Then, based on the EPA threshold for noise pollution (75 dB(A)), selections were made from identified locations like passenger loading parks, road junctions, busy roads, and low and dense areas in the Kotokuraba market.

A radius of 10m was used around the selected noise source locations; within this range, the respondent was selected. The 10m radius was chosen to reduce issues regarding sound level effect reduction with distance (Rathe, 1969). The total sample sizes were divided by the number of selected noise

source locations (20) in choosing the sample. The sample size (16) taken from each noise source selected location was determined based on that.

In selecting the respondents, a linear systematic sampling procedure was used. In applying the systematic sampling technique, all the traders who fall within the 10m radius around the 20-noise source location were all numbered (including those in shops and tables) to develop a sampling frame. After that, the total population of the traders in the radius were divided by the total sample size to get the Kth value. Afterwards, the traders (those in stores and tables) within the radius of the selected location were given a unique number starting from one to the last trader. Furthermore, to do systematic sampling, an interval value must be determined. The interval or kth value was determined by the formula below.

$$kthvalue = \frac{Totalpopulation}{Totalsample}$$

Kth value = 5.18

Kth value (interval) = 5

With the kth unit or interval value of 5 determined, a random respondent number within a radius was chosen as a starting point, skipping through every fifth trader in stores or tables each time until the total sample respondents of 323 respondents were selected and interviewed for the survey.

Selection of Respondents for Health Interviews

The selection of respondents for the interview on the effects of noise exposure was made using the purposive sampling technique. The choice was made based on these criteria:

- Proximity to the noise source.
- A respondent indicated that noise affected their health during the survey.
- Respondent's provision of medical report

- Assessment by Health Official from the University of Cape Coast Hospital

Ten (10) respondents (traders) were selected for the interview.

Selection of Participants for the In-depth Interviews (Key Informants)

The selection of Key informants was made using the purposive sampling technique. The selection was made based on these criteria:

- Number of years spent in the market,
- Health Official (Nurse) from the University of Cape Coast Hospital
- Role/Position in the Market and
- Knowledge of noise pollution cases.

Four (4) respondents were selected for the interview. The respondents who were selected are;

- The Deputy EPA director for Cape Coast Metropolis
- The Leader of the Kotokuraba Concern Union Association
- One (1) Official from the CCMA office of the registrar in charge of the Kotokuraba market
- One (1) health Official from the University of Cape Coast Hospital

Three hundred and thirty-seven (337) respondents were selected and interviewed for the study.

Measurement of Noise Levels

The noise was measured at street level (road junctions, market centre, passenger loading station, and shops). The instrument was kept with the microphone pointing at a distance not less than 1 m from any reflective object at the alleged noise source. In addition, noise levels and GPS coordinates were taken at the selected noise source.

The noise level was measured using a DT-8852 sound level meter that satisfied the IEC 61672 requirements in this study. The sound level meters that meet the IEC 61672 requirements are currently the only internationally recognized ones for measuring noise levels. In addition, it has a high level of precision.

Instruments used to measure noise levels in the study included a Precision Digital Sound Level Meter (DT-8852, manufactured to IEC 61672-1 Type 2, ANSI S1.4 Type2) and a Garmin eTrex 10 GPS device. It comprises a ½ electric condenser microphone and a 1/3 octave filter with a measured frequency range of 31.5Hz – 8Khz and 3dB -130dB. Both the GPS and sound level meter were calibrated before taking measurements. In addition, the sound level meter was switched to A-weighting from frequency weighting, time weighting, and lever range, while the GPS was set to Zone 30N and ensured good accuracy in measuring points.

A weekly measurement was first made in the market at various noise source locations to identify the average weekly noise levels to select noise source areas that exceeded the 75 (dB) limits set by the Ghana EPA for noise data collection. Afterwards, twenty (20) locations that met this criterion were selected for the actual measurement.

The actual noise measurement of noise was then done in the morning (8:00–8:30 am), afternoon (12:00–12:30 pm), and evening (6:00–6:30 pm) in the identified locations. These times were selected because, during the initial weekly measurements, the noise data showed that at these times and duration during the day, the noise levels in the noise source locations exceeded the EPA daytime recommended limit of 75 dB(A) for commercial areas. Moreover,

these times also corresponded with the market opening, peak moments, and closing hours. Recordings were taken both on weekdays and weekends.

Figure 6: DT-8852 Sound level meter

Source of Data

Primary and secondary data were used in this study. The primary data sources were obtained from the questionnaires, interviews, sound level meter, GPS device, and field record sheet. In contrast, the secondary data sources were obtained from journals, theses, newspapers, dissertations, and others.

Research Instruments

A questionnaire, interview guides, field record sheet, DT-8852 sound level meter, and Garmin eTrex 10 GPS device were used to gather primary data from the field per the study theory, method, and design. These instruments were selected, and they are the most suitable. Furthermore, primary data were collected using a sound level meter and GPS device across the Kotokuraba market (including passenger loading parks, road junctions, busy roads, and low and dense areas).

Primary data were solicited from traders and Key informants involved in issues regarding noise pollution in the Kotokuraba market. The questionnaire

and in-depth interview guides were used to collect the respondents' primary data. In light of the empirical review, the questionnaire was self-administered. Questionnaires were used for this type of research because it is a self-report measure that ensures confidentiality, and respondents are likelier to give honest answers. In addition, self-administered questionnaires were chosen as a data-collecting approach because they provide respondents with privacy, encourage people to honestly express their genuine sentiments and opinions (Yin, 2014), and are cost-effective (Bryman & Bell, 2011).

The questionnaire contained both closed and open-ended questions. The questionnaire was structured into four modules: Modules 1, 2, 3, and 4. Module 1 comprises questions that seek the socio-demographic information of respondents. This information helped the researcher to have a piece of practical information regarding the population under study. Module 2 of the questionnaire contains questions examining respondents' perceptions regarding noise pollution-related information. Module 3 of the questionnaire examines respondents' use of protective hearing devices. Module 4 examined the relative actions agencies use for noise management in the market and the proposed solutions to address noise pollution in the Kotokuraba market.

In addition to the questionnaire, field record sheets and interview guides were also designed for Key informants and traders to collect information regarding noise pollution in the market and its effect on health. The interview guide used a semi-structured format because it was flexible and allowed for the investigation of developing themes and ideas. The questions centred on self-reported data such as basic demographics, noise perception, noise related-health problems, and noise pollution control measures. Interviews were conducted

using ten respondents: thus, three key informants and seven traders on health. The field record sheet recorded details of measurement location, noise sources, and measurements taken in each area.

Pre-testing of Instruments

The researcher embarked on a separate pretesting in the Abura market in Cape Coast to check for the clarity and appropriateness of the research instrument. The pretesting aimed to eliminate ambiguity and ensure that the respondents understood the questions and that the noise measurement devices worked as intended.

The pretesting was done in two phases. The first phase was measuring the noise levels in the Abura market using the sound level meter and the GPS device to ensure they worked as intended. Two MPhil students from the Department of Geography and Regional Planning measured the noise levels and checked the instrument to see if it was correctly calibrated and worked as intended. The second phase of the pretesting was performed with ten respondents comprising traders, environmental sanitation workers, and officers in the Abura market to improve the questionnaire and interview guides.

Validity and Reliability of Instrument

The validity of a test instrument is the extent to which the tool (i.e., questionnaires, interview schedules, and field record sheets in this study) measures the variables under investigation (Drost, 2011). The instruments were carefully vetted before their final approval by experts in research to establish their validity. Specifically, the instrument was given to my supervisor, who meticulously inspected them and ascertained that they met both face and content validity. My supervisor affected changes to the instrument to complete the

study's objectives and validation requirements. One advantage of ensuring content reliability and validity is that respondents may better understand the questions and offer more meaningful, correct replies if they know what information the researcher is searching for (Saldana, 2016).

Data Collection Procedures

In collecting noise data using electronic devices (Sound level meter and GPS), ethics such as informed consent and information privacy were observed when measuring noise levels. The researcher first obtained permission from the CCMA and participants to use the devices to measure the noise levels in the market. The researcher explained the study's purpose to them and ensured there was no possibility of conflicts regarding the analysis. To ensure the privacy of the information, they were assured that the noise data collected with the Sound Level Meter and GPS was entered into a computer that was password protected and known by only the principal investigator and his supervisor, ensuring information privacy. Furthermore, the researcher's details were provided to the CCMA officials so that the researcher is responsible for any unauthorized use of the locational data for other purposes except the one intended for the study.

Noise levels were then measured at street level in road junctions, shops, market centres, and passenger and vehicle stations. The microphone was pointed at a distance of not less than 1 m at the suspected noise source from any reflecting surface. At the purported noise source, noise levels and GPS locations were measured. A DT-8852 precision digital sound level meter and a GPS were utilized to measure the noise level in this investigation. It comprises a 12-electric condenser microphone and a 1/3 octave filter with a frequency range of 31.5Hz – 8Khz and an estimated frequency range of 3dB – 130dB.

Before taking measurements, both the GPS and the SLM were calibrated. The sound level meter was changed from frequency weighting, time weighting, and lever range to A-weighting, and the GPS was adjusted to Zone 30N to guarantee that the measurement of points was accurate. Noise levels were measured in the morning (8:00–8:30 a.m.), afternoon (12:00–12:30 p.m.), and evening (6:00–6:30 p.m.). These recording periods were picked to correlate with the market peak hours. The recordings were made over the week, encompassing both weekdays and weekends. Commonly used community noise assessment variables were calculated using the recorded values.

Also, quantitative data was collected by administering a questionnaire to 323 respondents (traders) within a 10m radius of the measured location. The respondents included both sexes. The interviews did not exceed 30mins. The interview offered information on the dynamics of noise and its influence on the traders in the market. Field assistants were recruited to help collect data and solve the language barrier problem in the data collection.

The last data collection procedure is an in-depth interview with Key informants and traders on health. The researcher engaged vital Key informants and respondents with noise-induced health problems regarding noise pollution in the market. All three Key informants and ten traders were interviewed. The interviews did not exceed a maximum of one hour. The data collection process started from December 6, 2021, to January 13, 2022.

Data Analysis

The data analysis was done systematically based on the outlined objectives since the outcome of one goal feeds into the other. Therefore, the data analysis started with identifying noise exposure zones in the market. Analysis

of noise exposure zones was done using the data collected on the field using the Sound-level meter and the GPS. After taking the measurement, the sound level meter was connected to a computer to retrieve the noise sample recorded data with the help of the sound level meter software and tie them with the locational coordinates from the GPS. The data was processed with the help of ArcGIS 10.7 software. ArcGIS 10.7 software was used to provide a spatial distribution map showing the noise exposure zones in the market. The statistical information from the spatial distribution map was tied to each noise measurement location. The statistical information helped identify the site and the noise level measured at each point in the market.

Moreover, quantitative data was used to examine the perception of traders about noise pollution and the noise sensitivity and sociodemographic relationship of traders in the market. With this, inferences were made from the spatial distribution noise map to confirm some analysis of these objectives. The quantitative data helped obtain information about the noise sources, duration, days, sensitivity and their nuisance to traders—the data analysis was the descriptive analysis done with SPSS v. 25.

Lastly, the analysis of noise exposure-related health issues and relative noise management actions was mainly descriptive and thematic. Analysis at this level helped identify noise-induced health effects on traders, thus noise-induced health effect type, as well as identify comparable actions that traders have taken to curb the noise pollution in the market as well as actions taken by governing authorities such as the CCMA, EPA and Market Union in the market.

In Summary, the questionnaire data were analysed using SPSS version 25. The qualitative analysis was transcribed manually transcribed and analysed

using Maxqda pro-2020. Also, the noise measurement data were analysed in ArcGIS version 10.7. All these analyses are entailed in all the objectives which are explained above.

Data Management

Data that was gathered for this study was managed in a manner that all participants were protected. My supervisor was the only individual with access to the data. Concerning the quantitative data gathered, it was cleaned in Microsoft Excel to eliminate all errors. Regarding the qualitative data, the identity of participants was hidden to protect their anonymity. Again, after transcribing, all forms of grammatical errors were corrected such that the clear ideas of the participants were not altered. After visible cleaning, the data was in my possession for the next two years for publication. The data was stored in the researcher's Google Drive and Mendeley repository.

Field Challenges

As much as this study has its strengths methodologically in certain areas, the challenge faced during field data collection was related to the language barrier. During the interviews with some respondents, there was a problem with understanding and translating English to the Fante. To solve this challenge, the researcher solicited the help of other Fante native traders in the market who could translate the interview schedule to Fante from English to the respondents, and this affected the data collection time.

Ethical Considerations

This section relates to all moral standards researchers should adhere to in all stages of the conduct of research. First, Ethical approval was sought from the University of Cape Coast Institutional Review Board

(UCCIRB/CHLS/2021/36). Then, once the clearance was gained, in the data collection, all ethical concerns such as the right to participation, informed consent, confidentiality, data privacy, and anonymity were duly adhered to in conducting the research.

Participants' consent was first sought, and they were assured that participation was voluntary. Participants were not obligated to do so and were free to choose not to participate in the study. Permission to participate was also confirmed by the participant's signing or thumb printing in the space provided on the respondent's consent form. Furthermore, the participants were encouraged to ask questions about the study, and the investigator or research assistants provided satisfying answers. Furthermore, to ensure anonymity and confidentiality, participants were identified with serial numbers so that the information provided could not be traced back to them, and any information they provided was inaccessible to any unauthorized person. Lastly, to ensure privacy, participants were assured that the data was protected from unauthorized access, with the researcher storing it in a personal password-protected drive.

The study posed minimal or no risk to the participants. The only discomfort associated with this study was the participants' discomfort when providing sensitive information regarding noise in the market. The researcher ensured the anonymity of respondents and the confidentiality of the information provided. The researcher assured them that no unauthorized individuals would have access to the information they provided; the only persons who had access were the researcher and his supervisor. Also, to ensure anonymity, the researcher identified the respondents with serial numbers so that the information given could not be traced back to the respondents.

Also, using GPS and a Sound level meter to measure noise in the market, consent from the CCMA was sought, and information privacy was ensured. The researcher sought permission from the CCMA officials in the Kotokuraba market to measure the noise levels. Also, the noise data collected using Sound Level Meter and GPS was entered into a computer that was password protected and known by only the principal investigator, ensuring information privacy. Furthermore, the researcher's details were provided to the CCMA officials so that the researcher could be held responsible for any unauthorized use of the locational data for other purposes except the one intended for the study.

Chapter Summary

This chapter gave a detailed justification for the research methodology used in the study and a step-by-step explanation of the procedures employed for data collection. The chapter first examined the mixed-method study design, philosophy, and approaches employed. Other relevant issues that were carefully considered include population, sampling, instruments, validity and reliability of research instruments, ethical considerations, data collection procedure, and the method of data analysis. Ethical issues were considered.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the results and discussions of the study. This section contains respondents' information and the primary findings of the study.

The study findings presented in this chapter focused on the objectives that guide the study: identify noise exposure zones in the market, Examine the perception of traders about noise pollution in the market, analyse the relationship between traders' sociodemographic characteristics and noise sensitivity, analyse the perception of traders on health issues resulting from noise exposure in the market, and examine the relative actions taken to manage noise in the Kotokuraba market. The findings are presented under each heading with the objective of the study that it addresses.

Background Information of the Respondents

This section presents the socio-demographic characteristics of the respondents. These include gender, age, marital status, level of education, income, working conditions, and the number of working hours of traders (Table 2).

The findings showed that 75.9% of the respondents were females (Table 2). The results show that female traders outnumbered the males confirming the data from GLSS7 (GSS, 2019) report that female traders dominate Ghana's informal wholesale and retail markets.

Table 2: Socio-Demographic Characteristics of Respondents

Variable	Frequency (n=323)	Percentage
Gender		
Male	78	24.1
Female	245	75.9
Age		
15 -19	80	24.8
20 – 24	62	19.2
25 – 29	41	12.7
30 – 34	31	9.6
35 – 39	23	7.1
40 – 44	24	7.4
45 – 49	21	6.5
50 – 54	23	7.1
55 – 59	7	2.2
60 – 64	11	3.4
Education Level		
None	34	10.5
Basic	103	31.9
Secondary/Vocational	141	43.7
Tertiary	45	13.9
Marital Status		
Single	135	41.8
Cohabitation	11	3.4
Married	115	35.6
Separated	22	6.8
Widowed	40	12.4
Income Level		
Less than Gh₵ 319	131	40.6
Gh₵320 – Gh₵ 639	97	30.0
Gh₵640 – Gh₵ 958 above	95	29.4
Daily working hours		
1 – 5 hours	94	29.1
6 – 8 hours	100	31.0
9 – 12 hours	129	39.9
Market Conditions		
Bad	249	77.1
Good	74	22.9

Source: Field Data (2021)

In Ghana, the legal employable age starts from age 15(GSS, 2010). Based on the GSS age classification, most traders were between 15 and 19 years, constituting 24.8% of the respondents signifying a young trader population in the Kotokuraba market. The findings show that 89.5% of the traders had some

formal education in the market. In contrast, 10.5% had no formal education. The results were in line with a report made by Osei-Boateng and Ampratwum (2011), which stated a rising education level among Ghanaian traders because of inadequate employment in the country's formal sector. Furthermore, the results showed that 41.8% of the respondents were single, while 35.6% were married. The data further showed that 12.4%, 6.8%, and 3.4% of the respondents were widowed, separated, and cohabitated.

Regarding income, 40.6% of the respondents earn less than GhȻ 319 a month, while 59.4% earn a monthly income above GhȻ 319. The findings indicated that most traders earn above the monthly minimum wage in Ghana. However, the results differed from the report by Otoo (2018), which stated that traders are among the low-income earners in the informal sector. Moreover, Baah-Ennumh and Adom-Asamoah (2012) explained that rising income levels could result from the increased price of items in the market and the scarcity of commodities in different seasons.

According to the Kotokuraba Concern Union Association Leader, "most traders spend 6 am to 6 pm in the market". In this study, 39.9% of the respondents spend between 9 and 12 hours in the market. Furthermore, 31.0% of the respondents spend between 6 and 8 hours in the market. Furthermore, 29.1% of the respondents spend between 1 and 5 hours in the market. The findings confirm these studies, which stated that traders usually work long hours to meet daily expected income or sales, leading to traders suffering from health problems (Idyorough and Ishor, 2014; Amoako,2019).

Lastly, in terms of working conditions,77.1% and 22.9% of the respondents indicated that the market conditions were bad and good,

respectively. Bad market conditions were attributed to the little to no market regulations and increased noise levels. At the same time, good market conditions represented traders' general noise levels in marketing and relaxed regulations. The higher levels of noise pollution in the market and less regulation make working conditions unfavourable to most traders, as confirmed by Essandoh and Armah (2011).

Noise Exposure Levels in the Kotokuraba Market

This section focuses on research objective one, which sought to identify the noise exposure zones in the market. A noise map is a tool that provides images of a geographic area's acoustic activity at a particular time or on a statistical basis (Pinto & Mardones, 2009). Hence, Noise maps are tools for enhancing or preserving environmental quality. In this work, all the noise data collected from twenty (20) point locations (see Table 3.) were used to develop a noise exposure map for the Kotokuraba market.

Table 3: Daytime measurement and noise sources in locations in the Kotokuraba market

Kotokuraba market	Day (0600-2200h)				Source of noise
Measurement Location (20)	Morning (8 -8:30 am) noise level (dB)	Afternoon (12-12:30 pm) noise level(dB)	Evening (6– 6:30 pm) noise level(dB)	Daytime Average (0600 – 2200h)	
Station	89	95	65	91	Road Traffic, HMS and Shops
Ghana National Fire Service Office (GNFS)	86	94	60	90	Preachers and HMS
Fidelity Bank	84	90	62	86	Road traffic and Shops
Wizkid Collection	77	93	67	88	Shops
Sonturk Supermarket	90	97	68	94	Shop, Preachers, HMS and Road Traffic
Slaughterhouse	87	61	68	83	Shop
Ecobank	85	89	65	86	Road traffic
Road Junction	82	86	67	83	Road traffic
Viccabella Boutique	86	85	66	84	Road traffic and Shops
Associate Consortium	84	89	76	86	Shops
Zongo Mosque	89	95	65	91	Preachers
Opp. Saint 73 shop	85	91	65	87	Preachers
De Don Barbering shop	82	87	68	84	Preachers

Source: Field Data (2021)

Table 3 (contd): Daytime measurement and noise sources in locations in the Kotokuraba market

Kotokuraba market Measurement Location (20)	Day (0600-2200h)				Source of Noise
	Morning (8 -8:30 am) noise level (dB)	Afternoon (12-12:30 pm) noise level(dB)	Evening (6– 6:30 pm) noise level(dB)	Daytime Average (0600 – 2200h)	
Street Eagle Phones	74	80	69	77	Preachers and Shop
Ahmadiyya mosque	86	79	79	83	Preachers
Cape Coast Musical Centre (CCMC)	62	77	60	73	Shop
Chidon Phones	65	72	59	68	Shop
Fear God Phone Parts	68	72	81	77	Shop
Cape Coast Central Mosque	76	85	65	81	Preachers and Shops
Car Park	65	86	42	81	Road Traffic and HMS

Source: Field Data (2021)

In ArcGIS 10.7 software, GPS noise locations, noise level readings per location, and noise reading time were entered for analysis. Inverse distance weighting (IDW) performs surface interpolation on the data. IDW interpolation determines cell values by combining a set of sampling points in a linearly weighted manner. The methods produce a weighted interpolated surface grid that is accurate. IDW interpolation applies the Tobler law by estimating unknown measurements as weighted averages over known measurements at nearby points. The closest points receive the most weight (Longley, Goodchild, Maguire & Rhind, 2005). The IDW aided in determining the market's spatial distribution of noise levels. The level noise criteria that helped identify noise

exposure zones in the Kotokuraba market resulted in four zones: safe, tolerable, moderate risk, and high risk.

The findings showed that numerous places within the Kotokuraba market suffer moderate to high-risk levels of market noise based on the parameters utilized. Some areas experience moderate and high noise levels in the morning and afternoon. It is worth noting that the locations have significant population densities. As a result, there is a constraint in noise dispersion. It impacts a considerable number of individuals from various socio-economic groups. It indicates that market noise may affect traders in the market differently. For example, continuous noise exposure can affect the trader's health and performance (Nassiri et al., 2013).

Based on the noise levels produced in the market, noise maps showing the exposure classes were generated from the measurements of noise levels, as seen in Figures 7(a), (b), and (c).

Figure 7 (a) shows that, during the morning (8:00 am - 8:30 am), many areas within the market predominantly fall within the tolerable and high-risk zones. This was because during this time that the market was observed to be in the opening session, there was much noise from vehicles and many preachers blasting sounds from speakers in vantage points in the market. Noise levels around Station, Saint 73, Fidelity Bank, Zongo Mosque, GNFS, and Sonturk supermarket were within the high-risk zones. The only areas within the safe zones were CCMC, Chidon phones, the Car Park, and Fear God phone parts. Generally, the morning noise level in the market peaked at around 90 dB(A).

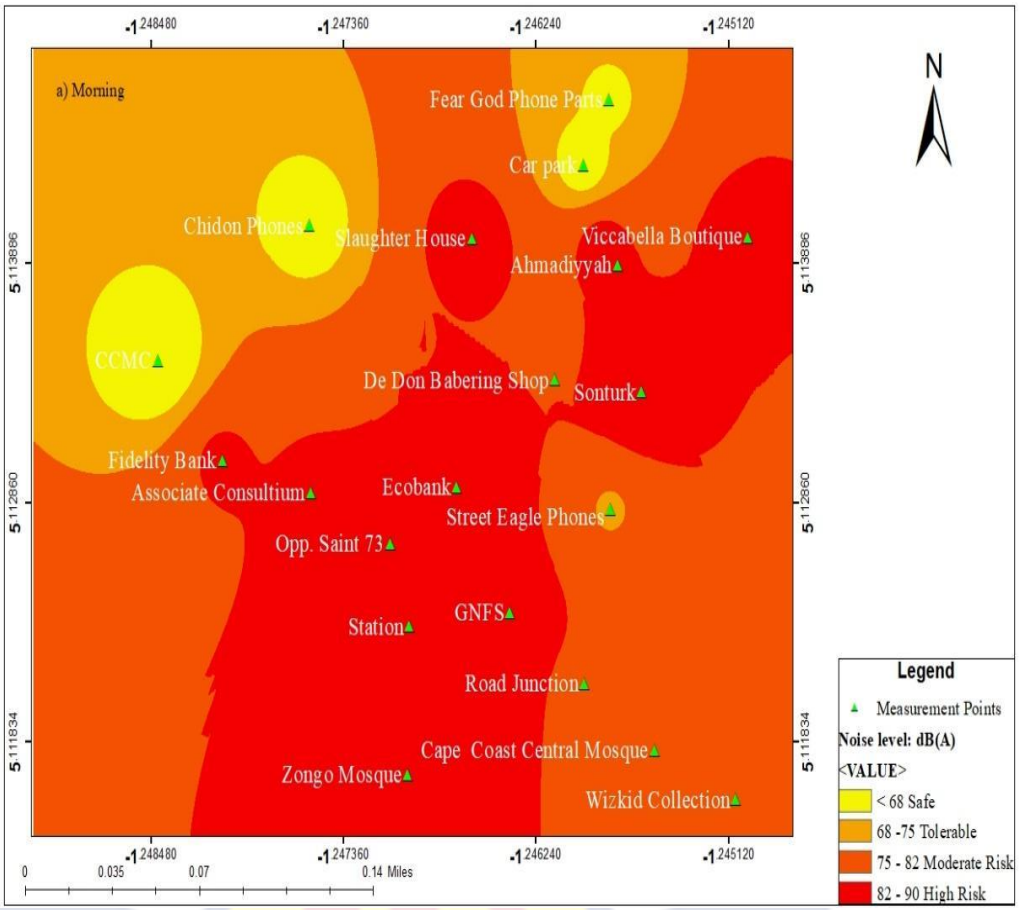

Figure 7(a): Noise exposure distribution in Kotokuraba market in the morning (8:00 am – 8:30 am)
Source: Field Data (2021)

Moreover, in the afternoon (**figure 7(b)**), the noise pollution levels in the market are relatively higher, peaking at 97dB(A). The rise in noise levels results from the noise produced by preachers, vehicles, shops, and music vendors—areas within the market in the afternoon fall within the high-risk zones. Locations in the northern part of the map, such as the slaughterhouse and Chidon phones, generally fall within the safe to moderate risk zones except for the Kotokuraba market car park areas. Generally, there is a rise in noise level in the market during the afternoon. Noise levels in the market exceed the EPA limits of 75dB(A) for commercial areas during the afternoon. Continuous exposure to this noise level for long hours can contribute to hearing loss

(Occupational Safety and Health Administration, 1910). Moreover, these findings confirm the study by Essandoh and Armah (2011), which identified noise as loudest in the afternoon in the Kotokuraba market. However, Essandoh and Armah measured peak noise levels in the afternoon to be around 74dB(A) compared to 97 dB(A) in this study, indicating an increase in the noise levels of about 23 dB(A).

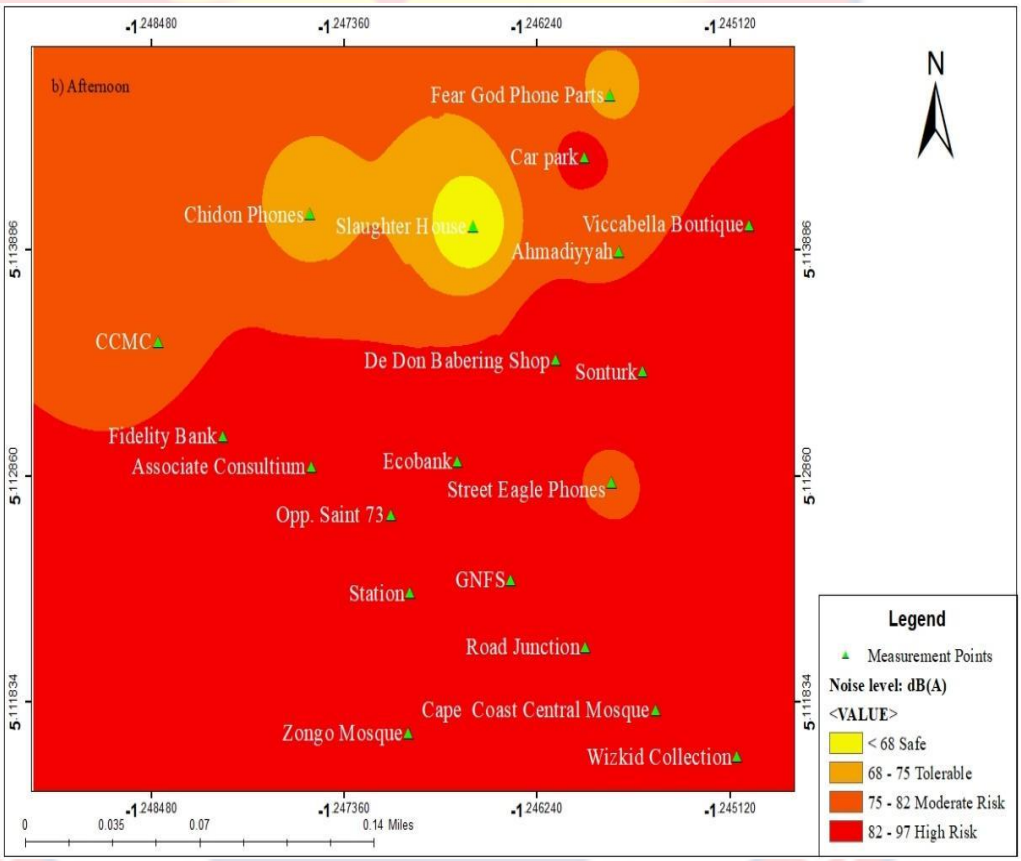

Figure 7(b): Noise exposure distribution in Kotokuraba market in the afternoon (12:00 – 12:30 pm)
Source: Field Data (2021)

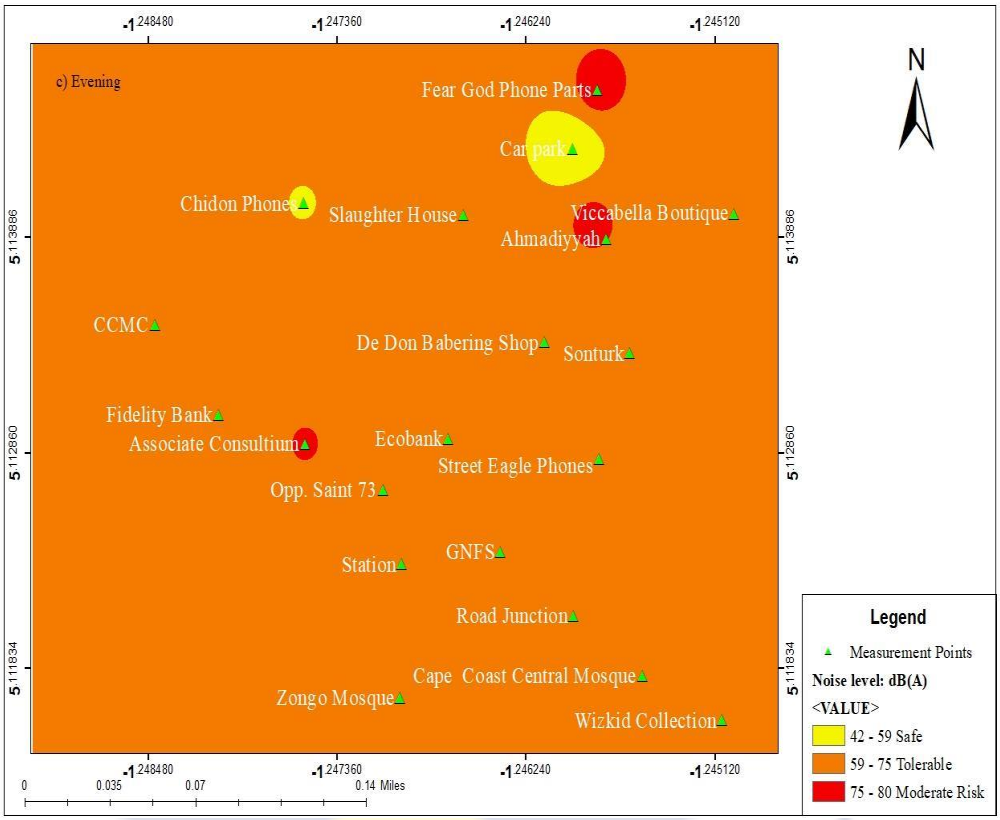

Figure 7(c): Noise exposure distribution in Kotokuraba market in the Evening (6:00 – 6:30 pm)
Source: Field Data (2021)

Furthermore, for the evening time (6:00 pm – 6:30 pm) noise exposure map, most of the areas within the market fell within the tolerable exposure zones. The reduction in noise level is because many traders begin to leave the market as that time is within the market closing hours. **Figure 7(c)** shows that, in the evening, noise levels in highly exposed locations such as Sonturk supermarket, Station, and GNFS change to tolerable zones. The evening noise level in the market is within the tolerable range, which covers a much more significant portion of the study area.

Figure 7(d) shows the average daytime noise level in the Kotokuraba market. The average daytime noise level in the market ranges from 67dB(A) to 94dB(A). A more significant portion of the study area lies within the moderate to high noise exposure zones during the daytime in the Kotokuraba market.

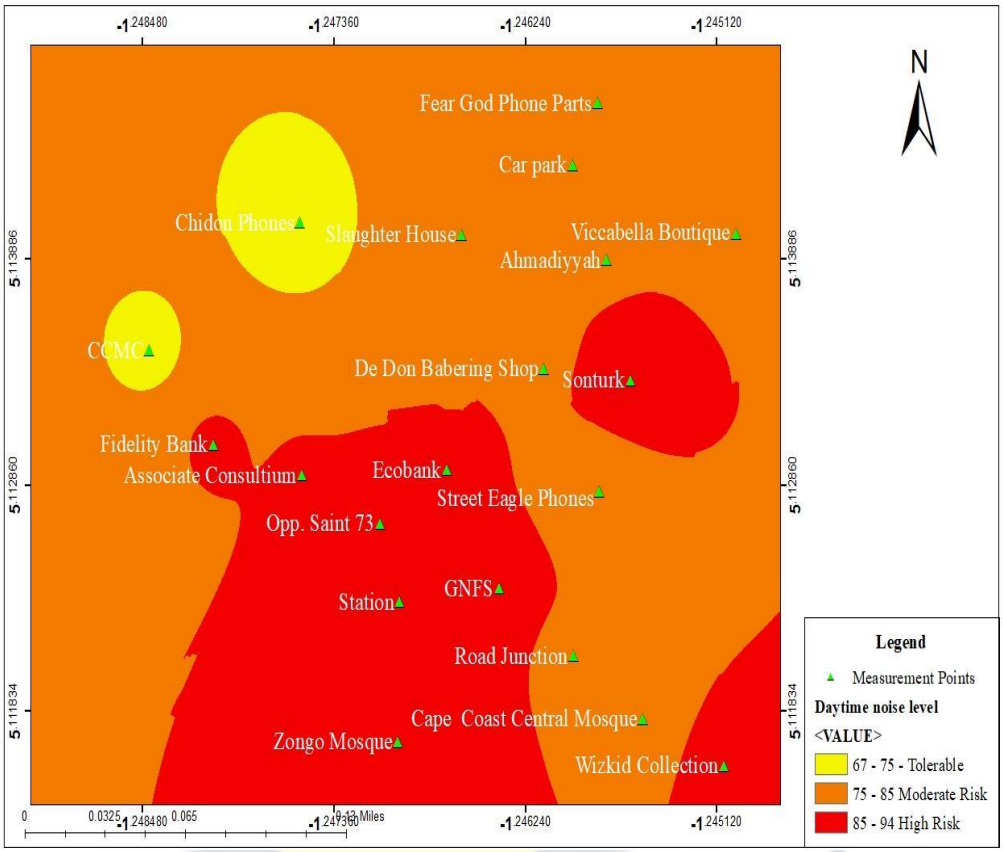

Figure 7(d): Average Daytime noise exposure distribution (day 0600-2200 h)
Source: Field Data (2021)

Except for areas around CCMC and Chidon phones, all the areas in the market experience high noise levels above the recommended EPA upper limits of 75 dB(A) for daytime noise in commercial areas.

In summary, the average daytime noise level in the market is high. Noise levels in the market are high in the afternoon, followed by the morning and fall in the evening, confirming the studies made by Essandoh and Armah (2011) in the Kotokuraba market. Furthermore, there was variation in noise level in places such as the station and Sonturk supermarket. Essandoh and Armah (2011) observed a rise in noise levels in these places in the morning and reached peak levels in the afternoon and evening. However, the findings presented a different view, with noise levels rising in these places in the morning, peaking in the afternoon, and experiencing a decline in the evening. The noise declines in the

evening because traders are to exit the market by 7 pm, according to the CCMA's new regulations.

High noise pollution values recorded in different sites in the market were from sounds produced by preachers, shops, and music vendors, the proximity of those sites to roads, the presence of sirens, and the unnecessary blowing of horns confirming Essandoh and Armah's study findings (Essandoh & Armah, 2011). Other authors also observed that high noise levels in the market are mainly related to road traffic and vehicles (Saadu et al., 1998; Amando & Jose, 1998; Mansouri, Pourmahabadian, & Ghasenkhani, 2006)

Interestingly, the average daytime noise levels in the market exposure zones during different times are higher than the levels stipulated by the EPA. The noise level was about 1 to 19 dB(A) above the recommended limits specified by the EPA for commercial areas (Table 1). Compared to Essandoh and Armah's (2011) study, which observed the average daytime noise level in the Kotokuraba market to be about 15 dB(A), there has been an increase of about 4 dB(A) in noise levels. This is because there has been an expansion in the market which has caused a rise in the number of traders and noise sources. However, there were also places within the market during these times whose noise levels fell below the EPA noise upper limit standards. Places around Chidon Phones and CCMC fell into the tolerable noise range because there are regulations on noise sources and the time to make a sound in those areas.

Perception of Traders on Kotokuraba Market Noise Pollution

This section focuses on research objective two, which sought to examine the perception of traders about noise pollution in the Kotokuraba market. It

entails analysis based on noise-related market information, thus noise nuisance, noisy days within the week and time, and noise sources.

The results indicated that 71.5% of the respondents knew and were aware of noise pollution and perceived the noise levels in the market as a nuisance. In comparison, 28.5% of the respondents do not consider the level of noise in the market as a nuisance (Table 4).

Table 4: Noise as a Nuisance

Noise as a nuisance		
Category	Frequency	%
No	92	28.5
Yes	231	71.5
Total	323	100.0

Source: Field Data (2021)

Based on the findings in Table 4, most respondents perceive noise levels in the market as a nuisance. Many authors have confirmed that traders consider noise levels from shops and vehicles in the market a nuisance (Essandoh & Armah, 2011; Oyedepo & Saadu, 2010). Furthermore, the respondents explained that it becomes a nuisance due to its irritating nature and effects on their sleep and concentration.

Moreover, to fully comprehend the nature of the perception of traders in the market, the study analysed respondents' perceptions concerning day and time noise and noise sources. Table 5 shows that most respondents view Sunday as the loudest day in the market. The findings align with the studies by Essandoh and Armah, which observed the weekends as the loudest day in the market since the official market day is Sunday (Essandoh & Armah, 2011).

Table 5: Loudest Day(s) in the market

Loudest Day(s) in the market	n	Percentage	Percentage of cases
Monday	184	13.7	66.9%
Tuesday	208	15.5	75.6%
Wednesday	173	12.9	62.9%
Thursday	190	14.1	69.1%
Friday	165	12.3	60.0%
Saturday	188	14.0	68.4%
Sunday	238	17.7	86.5%
Total	1346	100%	489.5%

Source: Field Data (2021)

Table 6 shows that the Afternoon (85.9%) was the loudest time in the market. It was observed that during the afternoon, most traders were already settled in the market, and there was much noise from shops advertising their products and sounds from preachers. Studies by Essandoh and Armah (2011) and Oyedepo and Saadu (2010) also confirm that the Afternoons are the loudest time in the markets, with most noise produced by preachers, music vendors, or shops. The findings are in confirmation by the noise exposure distribution map (Figures 7(a), (b), and (c)), which shows high-risk zones with high noise levels in the Afternoon.

Table 6: Loudest time of day and source of noise in the market

Loudest time in the market and sources of noise	N	Percentage	Percentage of cases
Loudest time of day			
Morning	246	32.8	76.9%
Afternoon	275	36.7	85.9%
Evening	228	30.4	71.3%
Total	749	100	234.1%
Sources of noise			
Road Traffic	194	30.4	51.1%
Music Vendors and Shops	158	24.7	41.6%
Preachers	227	35.5	59.7%
Herbal Medicine Sellers	60	9.4	15.8%
Total	639	100%	168.2%

Source: Field Data (2021)

The vast majority of traders indicated that the Preachers in the market are the primary source of noise (59.7% or 227) (shown in Table 6), followed by road traffic noise, music vendors and medicine sellers. According to the Kotokuraba Concern Market Union Association Leader, these noise sources are the primary sources of noise pollution in the market. Preachers, the market's most selected noise source, depicts the noise preachers produce as the traders' primary concern. There were many locations of preachers observed in the market during the survey. The findings were in line with studies which confirm religious noise (from preachers and mosques), road traffic, and shops to be a significant source of noise in markets (Anomohanran, Iserhien-Emekeme & Emekeme, 2004; Oyedepo & Saadu, 2010; Essandoh & Armah, 2011).

Relationship between Socio-demographic Variables and Noise Sensitivity

The third objective of this study was to analyse the relationship between noise sensitivity and traders' sociodemographic characteristics. A bivariate or chi-square analysis was conducted to test the association between the trader's socio-demographic variables and noise sensitivity. The findings are presented in Table 7.

Table 7: Relationship between sociodemographic variables and noise sensitivity

Noise sensitivity	X^2	Asymptotic Sig. (p<0.05)
Gender	3.230[a]	0.072
Age	12.945 [a]	0.165
Education level	18.715 [a]	0.000*
Marital Status	36.548 [a]	0.000*
Income Level	7.039 [a]	0.030*
Hours per day	0.459 [a]	0.795
Working conditions	15.044 [a]	0.000*

Source: Field Data (2021)

The relationship between education level and noise sensitivity was significant, $X^2(3, N = 323) = 18.715, p < 0.05$. The education level of a trader influences their sensitivity to noise levels. Traders with different levels of education exhibit varying degrees of sensitivity to noise levels. It was observed that traders with higher levels of education were more sensitive to the noise levels in the market. This suggests that education plays a role in shaping individuals' tolerance or perception of noise. According to Sieber et al. (2018), education level is associated with noise sensitivity, further supporting this deduction.

Moreover, the marital status of traders was found to be statistically significant to noise sensitivity, $X^2(4, N = 323) = 36.548, p < 0.05$. This implies that traders' marital status influences their sensitivity to noise levels in the market. However, it is important to note that the specific impact of marital status on noise perception varies from individual to and mostly depends on factors such as the quality of the relationship, personal preferences and

individual differences in sensitivity. Park et al. (2017) have previously identified marital status as a factor affecting noise sensitivity confirming the findings.

Furthermore, an association was found between working conditions at the market and noise sensitivity, $X^2(1, N = 323) = 15.044, p < 0.05$. This suggests that the working environment's nature, including factors such as high noise levels and lack of noise regulation, may impact traders' sensitivity to noise. Abbasi et al. (2019) also observe that noise exposure, sensitivity and working environment are related as they can affect job satisfaction and stress.

Lastly, there was a significant relationship between income and noise sensitivity, $X^2(2, N = 323) = 7.039, p < 0.05$. Traders with different income levels exhibit different levels of sensitivity to noise. Higher-income individuals were observed to be more sensitive because they have more knowledge about noise pollution effects and might have more resources to mitigate or cope with noise, potentially leading to lower noise effects on their health. Park et al. (2018) support this deduction by highlighting the influence of income on noise sensitivity.

Influence of Noise Exposure on Trader's Health

This section focuses on research objective four, which sought to analyse how noise exposure affects the health of traders and how they perceive it. It entails analysis based on the health implications noise has on the health of traders in the market.

The findings focus on responses from interviews of respondents on their perception of noise pollution health effects. The results were attributed to the noise levels measured in the market (the participants' locations) compared with

studies on noise levels and their health effects. It helped confirm if the health problem that the respondents perceived to experience due to noise exposure matches the noise level and empirical data. Factors such as; the family history of impairment, other activities that may expose the respondent to similar noise health problems, length of exposure, injuries to the ear, and others outside the market, were not considered.

Noise on Health

Throughout the study, the most dominant observation made in the market was the surge in noise sources, such as public address (PA) systems used by shops and preachers near each other in the market. The Kotokuraba market was full of many noise sources; they did not follow the prescribed noise guidelines of the Ghana EPA. Recorded noise levels from observed sources in the market were above 75dB(A), with some ranging to 97dB(A). Prolonged noise exposure can cause various health problems (Sliwinska-Kowalska & Davis, 2012). Through the survey, about 91% of the respondents indicated that noise levels in the market affect their health. The findings were ideal since noise levels exposure beyond 85db(A) for several hours are known to cause serious health issues ranging from both physiological and psychological.

The account of a 34-year-old female trader in the market is as follows:

> *I experience many health complications because of the loud noise produced by the sound systems from these preachers and the information centre closer to my shop. Before I moved to this place, I was all right. I have headaches and ear problems, which worsen since the sounds produced by the preachers and the information centre are not regulated.*

When asked if the noise in the market affects the respondent's health, a 28-year-old male trader responded:

> *I usually have headaches when the market is busy and the music shop owners turn the volumes of their speakers loudly*.

According to the Health Official:

> *Most traders in Cape Coast have problems related to the noise in the market, especially in Kotokuraba, with the high noise level from speakers. Usually, patients in the Kotokuraba market and other markets in Cape Coast often report headaches, heating losses and other problems such as high blood pressure.*

The above assertions conform to the findings of Kurabi et al. (2017) and the Occupational Safety and Health Administration (1910) that exposure to noise levels above 85dB(A) for 8 hours or 100dB(A) for more than 15 minutes could cause health issues. Nevertheless, there were instances where respondents were known to have health suffered from a health defect even at places with noise levels below 75dB (A).

Noise-Induced Hearing Loss

Noise-induced hearing loss is one of the most common health problems affecting the ears when exposed to loud noises. It can affect one or both ears, and the effects can be permanent or temporal. Besides the decreased sensitivity to sound, NIHL can have symptoms like fullness in the ears, muffling noises, or ringing in the ear. According to the Ghana Statistical Service (2014), 413 people above 15 years had hearing impairment and hearing loss in Cape Coast. The Cape Coast Teaching Hospital 2021 also recorded 112 cases of hearing loss, an increase from 76 in 2020, from patients in Cape Coast caused by high noise

levels, head injuries and other factors. These data show that noise-induced hearing loss and impairment are health problems residents in cape coast face due to noise and other factors. From the interviews, respondents were noted to have experience fullness in the ear and hearing loss. When asked whether they experienced any symptoms related to NIHL, a 25-year-old female respondent revealed that;

> *I sometimes have temporal hearing loss and fullness in my ear. I occasionally experience it in my left ear, which does not happen consistently. It makes it difficult to hear when customers are buying items. Sometimes, it is frustrating because you have to ask the customer to speak louder when buying items.*

Relatively, on NIHL, a 48-year-old female trader also gave the following account;

> *I have hearing difficulties in both my ears sometimes. I have medications to help, but I have to limit my time spent in the market after doctors advise me. It happens when I am exposed to the preacher's sounds in front of my shop.*

A female fish trader also gave a similar account:

> *I am having difficulty in hearing. Moreover, I always shout at the top of my voice in the market. I have it in my right ear and sometimes feel the hissing sound in my right ear. However, it is not permanent, and it happens not frequently.*

The Health Official also stated:

> *Hearing loss in the Cape Coast Metropolis is common among market women. Often, they experience these in both or one of their ears.*

However, patients often report these cases late after they have experienced detrimental effects or the case worsens.

The account of the respondents conforms to reports that state that prolonged exposure to intense noise with sound pressures above 75dB can destroy the inner ear structures leading to hearing loss (Occupational Safety and Health Administration, 1910; EPA, 2008; Sliwinska-Kowalska & Davis, 2012).

Tinnitus

Tinnitus usually results from long-time exposure to loud noises. For most traders, the condition is a mere annoyance. However, they stated that it prevents them from sleeping and concentrating in severe cases. Most of the respondents suffering from tinnitus were also observed to have hearing problems. In Wang et al.'s (2020) view, people with tinnitus may also experience noise-induced hearing loss.

In an interaction with some traders on their health experience before discovering tinnitus, some traders clarified that they did not experience these conditions years before. However, with the rapid increase in sounds from public address systems in the market from preachers and shops closer to their stores and tables, they began to discover hissing sounds in their ears. However, some traders did indicate that they did discover this condition after a doctor diagnosed them. The narration from the traders showed that they began to experience tinnitus because of their exposure to loud noises in the market (Mahmoudian-Sani et al., 2017, Ugbebor et al., 2017; WHO, 2018).

The account of a 46-year-old female trader experiencing the symptoms of tinnitus is as follows:

At first, when I heard this hissing or whistling sound, I thought somebody might be calling me, or some of my kids were doing that. However, with time, I discovered that even in places where being alone and there is no sound, I occasionally experience this discomfort. I learned this when I visited the "Interbeton" hospital and was diagnosed with a hearing problem. I am advised to avoid noisy areas, which is impossible since trading is my occupation. It usually happens when the preachers and the herbal seller's trucks play music close to my shop. I have gotten used to it with time, but sometimes it is worse because it takes a while after they have turned off their speakers for my hearing to return to normal.

According to the Health Official:

We often have cases of tinnitus which indicate early signs of NHIL. However, patients often try to cure these cases, which can be bothersome. They often complain of hissing sounds in the ear, which often points to signs of tinnitus. However, the causes of tinnitus in patients are often attributed to noise and other factors.

When asked whether he experienced symptoms of tinnitus, a 32-year male trader made the following comment:

Sometimes I cannot hear anything when the herbal medicine sellers are around and when many vehicles blow their horns on the road. I hear this hissing sound, but it goes away after a time. So, it is not much of a problem, it is part of the occupation, so I have gotten used to it.

The comments by the respondents above align with the findings of Ugbebor et al. (2017) that high noise levels in the market can cause tinnitus.

They further revealed that an individual's reaction to tinnitus includes sleep and concentration problem. The continuous and unchecked increase in noise levels in the market may increase the number of traders developing tinnitus. The traders endure this uncomfortable health condition as they are consistently exposed to loud noise.

Concentration

Traders also experience a loss of concentration due to their exposure to noise in the market. Concentration plays a critical role in the daily affairs of traders as it helps in transactions. According to Jafari et al. (2019), loud noise causes changes in activities that require concentration. Noise levels above 70dB(A) reduce one's ability to concentrate, which affects cognitive functions (Hockey, 1970; Smith, 2012; Wright *et al*., 2014).

In recounting the participant's experience of having difficulty concentrating, a 32-year-old male trader in the market made the following statement:

> *The noise levels in the market are a challenge to us, and it does not help when it comes to transacting business. Sometimes it is difficult to hear and even concentrate on what a customer says. When I am busy calculating sales and the jingles from the "Taabea" sellers distract me, I must review the whole process again.*

With the noise levels from this study peaking around 97dB(A), the above assertion conforms to the study conducted by Wright et al. (2014) and Jafari et al. (2019), which revealed that the concentration becomes affected when exposed to noise at 95 dB level. Other research, however, found inconsistent results regarding the impact of noise on concentrations, further

arguing that noise can improve concentration (Pawlaczyk-Łuszczyńska et al., 2005; Hoskin, Hunter & Woodruff, 2014).

Sleep Disorder and Headaches

High noise levels cause psychological and physiological effects among traders (Ugbebor et al., 2017). Sleep disorders and headaches were discovered to be the effects traders are experiencing due to the levels of noise in the Kotokuraba market. From the interaction with the traders, it was observed that the disturbance threshold varies among respondents. It was observed that some traders complained about having difficulty sleeping when they were exposed to noise levels that were measured to be as low as 35dB(A). Others can sleep after exposure to noise levels above 90dB(A).

According to a 46-year-old female trader who sells closer to Sonturk supermarket, where noise levels can rise to 97dB(A):

> *I have no difficulty sleeping after I go home from the market. Usually am tired after work, so it is easy for me to sleep.*

However, an account by a 32-year-old male trader at the exact location is as follows;

> *I find it difficult to sleep after work. On busy market days like Sundays, I have problems sleeping when I return home. After hours of noise exposure, I have headaches, and my sleeping schedule becomes disordered. However, I find it less difficult to sleep on days when the market is less noisy.*

The Health Official also stated:

> *High noise levels can also influence the sleep pattern of traders in the market. However, the influence may vary among individuals as some may have difficulties sleeping while others may sleep amid the noise.*

Studies by Dawal, Taha and Ismail (2007) and Akinkuade and Fasae (2015) also support the findings that noise pollution can lead to sleep disturbances. Therefore, there is strong evidence that sleep disruption is associated with declining health, and rising evidence points to exposure to noise (Halperin, 2014); however, whether these noise-induced sleep disruptions correlate with noise exposure and adverse health outcomes is uncertain.

In addition to the physiological and psychological effect of the noise exposure, traders accounted to have experience headaches on occasion. The respondents indicated they had experienced headaches in the market from continuous noise exposure during the interviews. In recounting the participant's headaches experience, a female fish seller gave the following accounts.

> *I do experience consistent headaches as a result of noise exposure. I have headaches when the preachers closer to us turn their volume too high in the afternoon. I usually tell them to turn it down, but they refuse, which has become a norm. I have gotten used to it, so I take drugs whenever they are around.*

The above assertion conforms to the study report of Ugbebor et al. (2017), which cites a higher prevalence of headaches among market traders related to noise exposure.

Actions to Control Noise in the Kotokuraba Market

Noise management aims to keep noise levels low to safeguard people's health. This section examines research objective five, which examines the relative action taken to manage noise pollution in the Kotokuraba market. In doing that, assessment was made of the respondent's knowledge of using hearing protective devices and noise regulations in the market.

NIHL is the only type of hearing loss entirely preventable through Hearing Protective Devices (Sliwinska-Kowalska & Davis, 2012). Hearing protection is essential for reducing exposure to noise and maintaining good hearing. Table 8 shows the findings of the participant's answers to the hearing aid usage in this study. It was fascinating that just 26% of the participants knew about noise pollution and were aware of hearing protection devices (HPD). All 26 % of the respondents identified ear muffs and earplugs as the kind of HPD they knew.

Table 8: Knowledge and Usage of hearing protection devices

Knowledge assessment	**Responses**		**Type**	
	Yes	No	Ear Muffs	Ear Plugs
Knowledge about hearing protection devices	84 (26.0%)	239 (74.0%)	72 (85.7%)	12 (14.3%)
Use of hearing protection devices	0 (0.0%)	84 (100.0)		
Reason for not using a protection device	No Knowledge 0 (0.0%)	It is uncomfortable 84(100%)		

Source: Field Data (2021)

However, none of the participants used HPD in the market, citing discomfort. These findings are similar to that of other researchers (Ugbebor et al., 2017; Ogunseye et al., 2018), who noted that hearing protection devices are not common among traders in the market. They further attributed this to the lack of awareness among traders. However, this study demonstrated that the respondents have some form of knowledge about hearing protection devices. The study discovered that 26% of the respondents knew about HPD. Nonetheless, awareness of the harmful effects of noise on hearing does not convert into the usage of hearing protection devices (Rashaad & Dickinson, 2010).

In Ghana, decisions, except noise limit values, are usually made by local authorities. Act 490 requires the EPA to establish noise pollution regulations and recommendations (EPA, 2008). Consequently, under section 79 of Local Government Act 462 of 1993, MMDAs can outline bye-laws to regulate noise pollution in their respective assemblies.

Table 9: Noise regulation assessment

Market Regulation assessment	Responses			
	Yes	No		
Existence of noise regulations in the market	105 (32.5%)	218 (67.5%)		
Effective implementation of regulation	103 (98.1%)	2 (1.9%)		
Have you made complaints to any agency?	CCMA 59 (56.2%)	EPA 9 (8.6%)	Market Union 14 (13.3%)	No Reports 23 (21.9%)
Agency Action	Taskforce 16 (19.5%)	Fine 11 (13.4%)	Warning 15 (18.3%)	Nothing 40 (48.8%)
If the agency did nothing, why?	Officials give permit 8 (20.0%)		Non-enforcement of laws 32 (80.0%)	

Source: Field Data (2021)

From Table 9, about 67.5% of the respondents indicated that no regulations regarding noise pollution exist in the market. In comparison, 32.5% indicated the existence of noise regulations in the market. With this, the Deputy Director of EPA in Cape Metropolis stated that;

> *The Environmental Protection Agency, Act 490 of 1994 prescribes the standards and guidelines relating to the noise level in Ghana. It also gives the legal basis for the intervention to control and deal with the noise in the market. However, the CCMA oversees noise regulations and enforcement in the Kotokuraba Market.*

Moreover, the Official from the Registrar's Office of the CCMA also stated that;

> *We have by-laws that restrict the playing of music in the market. For instance, we have laws against playing music or making noise so loud that it disturbs other traders in the market. Usually, these apply to the preachers and any religious activities in the market. Moreover, regulations exist on where and when sounds should be played in the market, specifically before 9:00 am or afternoon.*

In contrast, the findings showed no effective implementation of noise regulations in the market. According to a 32-year-old male trader:

> *Noise pollution regulations in the market are not effectively enforced in controlling noise levels—officials of the CCMA usually back offenders. Therefore, any reports made against them are often ignored.*

Also, the following statements made by the Leader of the Kotokuraba Concern Union Association confirmed how the CCMA fails to assert its role in enforcing the bye-laws on noise:

Several reports have been made to the CCMA, but they ignored them. I advised a preacher to reduce the speakers' volume since it affected traders. Moreover, this individual later used me to preach in one of his sermons as an attack against Christianity. This issue was reported to the CCMA, but they overlooked the report, and it was left unresolved. So, I have not witnessed any effective action regarding regulations' effectiveness.

The statement aligns with Knott and Gyamfi's (2019) findings. They discovered that people usually end up being branded as having an evil influence when complaining about noise caused by preachers and churches.

It was discovered that the respondents had reported cases of noise pollution to agencies such as the CCMA (56.2%), the Market Union (13.3%), and the EPA (8.6%). The findings revealed that about 48.8% of the respondents did not witness any action taken by these agencies. About 19.5% indicated that these agencies use Taskforce to displace the perpetrators in the market, followed by warning (18.3%) and fine (13.4%%).

Section 296(7) of Ghana's constitution states that a person can be subject to a fine not exceeding ¢200,000 if he produces noise that disturbs others. For instance, based on an article published in Graphic Online, the Accra Metropolitan Assembly District Court 2013 fined people between GH¢60 and GH¢1,800 for causing noise pollution in the capital, depending on the gravity of the incidence (Boadu, 2017). According to the office of the registrar of the CCMA:

Usually, we use task forces and fine offenders who continuously abuse noise regulations in the market. Individuals usually pay a fine within the

range of GH¢1,000 to over GH¢2,500. However, it is difficult to enforce them mainly due to public opinion, so we attend to noise offenders in extreme cases or those without permits.

Regardless, based on observations made by Nyabor (2018), bans and fines on noise-making only work on the Cape Coast during the festival season on the first Saturday in September every year. He further indicated that there are still reports on how individuals violated these bans, even during the festive season. The question then is: how effective are regulations on noise pollution? Despite the fines (GH¢100 and above) and penalties (such as the seizure of items and prohibition and expulsion from the market) taken by the CCMA, the penalties and fines on noise pollution are no longer deterrents. These incidents prove how irrelevant the bye-laws on noise prevention are.

The study revealed that agencies responsible for preventing noise pollution fail to enforce noise regulations. The respondents indicated this happens because the officials do not enforce noise by-laws and permit people who cause noise pollution in the market. According to the Market Leader:

Some perpetrators are backed by the officials of the CCMA, which makes it difficult for them to act against such individuals since they have authorization from them. For instance, the task force once took the machines of one preacher who consistently made excessive noise in the market. Nevertheless, later, this individual's items were returned to him. He continued to make noise in the market at the exact location.

However, the CCMA attributed the non-enforcement of regulations to the "*outrage of the traders when they enforce the by-laws."* These incidents show how questionable and problematic the enforcement process of noise

regulations is in the market. Despite this, the noise can be stopped if the CCMA tries to revise its bye-laws and relevantly enforce them.

While at it, the study also revealed possible solutions recommended by respondents to curtail noise pollution in the market. From Figure 8, the respondents proposed using a task force, regulating road traffic, regulating the volume of preacher's PA systems, reducing the volume of music vendors, issuing permits, enforcing laws, and public education.

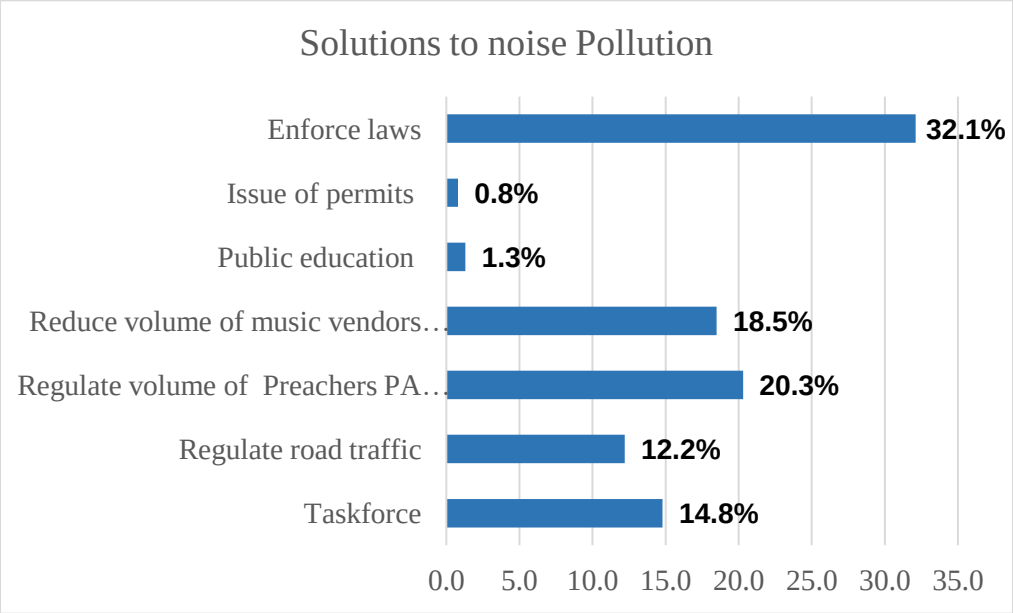

Figure 8: Solutions to noise pollution in the market
Source: Field Data (2021)

About the proposed recommendations, a female respondent stated that;

> *Time needs to be apportioned to the preachers regarding when they are to be in the market, the duration of their teachings, and the regulation of the volume of their sound systems.*

The Kotokuraba Concern Union Association Leader also stated that "

> *The CCMA should stop drivers who use the market roads to avoid traffic on the main road; it will help reduce the unwanted noise in the market.*

In this wise, the CCMA and the traders in Kotokuraba must make efforts to make the bye-laws relevant and enforceable towards a more noise-sustainable set objective. While they are at it, local governments, the NCCE, and the EPA should raise awareness about noise pollution's detrimental consequences and health implications.

Chapter Summary

This chapter discussed both the socio-demographic characteristics of respondents and attempted to answer the study research objectives. Generally, most of the respondents in the Kotokuraba market were females with some form of formal education. Furthermore, most of the respondents earn a monthly income above Gh₵ 319. Regarding time spent in the market, most traders spend between 6 to 12 hours. Generally, the study revealed that market conditions are not favourable because of the stringent nature of market regulation and the increase in noise pollution.

In determining the relationship between noise sensitivity and traders' socio-demographic characteristics, the study revealed that the educational level, working conditions, marital status and income level of traders are associated with their sensitivity to noise levels in the Kotokuraba market. However, age, gender and the number of hours traders spent daily in the market were not statistically associated with their noise sensitivity.

The study revealed that the traders perceived noise in the market as a nuisance. The study revealed that the noise market is high in the afternoon and Sundays, with areas highly exposed to noise pollution, including Sonturk supermarket, station, fidelity bank, and GNFS. The study further discovered

that the significant noise sources in the market are the preachers, followed by road traffic, shops, and herbal medicine sellers.

The study discovered that traders have noise-induced hearing loss, tinnitus, headache, sleep disorder, and loss of concentration because of their exposure to higher noise levels in the market.

The study discovered that most respondents do not know about hearing protection devices. However, the very few with that knowledge do not use the devices to protect themselves. The study further discovered that measures to control noise pollution have not been effective in the Kotokuraba market. However, respondents suggested that noise pollution can be controlled in the Kotokuraba market: by enforcing laws, regulating the volume of sound systems of shops and preachers, using the task force, and issuing permits to authorized personnel regulating road traffic public education.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter summarizes the study's preliminary results and its conclusions and suggestions. It also suggests some areas for further studies.

Overview of the Study

The study's primary purpose was to investigate the perception of traders concerning noise levels and health-related issues in the Kotokuraba market. Specifically, the study sought to: identify noise exposure zones in the market, examine the perception of traders about noise pollution in the market, analyse the relationship between traders' sociodemographic characteristics and noise sensitivity, analyse the perception of traders on health issues as a result of noise exposure in the market and finally examine the relative actions taken to manage noise in the market.

This study employed a sequential explanatory design. A total of 337 respondents took part in the study. The research instruments used for the study were a Sound level meter, GPS device, noise measurement checklist, interview guide, and a questionnaire. Data collected included information on the noise levels in the market, traders' perception of noise pollution, noise-induced health effects, and actions taken by traders and Key informants in managing the Kotokuraba market. The information was evaluated and presented using noise maps, frequencies, and direct quotations to contextualise the participants' remarks.

Summary of Key Findings

Research question one sought to identify the noise exposure zones in the market. Measurements were made in the Kotokuraba market, with areas grouped into safe, tolerable, moderate-risk, and high-risk zones. In the morning, places around Sonturk supermarket, Ecobank, Fidelity Bank, Station, and Slaughterhouse were identified to fall within the high-risk zones. Relatively, many areas in the market during the morning fell within the tolerable to high-risk exposure zones, with noise levels ranging from less than 68 dB to 90 dB. Moreover, in the afternoon, noise levels recorded in the market peaked around 97dB, with a significant part of the areas falling within moderate to High-risk exposure zones (75dB – 97dB). Most areas in the market recorded higher noise values except places around the slaughterhouse with noise from sources such as vehicles, shops, herbal medicine sellers, preachers, and music vendors. Lastly, in the evening, noise levels in the market are within the tolerable range (59-75 dB). Generally, the daytime average noise levels measured in the market were about 1 to 19 dB(A) above the recommended upper limits for noise levels in commercial areas stipulated by the Ghana EPA.

When examining traders' perceptions of noise pollution in the Kotokuraba market, the respondents considered noise levels a nuisance. Sunday was the nosiest day in the market, and the afternoons were the loudest/nosiest time. The study further revealed that preachers' noise in the market is primarily produced, followed by Road traffic, shops, and herbal medicine sellers.

Moreover, the study observed a relationship between traders' sociodemographic characteristics and their sensitivity to noise. The study revealed that traders' educational level, working conditions, marital status and

income level are associated with their sensitivity to noise levels in the Kotokuraba market. However, the number of hours traders spent daily in the market was not statistically associated with their noise sensitivity.

The study discovered that traders have hearing loss, Tinnitus, Loss of concentration, sleep disorders, and headaches. However, since exposure and its effects were subjective, the threshold of the effects varied among respondents, with respondents experiencing different symptoms within the same noise exposure zone.

Concerning the relative actions taken to manage noise in the market, it was discovered that about 21.9% of the respondents knew hearing protection devices, such as ear muffs and plugs. However, none of these participants used hearing devices, declaring it uncomfortable as a reason for unused. In addition, the study revealed that about 27.3% of the respondents indicated that there are noise regulations in the market, and they are effectively implemented. The research also found that respondents complained about noise levels in the market to agencies such as the CCMA, EPA, and the Kotokuraba Concern Traders Union. The use of task force to seize items of perpetrators, fines, and warnings were actions taken by these agencies against individuals who violate noise regulations. However, it was also discovered that sometimes these agencies refused to act on these reports made. The respondents attributed this to the non-enforcement of laws in the market and the CCMA official's involvement in giving permits to perpetrators. On this issue, the CCMA official attributed their non-enforcement of the regulations to the trader's outrage against the enforcement of noise by-laws. Moreover, respondents proposed solutions to manage noise pollution in the market, including law enforcement, regulating

music volumes of shops and preachers' sound systems, issuing permits, using a task force, and public education.

Conclusions

Based on study results, it can be concluded that traders consider noise levels a nuisance in the market. Noise levels in the Kotokuraba market are generally high on Sundays, such as in the afternoon, morning, and evening. The primary sources of noise pollution in the market are preachers, road traffic (vehicles), music vendors (shops)s and herbal medicine sellers.

Areas within the market known to fall within high exposure zones include Sonturk Supermarket, Station, and fidelity bank. The sources known to cause high noise levels within these areas included sounds from vehicles, shops, preachers, herbal medicine sellers, and music vendors. Also, daytime average noise levels in the market are about 1 to 19dB(A) above the recommended upper limits for noise levels in commercial areas stipulated by the Ghana EPA.

Traders' socio-demographic characteristics, such as gender, age, educational level, working conditions, marital status and income level of traders, affect how sensitive they are to noise pollution levels in the market.

Furthermore, traders in the Kotokuraba market health are at risk due to the high noise levels. Tinnitus, hearing loss, loss of concentration, sleep disorders, and headaches are problems they face because of their consistent noise exposure.

Moreover, noise regulations and bye-laws are not effectively enforced in the Kotokuraba market. This was because of the ineffectiveness of the CCMA enforcing the regulations in the market and the officials' backing of the perpetrators by issuing them permits. Moreover, some traders in the Kotokuraba

market do not use hearing protection devices to protect themselves despite knowing about it because they deem it uncomfortable.

The Implication of the Findings for Regional and Urban Planning

Noise has become a priority environmental problem for urban managers and planners. Noise pollution can severely affect public health, decrease life and reduce the value of real estate (Pronello, 2001). The findings showed that the traders in the Kotokuraba market are exposed to harmful noise levels in their working environment. The noise is annoying, but it can lead to tinnitus, sleep disturbance, hearing loss, loss of concentration, and headache (Ugbebor et al., 2017). Therefore, creating a sound and sustainable environment (Tong & Kang, 2021) by urban planners can become difficult.

In regional and urban planning, noise mitigation strategies must become a priority. A sustainable strategy in terms of noise pollution should aim to regulate and plan urban areas with a long-term view to preventing the harmful effects of noise on the population. Slapping fines, use of Taskforce, and warnings is a short-term tactic that does not rest on a strategy that can sustain a better commercial environment in the long run.

To begin with, the CCMA does not adequately regulate new development in a way that can create a tolerable or noise-free environment. The city land use regulation requires that any significant new development undergo an environmental assessment. The environmental assessment should have considered the possible noise level the market traders are expected to experience. Therefore, the current town and country planning zoning guidelines and standards (Ministry of Environment Science and Technology, 2011) should be revised. The revision should contain the specifics relating to noise measured

levels, its effects, and the locational impacts of the developmental projects. Revising the zoning and planning standards and their effective enforcement will help reduce noise pollution levels in the metropolis.

Lastly, another set of corrective actions in urban areas that may be proposed often in programs for environmental protection against noise is resurfacing the street and modernization of the roadways. Improving the condition of roads around the Kotokuraba market can reduce sound generated at the interface (the wheels of vehicles in contact with the ground) and traffic congestion. Improving road conditions by urban planners and developers may go a long way to help reduce noise pollution levels. Road improvement will help because road traffic was identified as one of the significant sources of noise in the market.

Recommendations

The following recommendations were suggested depending on the study's findings and conclusions;

1. The Environmental Protection Agency and the Cape Coast Metropolitan Assembly should enforce legislation governing noise control in the Kotokuraba market. This would help reduce noise pollution and its resultant problems in the market.
2. Traders should be educated on the health complications associated with noise pollution and the steps they must take to protect themselves from noise pollution by the CCMA, and Ghana Health Service, to avoid the adverse effect of noise on their health. In addition, the radio and television and information centres in the market should be used by the

CCMA to promote the campaign on noise pollution, its effect, and control.

3. Traders and Officials of CCMA should ensure that the volume of public speakers and address systems are regulated in the market.
4. Traders should undertake regular check-ups at health facilities to ensure that health implications from noise influence, such as tinnitus and noise-induced hearing losses, are detected early, managed and prevented.

Suggestions for Further Studies

The current study focused on measuring the noise levels in the Kotokuraba market, traders' sociodemographic variables' relationship with noise sensitivity, the perception of traders about noise pollution, its effects on health, and management actions. Researchers who wish to continue their research in this area should focus on reviewing noise pollution policies, documenting and controlling the length of noise exposure, and introducing health variables such as the family history of impairment and other activities that may expose the respondent to similar noise health problems, length of exposure, injuries to the ear, and others outside the market.

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APPENDICES

APPENDIX A

UNIVERSITY OF CAPE COAST

FACULTY OF SOCIAL SCIENCES

DEPARTMENT OF GEOGRAPHY AND REGIONAL PLANNING

QUESTIONNAIRE FOR TRADERS

Title: Perception of Traders on noise levels in the Kotokuraba Market in Cape Coast, Ghana

Dear Sir/Madam,

I am Joe Addai Appiah Akwasi, a postgraduate student at the Department of Geography and Regional Planning, University of Cape Coast. This interview guide aims to gather information for a study on the **Perception of traders on noise levels in the Kotokuraba market and its related health effects** in Cape Coast, Ghana. I humbly want to seek your consent to participate in this study. Your participation is voluntary, and you may refuse to participate in or withdraw from this study. However, your participation in this study is relevant since the intention is to aid in policy drafting and implementation. The interview would last between 30 and 40 minutes to complete. I appreciate your cooperation.

MODULE 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS

1. Gender:
    - Male
    - Female
2. Age: ……
3. Education level:
    - Basic • Secondary/ Vocational • Tertiary • None

4. Marital status

- Single • Married •Widowed
- Cohabitation •Separated

5. Monthly income level?

- Less than Gh₵ 319
- Gh₵320 – Gh₵ 639
- Gh₵640 – Gh₵ 958 above

6. Daily hours spent in the market?

- 1 – 5 hours
- 6 – 8 hours
- 9 - 12 hours

7. How do you describe the working conditions in the market?

- Good • Bad

MODULE 2: NOISE-RELATED INFORMATION

8. Are you aware of noise pollution?

- Yes • No

9. Do you consider noise in the market a nuisance?

- Yes • No

10. Are you sensitive to noise?

- Yes • No

11. Which day(s) in the market is very noisy? (can pick one or more)

- Monday •Tuesday • Wednesday • Thursday
- Friday • Saturday • Sunday

12. Which time(s) is the loudest noise in the market? (can pick one or more)

- Morning • Afternoon • Evening

13. What do you think are the sources of noise in the market? (can pick one or more)

- Road Traffic
- Music Vendors/shops
- Preachers
- Herbal medicine sellers

14. Does noise affect your health?

- Yes • No

MODULE 3: USE OF PROTECTIVE HEARING DEVICES

15. Do you know about hearing devices?

- Yes • No

16. Do you use a protective hearing device when working?

- Yes • No

17. If No, what is the reason?

- It is uncomfortable
- No knowledge
- Other (Specify) ……

18. What type of HPD do you use?

- Earplug □ Ear muff □ Other (specify)……

MODULE 4: MANAGEMENT OF NOISE

19. Are there any regulations in the market regarding noise pollution?

- Yes • No

20. Are the market regulations effective at regulating noise pollution?

- Yes • No

21. Are there instances you have made reports to any of these agencies?

- CCMA • EPA • Market Union •No reports

22. What were the actions taken by these agencies?

- Use Taskforce • Warning
- Fine • Other(specify)……

23. If No, what do you think is preventing them from acting on the complaints?

- Non-enforcement • Official provision of permits

24. What would you recommend be done to solve/control this noise problem? Specify……

THANK YOU

APPENDIX B

UNIVERSITY OF CAPE COAST

COLLEGE OF HUMANITIES AND LEGAL STUDIES

FACULTY OF SOCIAL SCIENCES

DEPARTMENT OF GEOGRAPHY AND REGIONAL PLANNING

IN-DEPTH INTERVIEW GUIDE FOR KEY INFORMANTS

Introduction and Informed Consent Statement

Dear Sir/Madam,

I am Joe Addai Appiah Akwasi, a postgraduate student at the Department of Geography and Regional Planning, University of Cape Coast. This interview guide aims to gather information for a study on the **perception of traders on noise levels and its related health effects in the Kotokuraba market**, **Cape Coast**. I humbly want to seek your consent to participate in this study. Your participation is voluntary, and you may refuse to participate in or withdraw from this study. However, your participation in this study is relevant since the intention is to aid in policy drafting and implementation.

The interview would last between 30 to 40 minutes to complete. I appreciate your cooperation.

1. Brief background information about yourself and your role in the market.
2. What is your understanding of noise pollution?
3. In your view, what are the sources of noise pollution in the market?
4. What is your take on the effects of noise on traders' health? (Probe for cases and reports of excessive noise on trader's health)
5. What are the regulations concerning noise in the market?

6. Which agency(s) is responsible for enforcing them?
7. Are there any reported cases of excessive noise?
8. What are the steps taken to solve the problem?
9. What are the challenges you face in your department regarding issues relating to noise pollution?
10. Going forward, how do you recommend to be done to control/solve issues relating to noise in the market?

THANK YOU

APPENDIX C

UNIVERSITY OF CAPE COAST

COLLEGE OF HUMANITIES AND LEGAL STUDIES

FACULTY OF SOCIAL SCIENCES

DEPARTMENT OF GEOGRAPHY AND REGIONAL PLANNING

IN-DEPTH INTERVIEW GUIDE FOR TRADERS ON NOISE EXPOSURE HEALTH EFFECTS

Introduction and Informed Consent Statement

Dear Sir/Madam,

I am Joe Addai Appiah Akwasi, a postgraduate student at the Department of Geography and Regional Planning, University of Cape Coast. This interview guide aims to gather information for a study on the **perception of traders on noise levels and its related health effects in the Kotokuraba market** on Cape Coast. I humbly want to seek your consent to participate in this study. Your participation is voluntary, and you may refuse to participate in or withdraw from this study. However, your participation in this study is relevant since the intention is to aid in policy drafting and implementation. The interview would last between 30-and 40 minutes to complete.

I appreciate your cooperation.

1. Brief background information of yourself and your role in the market?
2. Do you know about the influence of noise on health?
3. In your opinion, have noise pollution affected your health?
4. Could you explain some of the negative effects noise pollutions have had on your health?
5. How were you able to identify the effects caused by the influence of noise pollution?
6. What are the steps you've taken to solve the problem?

THANK YOU

APPENDIX D

Noise Monitoring Field Record Sheet

Monitoring Location		
Description of Location		
Coordinates of Location		
Date of Monitoring		
Start Time (hh: mm)		
End Time (hh: mm.)		
Noise meter type		
Measurement Results	L_{90} (dB(A))	
	L_{10} (dB(A))	
	LEQ (dB(A))	
Primary Noise Source (s) During Monitoring		
Other Noise Source(s) During Monitoring		
Remarks		

APPENDIX E

INTRODUCTORY LETTER

UNIVERSITY OF CAPE COAST
COLLEGE OF HUMANITIES AND LEGAL STUDIES
FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF GEOGRAPHY & REGIONAL PLANNING

Our Ref:

Your Ref:

UNIVERSITY POST OFFICE
CAPE COAST, GHANA
WEST AFRICA

The Chairperson
Institutional Review Board
University of Cape Coast
Cape Coast
7th September, 2021

Dear Sir,

ETHICAL CLEARANCE FOR CONDUCT OF RESEARCH MR JOE AKWESI APPIAH ADDAI -STUDENT IDENTITY NUMBER: SS/GEP/19/0011

We write to introduce ***Mr Joe Akwesi Appiah Addai***, who is pursuing a Masters of Philosophy Degree at the Department of Geography and Regional Planning, University of Cape Coast. He requires ethical clearance to proceed with his data collection for his thesis titled "***Perception of traders on noise levels in Kotokuraba Market in the Cape Coast Metropolis***".

By this letter, we confirm that the Department has approved Mr Addai research proposal and has granted him permission to conduct and complete his thesis as part of the requirements for obtaining a Master of Philosophy degree.

We would therefore be most grateful if his thesis proposal could be reviewed to enable him carry out the research.

Thank you.

Yours faithfully

Prof. Benjamin Kofi Nyarko
HEAD

Telephone: *(Head)* 03321-30681, *(General Office)* 03321-30680
Fax: 03321-34072 E-mail: geography@ucc.edu.gh

APPENDIX F

ETHICAL CLEARANCE

UNIVERSITY OF CAPE COAST

INSTITUTIONAL REVIEW BOARD SECRETARIAT

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OMB NO: 0990-0279
IORG #: IORG0009096

29TH NOVEMBER 2021

Mr. Joe Akwasi Appiah Addai
Department of Geography and Regional Planning
University of Cape Coast

Dear Mr. Addai,

ETHICAL CLEARANCE – ID (UCCIRB/CHLS/2021/36)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted Provisional Approval for the implementation of your research titled **Perception of Traders on Noise Levels in the Kotokuraba Market in Cape Coast, Ghana.** This approval is valid from 29th November 2021 to 28th November, 2022. You may apply for a renewal subject to submission of all the required documents that will be prescribed by the UCCIRB.

Please note that any modification to the project must be submitted to the UCCIRB for review and approval before its implementation. You are required to submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

Samuel Asiedu Owusu, PhD
UCCIRB Administrator

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
UNIVERSITY OF CAPE COAST