SCHOOL OF PUBLIC HEALTH, COLLEGE OF HEALTH SCIENCES, UNIVERSITY OF GHANA, LEGON

ASSESSMENT OF HEALTH RISKS ASSOCIATED WITH WASTE HANDLING AMONG SANITATION WORKERS AT PRAMPRAM

BY

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DECLARATION

This thesis is composed of my original work. It is the result of an independent investigation under the supervision of Dr Mawuli Dzodzomenyo. Where my work is indebted to those of others, I have made acknowledgements. I declare that this work has not been accepted in substance for any other degree nor is it concurrently being submitted in candidature for any other degree.

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DEDICATION

This work is dedicated all Sanitation workers at Prampram, to my family and all those who supported me during the course of the project.

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ABSTRACT

Introduction

Waste is produced from households, municipal sources, commercial and industrial organizations as well as construction and demolition. Waste can also be produced uncontrollably through agriculture, mines and quarries activities. Waste management involves lot of activities including sweeping.

Aim and Methods

To assess some aspects of the health risks associated with waste handling, a cross-sectional study was carried out at Prampram, a peri- urban community a district in the Greater Accra Region. 183 sanitation workers were enrolled for the study through the snow ball method. A focus group discussion and a structured questionnaire were used to interview sanitation workers after obtaining their informed consent. An observational checklist was used to observe their usage of personal protective equipment.

Results

Almost all the respondents (98.4%) believed that their physical contact with waste was a health risk and almost all of them (98.4) claim they cleaned themselves after work. The odds of getting higher health risk in those who use PPE before waste handling is reduced by 65% (95% CI 0.144, 0.85) as compared to those who do not use PPE before waste handling. Those who use PPE during waste handling are 9.59 (95% CI 2.214, 10.492) times less likely to have health risk as compared to those who do not use PPE during waste handling.

Recommendations

These findings suggest that the use of personal protective equipment and perceived health risk are associated with an increased risk of having a health outcome. This investigation may help reduce the health risk of sanitation workers by providing Personal Protective Equipment and education. It may also help in policy making concerning the Sanitation.

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LIST OF ABBREVIATIONS

DHRC	Dodowa Health Research Centre
DSS	Demographic Surveillance System
IWM	Integrated Waste Management
JMP	Joint Monitoring Programme
MDG	Millennium Development Goals
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated biphenyls
PM_{10}	Airborne Particulate Matter
PPE	Personal Protective Equipment
SUSA	Sustainable Urban Sanitation
UK	United Kingdom
UNICEF	United Nations Children's Emergency Fund
SO_2	Sulfur Dioxide
WHO	World Health Organization

DEFINITIONS

Experience: This refers to what waste handlers through, the hardship they face and stigmatization.

Hazards: any source of potential damage, harm or adverse health effects on something or someone under certain conditions at work.

Health: It is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (WHO, 1948).

Improved Sanitation: This refers to the proportion of a population with access to facilities that hygienically separates human faeces from human contact.

Peri-urban: The transition zone or interaction zone, where urban and rural activities are juxtaposed, and landscape features are subject to rapid modifications, induced by anthropogenic activity.

Risk: A situation involving exposure to danger.

Sustainable sanitation: Sustainable sanitation is one that integrates reliable sanitation services with change in sanitation behaviour, whilst raising public awareness of its significance.

Sanitation: According to the joint UNICEF WHO report 2008, sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces.

Solid Waste: This refers to any waste that is not fluid (gas or liquid waste). Solid waste is generally used as a collective term for garbage, refuse, rubbish, or trash.

Sanitation Workers: A person employed, as by a municipality or private company, to collect and dispose of garbage.

Waste management: This refers to the process of waste generation, its collection, processing, transport, treatment, reuse and disposal (Rushton L. 2003). Waste management is important for public health of a people. The potential health risks of waste itself and the consequences of inadequate waste management cannot be overemphasized in public health research.

CHAPTER ONE

1.0 INTRODUCTION

This chapter gives the background of the study. It presents the background to Health risks associated with waste handling by Sanitation workers and the experiences they encounter in carrying out their work. It follows up with the conceptual framework, the statement of the problem, justification for the study and the research objectives in the study.

1.1 Background

Sustainable sanitation and waste management are prerequisites for a healthy environment and an ultimate requirement for the development of a people, especially in urban and Peri-urban poor areas. (Sigauke, 2002)

Waste is produced from households (municipal solid waste), commercial and industrial organizations.(Rushton, 2003) Waste can also be produced uncontrollably through agriculture, mines and quarries activities and human beings.

Municipal solid waste (MSW) consists of a plethora of things including food and garden waste, human waste, paper and cardboard, glass, metals, plastics and textiles. Commercial and industrial organizations also produce these things in addition to large volumes of chemical and mineral waste depending on the sector. Agricultural waste primarily consists of slurry and farmyard manure among others like silage effluent. Most of these waste substances spread on land and are hazardous due to their inherent characteristics. (Rushton, 2003)

The disposal of wastes has caused concern about possible adverse health effects for populations particularly in relation to areas where hazardous waste is deposited. Substances, such as cadmium, arsenic, chromium, nickel, dioxins and PAHs are considered to be carcinogenic, based on animal studies or studies of people exposed to high levels.(Baudouin, Charveron, Tarroux, & Gall, 2002) Evidence that these substances cause cancer at environmental levels, however, is often absent. In addition to carcinogenicity, many of these substances can produce other toxic effects (depending on exposure level and duration) on the central nervous system, liver, kidneys, heart, lungs, skin and reproductive system. Hazardous waste substances have been revealed to influence the likelihood of developing lung, brain and lung cancer (Dolk et al., 1998).

For other pollutants such as SO_2 and PM_{10}, air pollution studies have indicated that there may be effects on morbidity and mortality at background levels of exposure, particularly in susceptible groups such as the elderly. Chemicals such as dioxins and organochlorines may be lipophilic and accumulate in fat-rich tissues and have been associated with reproductive or endocrine-disrupting endpoints.(stevanovic–carapina et al.)

Waste management involves use of personnel who actively participate in sweeping, collection and disposal. A sanitation worker is an employee hired by a public or private enterprise to collect and remove refuse and recyclables from residential, commercial, industrial or other collection site for further processing and disposal. These individuals are exposed to a lot of health hazards in undertaking their activities. They face many hardships including stigma, exploitation by middlemen, hazardous working and living conditions. (Gauley, 1999)

Handling of waste involves a lot of activities like bending and other activities. One is therefore exposed to a lot of ergonomic hazards. Working without the use of personal protective equipment allows a direct contact of the individual to waste.

Some factors that could help in the proper handling of waste include Engineering Controls, Administrative Control and Personal Protective Equipment. Engineering Controls involves the use of process change, substitution, isolation, ventilation, and source modification in order to control worker exposures by reducing the quantity of contaminants released into the work space. Administrative Controls includes management involvement, training, job rotation, reduction of exposure time, preventive/predictive maintenance in an effort to control worker exposures. Personal Protective Equipment (PPE) involves the use of devices like gloves, body, eye, face, ear protection, respirators designed to protect individuals from hazards in the workplace.

Hazardous waste substances have been revealed to influence the likelihood of sanitation workers developing lung, brain and lung cancer (Dolk et al., 1998). Studies have also revealed that workers involved with waste handling may have more gastrointestinal symptoms, irritation of the skin, eye and throat, respiratory disorders including organic dust toxic syndrome (ODTS; toxic pneumonitis) than in other occupations (Poulsen et al., 1995).

Helminthiasis is globally caused by worms of different kinds. Helminthiasis is prevalent in developing countries specifically in areas where sanitation is low. Eggs of Helminth are the infective agents when they are released in the environment in faeces. They cause diseases when they are ingested through the faeco-oral route. The improper disposal and

handling of waste, sludge and faecal sludge(Hays, 1977) pollutes water and food and in effect causes disease.

Other possible health outcomes due to helminth infections are fatigue, headaches, psychological problems, musculoskeletal pan, infections and allergies. Proper handling of waste prevents a lot of health conditions associated with waste handling. It is therefore very important that personal protective equipments are being used as much as possible and appropriately to avoid personal contact with waste materials.

The use of Personal Protective Equipment is very important in order to minimize the impact of hazards associated with waste handling (Salkin & Kennedy, 2001). Items of Personal Protective Equipment include helmets (with or without visors), respiratory face masks, eye protectors, overalls (usually disposable), industrial aprons, leg protectors or industrial Wellington boots, disposable gloves and/or heavy duty gloves.

1.2 The Conceptual framework of the study

Waste management involves the collection, transport, processing or disposal, managing and monitoring of waste materials. Waste management practices are different for various countries; for urban, peri-urban and rural areas. In Prampram waste management involves sweeping, collection, processing, transport and disposal. Waste is not sorted out into hazardous and non-hazardous and so poses a health threat to sanitation workers. There are a lot of health effects from inhaling, ingestion or dermal contact of these waste materials. A few of these effects are musculoskeletal disease, respiratory symptoms, allergies and risk perception.

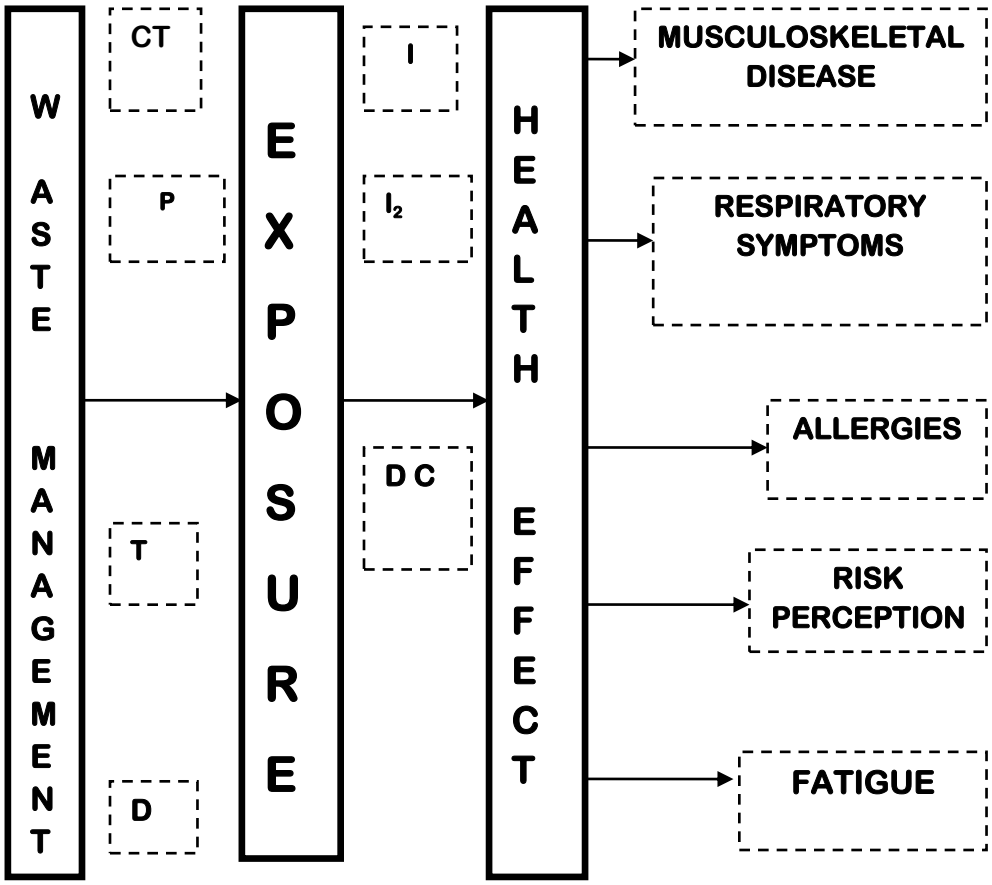

Figure 1: The conceptual framework of the study

SW- Sanitation Worker **CT**- Collection and Transport **P**- Processing

T- Treatment **D**- Disposal **I**- Inhalation **I_2** – Ingestion **DC**- Dermal Contact

1.3 Problem Statement

Waste is generated at household and other localities. Since consequences exist for any household, community or institution where waste is not collected, attempts are made to collect, transport and dispose of waste. Waste handlers therefore are a group of workers tasked with the duty to collect waste. Collection of fecal waste is limited due to poor urban planning in the township, which limits the access of large trucks. There is no

facility for fecal waste treatment and no known reuse in the township. Human waste is highly intermingled with solid waste, which is indiscriminately dumped at the beach or in the bush. (SUSA baseline 2011) Collectors are exposed to physical waste, other exposure including helminthes infection etc.

These materials may be risky and may lead to some health hazards. A large proportion of households in the Prampram community, (77%) have no toilet facility therefore use the bush, beach or field for open defecation (SUSA baseline 2011). Garbage is haphazardly disposed off in public areas and most of the people defaecate in bushes, beaches and other areas. These practices expose those engaged in waste handling to risk associated with waste.(Zerbock, 2003)

In addition, individuals who are occupationally involved in waste management often use technologically outmoded or unsafe means of waste handling. In other cases the options for waste management is either completely absent, too expensive to purchase or in poor condition. Such conditions may compromise the health of persons directly involved in the management of waste in the communities as a whole.

Social status of solid waste management workers is generally low in both developed and developing countries, but more so in developing countries then developed countries.(Wilson, Velis, & Cheeseman, 2006) This owes much to a negative perception of people regarding the work which involves the handling of waste or unwanted material. Such people's perception leads to the disrespect for the work and in turn produces low working ethics of laborers and poor quality of their work.

There is available information on occupational health risks faced by waste handlers in North America (Rendleman and Feldstein, 1997) and Brazil (Porta *et al.*, 2004). Though there is some information on the prevalence of neck, wrist and back pain among professional solid waste collectors in Ghana (personal communication, 2011), none of these assessed their experiences and perception about health risks associated with waste collection and management and also the use of Personal Protective Equipment (PPE). This may be due to the fact most of the Sanitation workers are not aware of the risk of exposure to waste. In view of this, not much intervention has been implemented in the control of risks to sanitation workers.

This evidence-based study therefore seeks to assess the experiences and perception of risk of exposure to waste among sanitation workers in peri-urban community of Prampram. It also seeks to provide additional information on the waste handlers' use of protective equipment as a way of controlling the impact of exposure to waste.

1.4 Justification

Studies on waste management workers may aid in solving the issues of waste management. The work of waste collectors involves considerable heavy lifting as well as other manual handling of containers. There is also an increased risk of direct contact with waste thereby increasing the risk of musculoskeletal problems and other waste related infections.

It has been suggested that increased exposure to bio-aerosols and volatile compounds may lead to elevated incidence of work-related respiratory gastrointestinal and skin problems in waste collections compared to the general workforce.

For these reasons, it is important to seek information on local experience and perception of waste handlers with the aim of understanding their own experience and perception of health risks in relation to their occupation. This information will help recommend specific public health interventions to address specific occupational health needs of persons engaged in waste management.

It has been established elsewhere that the relationship between perceived magnitudes of occupational health risks in persons engaged in waste management is likely to be influenced by culture and behaviour, level of development of waste management technology within a community and level of education (Agbola, 1993;(Gutberlet & Baeder, 2008)).

Even though magnitude of occupational health risk may be attributed to one's own behaviour, it is often perceived that occupational risk is unavoidable (Mutha *et al.*, 1999). Notwithstanding this, the exact magnitude or prevalence of risk factors or generalization of findings to other locations cannot be established (Inui, 1996), quantitative and qualitative research methods can provide information about perceptions of occupational health risks to persons engaged in waste management.

Issues to be explored about experience and perception of occupational health risks among waste handlers will include, but not limited to perception about physical health, perception about risk of exposure to occupational hazards, perception of personal protection from occupational health risks as well as access to sanitation.

1.5 Objectives

1.5.1 The Main Objectives

The main objective of this study was to determine the health risks due to physical exposure to waste material among sanitation workers.

1.5.2 Specific Objectives

1. To describe the experiences of sanitation workers in handling waste.
2. To determine the use of personal protective equipment among sanitation workers.
3. To assess the perceived health risk of waste managers.

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter presents important literature on sanitation and waste management taking into consideration the objectives of the study. The review touches on the global sanitation situation, sanitation situation in Africa and in Ghana. It also reviewed what sustainable sanitation is, waste and its management and finally the health risk and perceptions of sanitation workers.

2.1 Waste and its Management

According to the UK Environment Agency, Waste may be classified as either controlled waste or non-controlled waste. Controlled waste includes waste generated from households (municipal solid waste), commercial and industrial organizations and from construction and demolition. Non-controlled waste includes waste generated from agriculture, mines and quarries and from dredging operations.

Based on an estimated population of 24,658,823 and an average daily waste generation per capita of 0.45 kg, Ghana generates annually about 3.0 million tons of solid waste. Accra, the capital, and Kumasi, the second city, with a combined population of about 4 million and a floating population of about 2.5 million generate over 3,000 tons of solid waste daily. In response to the global mandate for environmentally sound management of hazardous, solid and radioactive waste, Ghana has among other things, embarked on a life cycle approach to address chemicals and other hazardous wastes management in an integrated manner.

This involves a broad range stakeholder institutions and organizations including non-governmental organizations. It is in this light that we need to address issues in relation to sanitation workers to help increase their work performance and thus an increase in waste management.

Waste management includes the process of waste generation, its collection, processing, transport, treatment, reuse and disposal (Rushton L. 2003). Waste management systems evolved from basic practices designed to protect human health and are now becoming more sophisticated and geared towards environmental protection. With the drive in recent years towards sustainable development, the need to seek environmental, economic and social perspectives to waste management has led to the wider use of IWM. The next step is to integrate more fully the management of resources and waste to achieve truly sustainable waste management systems.

There is a central sewage system but much of the population is not connected to it because of high connection charges; an estimate in 1985 suggested that only 30 percent of the population was connected. New residential areas often use septic tanks for sanitation, while in other unconnected areas pan or bucket latrines are used, with their contents emptied into night soil containers provided by the city council. These are then emptied at a shoreline tipping station. In many poor settlements, there are very few public or private sanitation facilities, even in settlements with many thousand households.

The city's open drainage system collects surface runoff, domestic discharges (other than sewage), and some industrial discharges (often illegally), and in some areas may also (unofficially) receive waste from latrines.

The environmental effects of such a quantity certainly would impress upon decision-makers the need to re-examine the sanitation system on hand.

Although Ghana has made some progress in the past 10 years of the MDG implementation, challenges of inequalities, geographical disparities and sustaining the progress still remain. With only 4 years remaining to the MDG deadline, Ghana will have to accelerate its efforts towards the achievement of all the MDGs especially those that the country if 'off-tract in achieving such as MDG target 7c – improving access to basic sanitation (MAF – Country Action Plan for Sanitation report, 2011).

Many residents of low-income urban and rural areas lack access to basic sanitation and many more have no access to any kind of facility and practice open defecation. If current trends continue, it is estimated that the MDGs target related to sanitation will not be met in Ghana until 2100 or beyond. Investing in water and sanitation improves health and reduces health care costs, improves productivity and increases the return on investments in education (MAF – Country Action Plan for Sanitation report, 2011).

Sanitation related diseases are one of the most common diseases affecting people in developing countries, such as Ghana, resulting in public health problems.

2.2 Hazardous substances involved with Waste

A lot of studies has been done on the origins of hazardous substances emanating from waste of hence a great deal is known about the types and amount of substances from waste. Whichever way waste is being managed, it is generally believed that there are usually a large number of different substances and only a few of these are produced in any quantity with many being at extremely low levels (Johnson BL, DeRosa CT,1997).

Gases emitted from landfill sites, for example, consist principally of methane and carbon dioxide, with other gases, such as hydrogen sulphide and mercury vapour being emitted at low concentrations, and a mixture of volatile organic compounds (VOCs) comprising approximately 0.5% (Zmirou et al 1994).

Waste incineration also produces a large number of pollutants from the combustion of waste, which can be grouped as particles and gases, metals, and organic compounds (Harrad ,& Harrison, 1996).

According to the Institute of Environmental and Health UK, ten pollutants are known to have the greatest potential impact on human health based on environmental persistence, bioaccumulation and amount emitted and/or on inherent toxicity. These pollutants are cadmium, mercury, arsenic, chromium, nickel and dioxins, PCBs, PAHs, PM_{10} and SO_2. Microbial pathogens are a potential source of hazard, particularly in composting and sewage treatment but also in landfill. Dust and the production of particulate matter are produced in landfill, incineration and composting processes and by road traffic involved in all waste management options. Less easily quantifiable hazards, which might nevertheless impact on the population near a waste disposal site, include odours, litter, noise, heavy traffic, flies and birds.

A WHO exposure assessment expert group suggested that priority pollutants should be defined on the basis of toxicity, environmental persistence and mobility, bioaccumulation and other hazards such as explositivity.

2.3 Health Risks and Perception

At the various levels of waste handling e.g. picking, weeding, sweeping, burning, cleaning, sorting, collection, transportation, disposal, recycle or reuse, there usually exist risks that threaten the health of handlers. Frequently it is the manner in which the waste is mixed with faecal matter coupled with strenuous body movements and use of waste equipments that dictate health risks to waste handlers.

Health hazards control has become more difficult and complex, necessitating the anticipation of hazards during the development of facilities, processes and products.

There are a lot of literatures on the potential adverse health effects of different waste management. A wide range of toxic substances can be released into the environment from waste disposal sites. A lot of research has focused on the health of the general population especially people near a waste disposal site, occupational health problems of sanitation workers are also important to consider. Many people either over or under-estimate health risks associated with particular occupation, usually as a result of lack of information or understanding regarding that occupation (Tate *et al.,* 2003). The ultimate ways to organise and empower waste handlers is to assess their health risk and educate them on practical ways to work effectively. There is however a growing consensus that local experience, perceptions and indigenous knowledge should be important elements in evaluation of programs aimed at improving public health (Tate *et al.,* 2003). There is a large workforce employed in waste collection, sorting and disposal. Workers may be exposed to the same potential hazards as the general population, although the amount of exposure and risk may differ. The type of work varies between waste management options with some, such as landfill and incineration, being more automated than others,

such as waste collection, sorting and recycling. The incidence of occupational accidents in waste collection workers has been found to be higher than the general workforce. (Poulsen et al, 1995)

The World Health Organization (WHO) estimates that 7% of the world's deaths and 8% of the global disease burden is caused by diseases related to unsafe sanitation (WHO, 2008). It is estimated that 80% burden of sickness of the world can be traced to poor sanitation and hygiene (Talbot, 2005). The improper handling and disposal of waste frequently cause microbial diseases and contamination, particularly in locations with no or inadequate infrastructure to properly handle waste.

While the type of sanitation facilities does have an impact on health, there are many other factors related to sanitation that have much greater impacts on health. The containment of faeces (e.g., whether or not there is open defecation in the neighborhood) and the number of households sharing sanitation facilities have been both found to exhibit higher correlations with illness than sanitation technologies used (Benneh 1993; Greed 2006). Each year about 5 billion cases of diarrhoea occur in developing countries, responsible for 16% of the deaths among children under five years of age in sub-Saharan Africa (WHO, 2009). Sanitation experts explain that improved sanitation has a direct positive effect in reducing morbidity due to diarrhoea. Watkins (2006) suggest that just by providing access to toilet facilities the global risk of diarrhoea could be reduced by 50% if each household uses flush toilet or by 30% if pit latrines are used. "Still progress in improving sanitation for almost half the world's population remains slow and diarrhoea

from unsafe water, sanitation and lack of hygiene causes 1.8 million deaths per year, 90 % of which are children under 5 years age" (SIWI, 2005).

Agbola (1993) and Gutberlet (2008) have established that the relationship between perceived magnitudes of occupational health risks in waste handlers is likely to be influenced by culture and behaviour, level of development of waste management technology within a community, and level of education.

Occupational health risk may be attributed to one's own behaviour; others perceive that occupational risks are unavoidable (Mutha *et al.,* 1999). Specific issues that need to be explored about experience and perception of health risks among waste handlers in Prampram include, but not limited to perception and experience about physical health, exposure and personal protection from health risks as well as access to sanitation and hygiene facilities. It is also imperative that indigenous experience and perceptions about waste handling should be incorporated in evaluation of programs aimed at reducing health risks and improving public health (Tate *et al.,* 2003).

2.4 The Global Sanitation situation

Even though the Millennium Development Goals (MDGs) has its goal number seven to ensure environmental sustainability and to halve the proportion of people without access to basic sanitation, global access to basic sanitation is still not sufficient to achieve the target by 2015 (JMP, 2008; JMP, 2010). The lack of access to basic sanitation, globally, rose from 2.1 billion in 2004 to 2.6 billion, a situation which has not seen much

improvement since then (JMP, 2010). About 1.1 billion people around the globe still practice open defecation. The WHO reports that whilst 62% of the global populations have access to improved sanitation, the lowest rates of access to improved sanitation are found in Southern Asia (33%) and Sub-Saharan Africa (31%) (WHO, 2009).

Though improved sanitation is generally increasing across the globe due to increased awareness creation, more than one third of the global populations still lack access to improved sanitation (WHO/UNICEF JMP, 2010). The coverage of improved sanitation varies widely in different countries. The national coverage of improved sanitation in Nepal is about 30%, whilst that in Uganda, Malawi and Sri Lanka is 48%, 56%, and 91% respectively. Meanwhile it has been reported that with this current low rates of improved sanitation coverage, the MDG target on sanitation will not be met globally until 2049 (WHO/UNICEF/JMP, 2010).

Improved sanitation is widely acknowledged to be an essential foundation for better health, welfare and economic productivity. Nevertheless in Africa and other developing countries with high poverty levels, about half of the populations do not have access to basic toilet facilities (WHO/UNICEF/JMP, 2010). Therefore the progress to improve health and reduce the burden of sanitation related diseases, in Africa and other developing countries remains slow. Globally, the insufficient sanitation problem coupled with poor personal hygiene contributes to an estimated 2.2 million annual deaths related to these essential services.

The World Health Organization report on World Health and MDG (WHO, 2010) showed that, health implications due to poor sanitation facilities are considered very serious. The same report estimated that in 2008 over 2.5 billion people were not using proper

sanitation facilities resulting in high level of environmental contamination and exposure to risks of microbial infections. Death caused by non-communicable diseases or injuries in developing countries totaled in 2004 to 33 million. The absence of adequate healthcare systems will still adversely affect the public health conditions. Health problems caused by poor hygienic and sanitation conditions require improving and upgrading infrastructure for waste management and introducing the integrated management approaches.

2.5 Sanitation situation in Africa

About 62% of the African population lack access to improved sanitation facilities.(Kirigia et al., 2009). Of the 54 African countries, only five 5 are on track to meet the MDG target for sanitation(Bryce et al., 2006) . It is estimated that for Africa to meet its MDG target for sanitation, the number of persons reached with sanitation facilities must double from 350 million to 700 million by 2015(van der Hoek et al. 2010). Even if this is achieved, about 200 million people will still be left without sanitation facilities.

Even countries in Africa, whose sanitation programmes are being supported by European countries such as Denmark still have relatively low coverages;, Benin (19%), Burkina Faso (10%), Niger (5%), Ghana (31%), Kenya (43%), Uganda (58%) and Zambia (13%) still have low sanitation coverage(van der Hoek et al., 2010). (Salifu and Doyen, 2001) state that in Africa rapid urbanization is largely taking place through the expansion of informal and peri–urban settlements.

Whilst urbanization is not a new phenomenon in Africa, the current rate of uncontrolled and unplanned urbanization in Africa has given rise to a huge amount of liquid and solid wastes being produced, so much so that these wastes have long outstripped the capacity of city authorities to collect and dispose of them safely and efficiently ((Porter et al., 1997):(Demanya, 2006):(Wetherall et al., 2003)).

This rapid urbanization in African countries and by the same logic, a rapid accumulation of garbage has been likened to "a monster that has aborted most efforts made by city authorities, urban planners, states and federal governments", to manage or at least contain it (Onibokun & Kumuyi, 1999). Nevertheless, if waste is poorly managed it becomes a danger to health, a nuisance, and possibly a major social problem. The problem of wastewater disposal is serious in most of sub-Saharan countries. Currently thousands of tonnes of untreated faecal sludge are improperly disposed into open urban and rural spaces(Vodounhessi, 2006).

2.6 Sanitation situation in Ghana

According to the UN report, Southern Asia has made some progress in attaining some Millennium Development Goals (MDGs). Eastern Asia and South-Eastern Asia have met most of the MDG targets. Individual African countries are trying to attain many of the targets and a growing group of countries such as Ethiopia, Rwanda, Uganda, Tanzania, Burkina Faso Malawi and Ghana are making significant progress towards multiple goals.

Sanitation in Ghana is poor and statistics on access to improved sanitation by the population is conflicting. The MDG mid-term assessment report in 2002 estimates 58% access by Ghanaians to improved sanitation, whilst WHO/UNICEF Joint Monitoring

Programme (JMP), 2006, estimates only 18%. This disparity is attributed to the fact that large percentage of Ghanaians use shared toilet facilities (WHO/UNICEF, 2004).

Since the criteria for improved sanitation exclude use of shared facilities, the percentage of Ghanaians with access to improved sanitation substantially reduced. The Ghana Demographic and Health Survey (Ghana Statistical Service, 2003) reports that 78.5% of urban Ghanaians share sanitation facilities with at least one other household. However, for Ghana to achieve its MDGs for sanitation, the number of people who use shared facilities will have to decrease significantly. Currently, Ghana is not on course for attaining the MDG for sanitation. In order for the country to attain this, it has to raise its national sanitation coverage from 18% as at 2006 to 54% by 2015 (WHO/UNICEF, 2010).

Solid waste collection services cover less than 20 percent of residents and much garbage is dumped in open heaps or open drainage channels. It is left unattended to and in effect they become hazardous. Only 30 percent of the population in Accra are connected to the central sewage system.(Economic Commission for Africa, 1996). Most urban households especially slum dwellers depend on public latrines where they are face with long queues and unhygienic conditions.

Another sanitation situation faced in Ghana is defecation in the open. This situation is common, especially in rural and peri-urban communities of Ghana. Though the percentage of people engaged in this act reduced by 25%, a large percentage of the population still practices open defecation (WHO/UNICEF, 2008). Lack of access to public toilets is the number one reason cited for open defecation in Ghana (Benneh *et al.*,

1993). It was against this background that the CLTS Concept was introduced, with the aim of creating awareness of the negative impact of open defecation and stimulates communities enough to make them change their behaviour towards the practice.

Notwithstanding some communities in Ghana have been declared Open Defecation Free (ODF) by various Regional and/or District Environmental Health Directorates, several others including Prampram are still noted for open defecation practices.

The main problems regarding sanitation in Ghana are the deficient government financial support in this area and that the attention has gone from preventive to remedial approaches. The lack of funding, education and planning is responsible for the growing propagation of waterborne diseases, with children being the most affected part of the population.

Also, the lack of law enforcement has led to the improper disposal of human waste generated in public toilets and to the use of drain water and untreated faecal sludge for irrigation and cultivation (United Nations Department of Economic and Social Affairs – UNDESA, 2004;(Tettey-Lowor, 2008)). The wastewater disposal and treatment infrastructure is not sufficient to cope with the amount of human excreta generated within the cities, which has lead to heavy contamination of open spaces (Boadi & Kuitunen, 2003).

CHAPTER THREE

3.0 METHOD

This chapter presents the method of the study. It includes the following areas; the study site, the study design, study population, sample size and sampling procedure, data collection and ethical issues. Data management, analysis and quality assurance is also included.

3.1 Study Area and justification for selection

The study was carried at Prampram, the district capital of the Dangme West of the Greater Accra Region of Ghana. It is located in the east of Accra, Ghana's capital. PramPram township is the largest community in the Dangme West District. As a coastal community, the primary occupations of the people are fishing and fish selling, but there are also small farmers and artisans.

The District Assembly serves as the local government authority in collaboration other Ministries Departments and Agencies (MDA) like the District Health Directorate and the Dodowa Health Research Centre. The community has three health centres and a district hospital is located in Dodowa, the District Capital, and a 45 minute drive away. This locality was picked for several reasons. This rural area has seen a very rapid rate of urbanization over the last 10 years. This is as a primary result of industrialization. Ghana has seen an increase in the economy which is projected in industries. The Tema Industrial Area, barely 30 minutes from the capital, Accra, is home to one of Ghana's main harbors, several industrial plants and the import/export industry. The increased need for skilled workers in these areas led to an influx of young blue-collar workers. The inability to

reside in the Tema and Accra municipality due to high cost of living and over population, many have settled on the outskirt communities, of which Prampram is one. This provides a low cost of living, while enabling the opportunity for many to participate in building the economy.

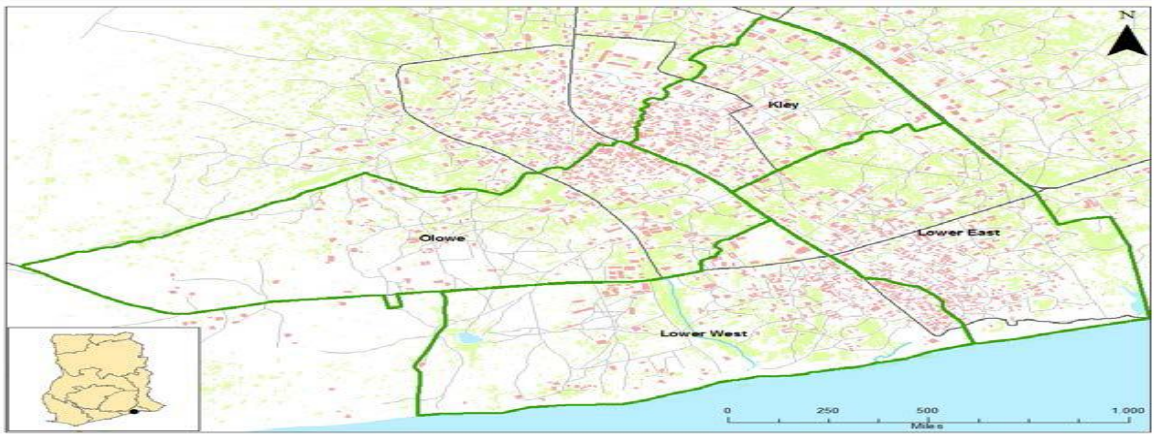

Fig.2 Study Area Comprising Four Townships (SUSA-Ghana)

Another reason for selecting Prampram is its present participation in the DRCH's DSS. Being part of the catchment area for the DSS, a bi-annual demographic socio-economic data is collected. This provides existing and current data to utilize in determining criteria for selecting townships. Finally, sanitation workers from the four townships selected are truly reflective of the entire sanitation workers. Four out of ten townships were selected for the project, Kley, Lower East, Lower West and Olowey.

3.2 Study Design

The study design was cross-sectional in nature. A mixed method was used in gathering data to achieve the objectives of the study. This study provide a snapshot of the frequency and characteristics of the health risk among the Sanitation workers at a particular point in time. Data on their experience, the use personal protective equipment and their health risk were obtained from the study subjects one at a time. Background information such as age, sex, marital status, level of education, occupation, religion etc was obtained.

3.3 Study population

The study population included sanitation workers employed by Waste Management Companies in Prampram, working in the four townships namely Kley, Olowe, Lower East and Lower West of Prampram. Respective respondent in charge of sanitation workers in Prampram were also interviewed.

3.4 Sampling

3.4.1 Sample Size Determination for Sanitation workers

The sample size for the study was calculated using the following formula:

$$n = \frac{Z^2 \times PQ}{d^2}$$

Where:

n = desired sample size

Z = the standard normal deviation, set at $\alpha = 0.05$ based on a 95% confidence level

P = the estimated proportion of sanitation workers. As a rule of thumb 0.5 will be used since this estimate is not available in literature.

Q = 1 - P

d = the allowable error = 0.05

Therefore n is 384

But S = n / (1 + n / population)

S = 384 / (1+ 384 / 320)

S = 174.5

Therefore a minimum of 175 sanitation workers were to be allowed for the estimation of the health risk associated with waste handling. A 9.5% was added for non-response making the total number of 183 waste handlers.

3.4.2 Sampling Procedure

The number of sanitation workers was obtained from the Waste Management Companies operating in Prampram. After compiling a list of all workers, the respondents for the quantitative study were purposively sampled after an initial assessment of their level of exposure. Respondent for the focus group discussion were sampled using the snow ball method.

3.5 Data collection techniques

A structured questionnaire with both open and close-ended questions was developed to gather quantitative data from the selected waste workers. After getting approval from the participants through informed consent, the research assistants administered the questions to the respondents, one at a time, face to face and in their preferred language.. For the qualitative aspect of the study, a focus group guide was developed for the focus group discussions for female and male sanitation workers at Prampram. An observational check list was used to gather data on waste management practices, experience and preferences from Sanitation workers. Their health history was also taken at the Prampram Health Center to check if sanitation workers were reporting to the hospital with conditions relating to the sanitation work.

3.5.1 Data collection tools

Tools which were employed in the collection of the data included observational checklist, structured questionnaires, in depths interview guide and a focus group guide.

3.6 Data Processing and Analysis

Data collected from the field in the form of answered questionnaires and checklists were stored in files whilst awaiting analysis. Computer software Statistical Package for Social Science (SPSS) version 16.0 and an Excel page was used for the data entry and analysis. The data from the questionnaire were coded and fed into the computer for onward analysis based on the study objectives and the main study variables.

Data from the focus group guide was analysed using a thematic network analysis. The data were grouped into basic themes, organizing themes and global themes. The global themes were formed by considering certain organizing themes, which best describe them under that theme. Further, under each global theme, the codes were grouped under common organizing themes that describe them and are related to the global theme.

3.7 Quality Control

The following steps were taken to ensure the quality and validity of the data.

- The research assistants were recruited from people with health background and given adequate training. The content of the training included the purpose and objectives of the study, data collection techniques and tools to be used, translation of questionnaires into the various local dialects, actual data collection and ethical issues or considerations.
- The principal Investigator was part of the team during the interviews to ensure that the relevant information was collected.
- Questionnaires returned were checked for mistakes and completeness. Errors and omissions detected were discussed with the respective assistants and asked to go back and make the necessary corrections.
- All data collected were entered twice by two different qualified personnel to ensure validity

3.8 Ethical considerations

Ethical clearance was sought from the Ghana Health Service Ethical Review Board.

The study subjects were adult heads of households or their representatives. Written informed consent was sought from all study subjects and the study was explained to all respondents. The potential risks of the project were the respondents' time and privacy. The study would be beneficial to the participants since information from them will to improve on health intervention and promotion activities in the area and also add up to existing knowledge. There was compensation for participants. The data collected was used for analysis, soft copies were password protected and hard copies stored in locked cabinets. Only the researcher had access to the data. Potential study participants were made to understand that their participation in the study was entirely voluntary. Their decisions not to enter the study, failure to answer any question or termination of the interview were respected. The study was funded by the Sustainable Urban Sanitation – SUSA Ghana. There were no issues of conflict of interest.

3.9 Prestesting

Data collection tools and observation checklist were pre-tested at Abia, a neighbouring rural community of Prampram for reliability before actual data collection. 20 people were used for the pre-testing.

Measured Variable

The following variables were collected and analyzed as des**cribed in the anal**ysis section below to meet the objectives of the study.

Dependent Variable:

Health Risk – Helminthiases, Musculoskeletal Disease, Respiratory Symptoms, Allergies and risk perception.

Independent Variable:

- Age
- Sex
- Level of education
- Sanitation activity
- Hours per shift
- opinion about this job
- Stigma
- Waste Handling
- Perceived Health Risk

CHAPTER FOUR

4.0 RESULTS

This chapter presents the findings of the study. The assessment of the health risk of waste handlers among sanitation workers at Prampram was analysed under three major global themes, which form the keywords of this study: Experience, Protective personal equipment and Health perception.

4.1 Background, Socio-demographic Characteristics of the Study Participant

Table 1 describes the demographic characteristics of the respondents. In all, 183 respondents were interviewed. Majority of the respondents were females representing about 73.1% and the remaining 27.5% males. For the age groups of these respondents: 21.3% were between the ages of 31 to 35, 16.4% between ages 36 to 40, ages 41 to 45 represented 13.7%, ages 46 to 50 made up 13.1%, 7.7% were between 51 to 55, with the remaining 4.4% taken up by respondents who were less than 25 years old.

Almost half (47.5%) of the respondents had no education, 27.9% having completed Middle School. 24% and 0.5% of the 183 respondents have had Senior Secondary Education and Vocational Training respectively. Furthermore, it was realized that about three-quarters (71%) of the respondents were married.

Majority (88%) were Ga – Adangbes, with Ewes making up 10.4% and the remaining 1.6% being Akans. Almost all respondents were Christians and they represented 91.8% of the 183 respondents interviewed.

In addition, it was realised that 45.4% of respondents lived in family houses, 35.5% lived in the own homes, and 18% and 1.1% lived in rented or shared houses.

Table 1: Demographic Characteristics of waste handlers in Prampram (N=183)

Demographic Characteristics	Frequency	Percent (%)
Sex		
Male	50	27.5
Female	133	73.1
Age		
≤25	8	4.4
26-30	23	12.6
31-35	39	21.3
36-40	30	16.4
41-45	25	13.7
46-50	24	13.1
51-55	14	7.7
56+	20	10.9
Level of education		
Never	87	47.5
MSLC	51	27.9
Secondary	44	24.0
Vocational	1	0.5
Marital status		
Single	10	5.5
Married	130	71.0
Separated/Divorced	14	7.7
Widowed	29	15.8
Ethnicity		
Ewe	19	10.4
Ga/Adangbe	161	88.0
Akan	3	1.6
Religion		
Christian	168	91.8
Muslim	4	2.2
Traditional	5	2.7
Other/Specify	6	3.3

Current residence		
Own home	65	35.5
Rented	33	18.0
Family House	83	45.4
Shared house	2	1.1

4.2 Experiences of sanitation workers

The experiences of sanitation workers are reported in Table 2. When respondents were asked their reasons for being involved in sanitation work, majority of them (37.2%) said it was for money. 30.4% of the 183 respondents claimed it was due to the lack of other available means of employment. It was only 21.3% who loved their involvement is the sanitation field. 7.9% and 3.2% of the respondents claimed they did not want to be idle and other reasons respectively.

Moreover, 37.1% were of the opinion that the job was rewarding. 36.7% claimed that they were respected, 12.9% believed that they were satisfied with being a sanitation worker. However, 7.9% said being a sanitation worker was difficult, 2.9% claimed it was unhygienic and 1.8% believed it was embarrassing. Moreover, 94% of the 183 respondents did not feel bad working with waste

A whopping number (93.4%) of the 183 respondents interviewed disclosed that they were not being stigmatized as a result of their involvement in the sanitation field. Furthermore, 50.8% of the respondents were likely to change their jobs.

Table 2: Experiences of Sanitation Workers at Prampram

Experience of sanitation workers	Frequency	Percent (%)
Why are you involved with Sanitation Work?		
I enjoy it	54	21.3
For Money	94	37.2
I can't get any other work	77	30.4
Don't want to be idle	20	7.9
Other	8	3.2
Total	253	100.0
Opinion about this job		
Unhygienic	8	2.9
Embarrassing	5	1.8
Respected	102	36.7
Difficult	22	7.9
Rewarding	103	37.1
Satisfactory	36	12.9
Other	2	0.7
Total	278	100.0
Feel bad working with waste		
Yes	11	6.0
No	172	94.0
Total	183	100.0
Stigmatized		
Yes	12	6.6
No	171	93.4
Total	183	100.0
Change of jobs		
Yes	93	50.8
No	90	49.2
Total	183	100.0

Three main organizing themes were identified under the experiences of sanitation workers which is the global theme: *daily routines, challenges and motivation.*

4.2.1 Daily routines

The experiences of the waste handlers were explored by considering their daily routines. Four major codes were developed from the quotes under this organizing theme: *activity, duration auxiliary job s* and *team work.* The code *activity* considers the types of work the waste handlers engage in. The work among the waste handlers seemed to be gender-assigned; while the males acknowledged performing certain kinds of work such as weeding and digging, the females were involved in duties such as sweeping and collecting of rubbish. See the quotes below:

"We sweep, we collect rubbish…we bury the rubbish too…we collect the shit here too"

(FGD females)

"We weed…we sweep and dig and bury the toilet and the rubbish there… Some of us sweep the gutter… we rake the rubbers and burn it" (FGD males)

Despite the gendered duties among the workers, there is some form of collaboration that depicts *team work.* Thus there may be times where both sex may consider performing the duties of the other:

"Even two people cannot weed this entire place that is why we asked the women to be at the beach so that we can also clean here" (FGD males)

The number of months or years spent as waste handlers was also explored: *duration*. It is noted that the males had worked for longer periods as sanitation officers and hence may have much experience compared to the females.

"for about 4 months now, we are starting the 5th month" (FGD females)

"When we started 4 years ago" (FGD males)

The experience of the males as waste handlers had made them consider certain *auxiliary jobs* aside their main work.

"Many of us have our own jobs, I am an electrician so when I close I will go and do my private job you see…..most of us from here we have other jobs that we are going to do"(FGD males)

4.2.2 Challenges

From the analysis, there were some difficulties mentioned by the sanitation officers. Eight codes were used to describe the organizing theme challenges. These were *stigmatization reaction, poor administration, bitter job, poor remuneration, worry, dangers, lack of jobs and recalcitrant inhabitants.* In these challenges are bound to happen considering the different length of work experience.

Stigmatization and bitter job: this refers to the event where sanitation officers experience unpleasant moments in the course of their work. The analysis shows that sanitation workers are mocked and even intimidated. These experiences have the tendency of

affecting or influencing the level at which the workers attend to their duties or impact negatively on their outputs, in spite of the good will and the good nature ascribed to the work. With respect to the quotes below:

"We are stigmatized and the job is also rejected because of the toilet we are cleaning … They talk and tell us we sweep toilet or we clean toilet… It is because of the toilet we have been cleaning at the beach … some of them, if they have a problem with your child then they will tell him your mother cleans shit." (FGD females)

"yes we are stigmatized very well. They tease us. When you are even go to talk with someone they say you, you work at Zoom Lion or Zoil … now the banks too when we go there they don't want to give us overdraft again they say our money do not come on time but our pay passes there and that we don't understand" (FGD males)

"Again what is killing us is when we wake up in the morning; we buy water and pay for where we go to toilet, the only thing we get for free is urinating behind someone's house…it was nice but now it is bitter."(FGD males)

Poor administration and poor remuneration**:** Two related challenges and most mentioned among the challenges have a great negative impact on the waste handlers socially and mentally. Sanitation officers expressed their dissatisfaction for the remuneration received: late payments and insufficient salary, however they acknowledged trying to manage the little amount they received. This they attributed to the delays in the reports of

some of their administrators hence resulting in the late payments and thus appealed to the government to see to the early payments: see the quotes below.

"The only thing is our pay that is what is worrying us … We have school going children, we get sick and that is what we use some to pay our bills. So they should look at that for us they should not keep our money they should pay us at the end of the month… so they should increase our money for us a little*" (FGD females)*

"the pay is the only problem; it does not come early… Although the salary is not good it is better than sitting at home idle so we will take it like that." (FGD males)

"Sometime when we talk they say our coordinators who were supposed to bring the report did not bring it on time…we are pleading with the government to let the money come though small it should come and we shall mange and work." (FGD males)

One of the effects of the challenges they face is *worry*. Both females and males expressed their worry over buying on credit and thus related to the poor remuneration received. Worry can bring about depression and have adverse effect on their health.

"*When you wake up in the morning you will not even eat then you will come and be looking at shit" (FGD females)*

"We go and credit everything and every day people will be knocking at our doors for their money." (FGD males)

Recalcitrant inhabitant and reaction: The challenge experienced by the sanitation officers is also partly due to actions of the residents in their areas of work. For instance, sanitation workers complain of repeated work at places where person repeatedly litter which reveals that the continual actions of the inhabitants have the tendency of affecting the work of the waste handlers. These actions may spear up reactions from the waste handlers:

"*Yesterday they did it we went to sweep, today too the same and we have cleaned that also." (FGD females)*

"like you will slap the person in the face" (FGD males)

"it is those coming to shit here…yes is those who come to shit here…we will laugh at them now" (FGD females)

There were also dangerous events that are met by the workers on some daily basis: 'dangers'. In as much as these dangers put the workers at risk, they are also cautious of the kinds of explanations that could explain the deaths of some of their colleagues: see quotes below

"Recently we heard they are been attached by snakes." (FGD males)

"Four people have died that we don't even know the cause of their death." (FGD males)

4.2.3 Motivation

Waste handlers expressed their motivation behind the kind of work they perform as the following amidst the challenges faced: *good will, good job, understanding, divine*

intervention, knowledge of work, self-perception and. *praise.* The males uttered their desire for the upkeep of the community to be driven by their own *good will*, for instance the quotes below reveals the fact that sanitation officers are determined to work in order to curtail the number of cases of illnesses that are linked to dirt. Similarly the intention to work as a sanitation officer is important to promote tourism:

"But because I want the town to be clean to avoid sickness that is why…It is like communal labour and it is good. I want the town to be neat …we want the town to be neat so that we don't fall sick. We want everywhere to be neat so that when someone comes the person will see that we are neat that is why we are doing it" (FGD males)

The motivation to work is the fact that working as sanitation officer is a *good job*. The workers expressed their joy and appreciation for the work and the fact that it has contributed to solving the problem of unemployment. In that vein some of the sanitation workers mentioned of continuing to remain in the service as sanitation workers:

"we like it and enjoy it … we like this, the Zoom Lion job is what we like not any other thing…we shall continue to do this one."

(FGD females)

"we see it as a good job because there is no job" (FGD males)

"there is no job so we are managing this for our daily bread, that is why we are doing it"

(FGD females)

Three important codes '*understanding*', '*knowledge of work*' and '*self-perception*' explain how sanitation officers appreciate their work and also for them not to focus on the discouraging comments made by people who observe them. Therefore, sanitation are admonished to have good perception about themselves and as well as their work:

"one thing is that you as a worker if you don't understand what you are doing then you will be worried or feel bad but if you understand your work that will not discourage you."(FGD males)

"we don't feel bad or useless that we are working with Zoil or ACI, we are proud of working ACI or Zoil…Zoil is positioned under the Ministry of Tourism" (FGD males)

Furthermore, there were instances where sanitation workers are acknowledged or received *praise* for their work, despite the challenges about the stigmatization of the work. This tends to encourage them in performing their daily duties as keeping the city clean:

"they praise us for the good work we are doing, because our presence is making the beach very clean" (FGD females)

In meeting their plight for higher income and early monthly payments, the sanitation workers also resorts to God. The trust in God's provision has the tendency of reducing the worry over the main problem of poor remuneration:

"we are hungry and we are begging in the name of God." (FGD males)

4.3 Use of Personal Protective Equipment

Results from Table 3 shows that most of the respondents (91.3%) interviewed wore Personal Protective Equipment (PPE). The majority of them (66.5%) wore them before they had handled waste, though 7.2%% of them wear the PPE after and 26.3% during handling of waste. With the type of PPE worn, out of the 475 responses generated: 34.4% used over-all coats/aprons as a protective tool, 19.2% used gloves and 18.3% used wellington boots. 14.1% used nose mask/mouth cover for protection, helmets or headgears were used by 13.2% of respondents and the remaining 0.7% being other protective tools.

It was also realized that 54.5 % of the 16 responses generated did not wear personal protective equipment because it felt uncomfortable. A further 27.3% had their personal protective equipment spoilt and were yet to be replaced, 18.2% were not provided by their employers and the remaining did not see the need for it.

Table 3: Personal Protective Equipment

Personal protective Equipment	Frequency	Percent (%)
Wear personal protection equipment		
Yes	167	91.3
No	16	8.7
Total	183	100.0
When is PPE worn(n=167)		
Before Waste handling	111	66.5
During Waste handling	44	26.3
After Waste handling	12	7.2
Total	167	100.0
Protective tool do you see(n=167)		
Headgear/Helmet	60	13.2
Nose mask/mouth cover	64	14.1
Over-all coat/ apron	156	34.4
Wellington boot Glove	83	18.3
Glove	87	19.2
Other/Specify	3	0.7
Total	475	100.0
Do Not Wear personal protective equipment (n=16)		
Reasons		
Makes me feel uncomfortable	6	54.5
It is spoilt and hasn't been replaced	3	27.3
The company does not provide it	2	18.2
Total	11	100.0

Under Personal Protective Equipment as a global theme, three main organizing themes were under listed: *type, use, and inconveniencies.* These themes were developed in order to explore and assess the protective personal equipments used by the sanitation officers.

4.3.1 Type of PPE

This organizing theme is made up of one code '*working gear*'. The types of the working gear used by the waste handlers were described here. Examples of some of the working gears were mentioned as the boots, dress or uniform, helmet, goggles and nose cover. Also it can be said that the females patronized the use of the gears more than the males:

"the dress you wear to work… Like the boots they gave us and the uniform that is what we use and people will know that this is where you work that is why we like wearing it … like the nose cover we use it to cover our nose so we put it inside our bags and wear it when we are working" (FGD females)

4.3.2 Use of PPE

The use of the equipments is assessed using these codes: *utilize, training, education, importance and identity.* First of all the sanitation officers acknowledged the utilization of the equipments during working hours, although that was mentioned by the female group. In this regard it is expected that there will be fewer cases of females reporting of ailments that are related to the lack of use of the equipments. Below is a quote that signifies the use of the PPE:

"yes we do wear them" (FGD females)

In spite of the fact that sanitation officers acknowledged the use of the equipments, they did that at their own experiments. This means that there were either no or adequate *training or education* on the use of them. This probably may have influence on the proper

use of the PPE's and their lifespan, since their improper use may render them getting spoilt quickly. See quotes below:

"no we were not given any training, after written our names there and then they brought our brooms to us ...we were asked if we can do the work and also if we can collect the toilet at the beach and we said yes we can. They wrote our names and gave us the uniform but no training" (FGD females)

"we were not trained, they just brought it to us and just told us the purpose of using that it is for our safety ... we did not go for any training at all" (FGD males)

"for ACI the only training they were given is that the helmet will save your head when a coconut falls from above, (safety) and goggles so that sand will not enter your eyes and the boot so that you will not step on a nail or broken bottle to get hurt." (FGD males)

Importance and Identity: Notwithstanding the inadequacy of the training in the use of the equipments, the sanitation workers had devised a way of using them and hence are able to share their experiences on the use of the PPEs. In the first instance the PPE is known to be good for their use since it protects them from getting hurt. It is also mentioned that the PPEs identifies them as waste handlers of the ZOIL Company which they appreciate very much.

"yes it is good for us "(FGD females)

"Interviewer: when you walk with boots and you mistakenly step on a broken bottle…

Respondents: we always wear foot wear so something like that has never happened to us before" (FGD females)

"when we wear we are seen as workers of ZOIL … well when you are coming to work you will wear it so that people will know where you are working" (FGD females)

4.3.3 Inconveniencies

The unpleasant experiences about the use of the PPEs are described under the organizing theme "inconveniencies". Four main codes are identified: *unpleasantness, warmth, late arrival of equipments and lack of equipments*.

Unpleasantness and warmth: These are codes that explain the problems with using the PPEs. Both males and females experienced the inconveniencies and hence call for the attention in reviewing the type of working gear produced as well as considering educating the sanitation officers before using the equipments. Apart from the warmth, some of the uniforms were described as oversized and difficult to use. Below are the quotes:

"the dress for the women for the sake of urinating we prefer the top and down to the overall, we have to remove everything before you can pass urine and you know that women have to cover themselves too…because we are not working at home but in public … for me my uniform is too big for me so I tie it before wearing it" (FGD females)

"walking with it [boots] in the sand is very difficult" (FGD females)

"For the Wellington boots we can't wear them in the sand it is very difficult using it there" (FGD males)

"yes as we are here now it is very warm inside but we wear it," (FGD females)

"Again the working gears, when the sun is setting the overall become very warm so we don't use it" (FGD males)

Part of the inconveniencies center on *late arrival of equipment* and *lack of equipment*. The late arrival of the equipment results in the lack of the equipments. This has the tendency of discouraging sanitation workers from using the old equipments and hence puts them at risk of accidents or illnesses related to waste handling.

"they bring us uniform but for one and half years now the tools are not coming, the women use their own money to buy the brooms and the shovel we use to dig is also not coming and we need the tools to work so they should look at that for us… Again the tools are not coming for us to use, the standing broom is now 2cedis so they should look at that thing also for us." (FGD females)

"We don't have tools to work with; they have to give us cutlass and the machine, they are using over there (mower). Look, my palm is red from the weeding … they brought boots but it was not enough for all of us" (FGD males)

Table 4 shows the result on the knowledge of Personal Protective Equipment. All respondents affirmed the importance of the personal protective equipment and also its importance in preventing health risks. It was also realized that almost all the 183 respondents (96.2%) had been trained on the use of the PPEs.

Table 4: Knowledge on Personal Protective Equipment

Personal Protective Equipment	Frequency	Percent (%)
Importance of PPE	183	100.0
Yes	183	100.0
Prevention of health risk		
Yes	183	100.0
Trained on the use of PPE		
Yes	176	96.2
No	7	3.8
Total	183	100.0

4.4 Perceived health risk of sanitation Workers

Table 5 tabulates the perceived health risks associated with waste handling by the respondents. Almost all the respondents (98.4%) believed that their physical contact with waste was a health risk and almost all of them (98.4) claim they cleaned themselves after work. In addition, 37.2% said they had been ill since starting works as sanitary workers, 29.5% have never been ill. Also, 15.8% had been ill several times and 13.7% on more than one occasion. 2.2% and 1.6% could not remember and stated other reasons respectively. Less than half (43.2%) of them perceived their sicknesses to be related to the work as sanitation workers. 45.9% had visited the Prampram Health Centre

Table 5: Perceived Health Risk associated with waste handling

Waste handling and Perceived health risk	Frequency	Percent (%)
physical contact with waste as a risk		
Yes	180	98.4
No	3	1.6
Total	183	100.0
clean yourself after Sanitation Work		
Yes	180	98.4
No	3	1.6
Total	183	100.0
Frequency of illness as a Sanitation Worker		
Never	54	29.5
Once	68	37.2
More than once	25	13.7
Several times	29	15.8
Can't remember	4	2.2
Other/Specify	3	1.6
Total	183	100.0
Perception of sickness related to sanitation work		
Yes	79	43.2
No	104	56.8
Total	183	100.0
Visit to Prampram Health Centre		
Visit	84	45.9
No Visit	99	54.1
Total	183	100.0

Three major organizing themes were formed under the global theme health perception. They are *health risk, behavior, and helming infection*. The various organizing themes were built under codes from the transcript.

4.4.1 Health risk

Concerning *health risk*, the respondents mentioned the following codes: *illnesses and symptoms and causes* of the illness that mostly surround their work.

Among the illnesses and symptoms described by the workers were pains in the ribs and joints, headaches, nausea, malaria, fever and worm infestations. These experiences were described as uncomfortable by both males and females.

"We feel pains at our ribs our waist and joints…the main sickness is our rib waist headaches that is it … it makes you feel nausea you are not comfortable" (FGD females)

"There are so many sicknesses; you may get malaria, fever and other… Worms are very bad it will make you shrink when they are in your stomach, you will not feel comfortable … raking you will feel the pain at your rip and as we have come to weed, your arm will be paining you and your waist when you dig." (FGD males)

The *causes* of these illnesses were identified to be as a result of the work. For instance, walking in the sun, and climbing up and down can make the workers stressed; the heat

from the toilets and dirt that results into worm infestations are also identified as causes of sicknesses experienced by the sanitation officers. The situation depicts that the sanitation officers will not be able to deal with situation since they are working with dirt, always.

"walking in the sun, climbing up and down" (FGD females)

"You see, you are going to collect peoples shit … the heat that will come from the toilet is what will make us sick … dirt in from our job that is what gives worms … worms is that it is caused by dirt and we are also working with dirt" (FGD males)

4.4.2 Behavior of sanitation workers

The organizing theme behavior explains the how sanitation officers seek for health when ill. Three codes are discussed here: *health facility, health care and checkups.* There is different health facilities considered among the sanitation officers. This includes hospitals and pharmacies, which are manned by health professionals. Sanitation officers were also conscious of the need for frequent visits to the hospital.

"I go to the main hospital … when you are feeling nausea you go to the drugstore … we go there when there is a problem…we go there when we are sick" (FGD females)

"I went to the hospital and complain my body itches … we describe it to the pharmacist then they will give us (FGD males)

In view of the health consequences, the sanitation officers advocated for some health care from their company, in the form of health insurance to cater for their health needs.

"they have to give us health insurance … it is only the nose cover which is helping us a little so they should try and do the health insurance for us so that when we are sick and we take to the hospital we me receive treatment" (FGD males).

4.4.3 Helming infection

Under helming infection, two major codes are discussed: *safety measures* and *medication*. The safety measures taken by the sanitation officers in order not to contract any diseases are be mindful of how they eat, and then observing personal hygiene. For the medications used, both males and females acknowledged the use of de-wormers in dealing with worm infestations; it was only among the females where some herbal medications were also mentioned to be used for the worm infestations. The quotes below are examples:

"for worms the way you eat, when you are eating you have to clean your stomach... The dirt in your stomach is what causes worms… for worm infection sometimes when you take purgative … and say you want to de-worm and they will sell it to you … yes if the hospital one does not work for you then you use the herbal medicine…the herbal medicine helps us a lot" (FGD females)

"so after work we should get something like detol and a hand washing bowl to wash our hands so that when we go home and eat we may not get worms that is all" (FGD males)

Figure 3 represents a graph of reported illnesses the waste handlers claimed they have been experiencing. 160 experienced aches, 79 had also experienced fever, 44 were dizziness, 41 felt nauseous. Diarrhoea was experienced by 38 respondents, 37 felt itchy, 28 had skin rashes and 27.5 coughed. The graph further reveals that 22 lost appetite, 17 had runny nose, 16 had anaemia and 11 had itchy anus. 8 had asthma attacks and skin diseases, with 3 having sore throats.

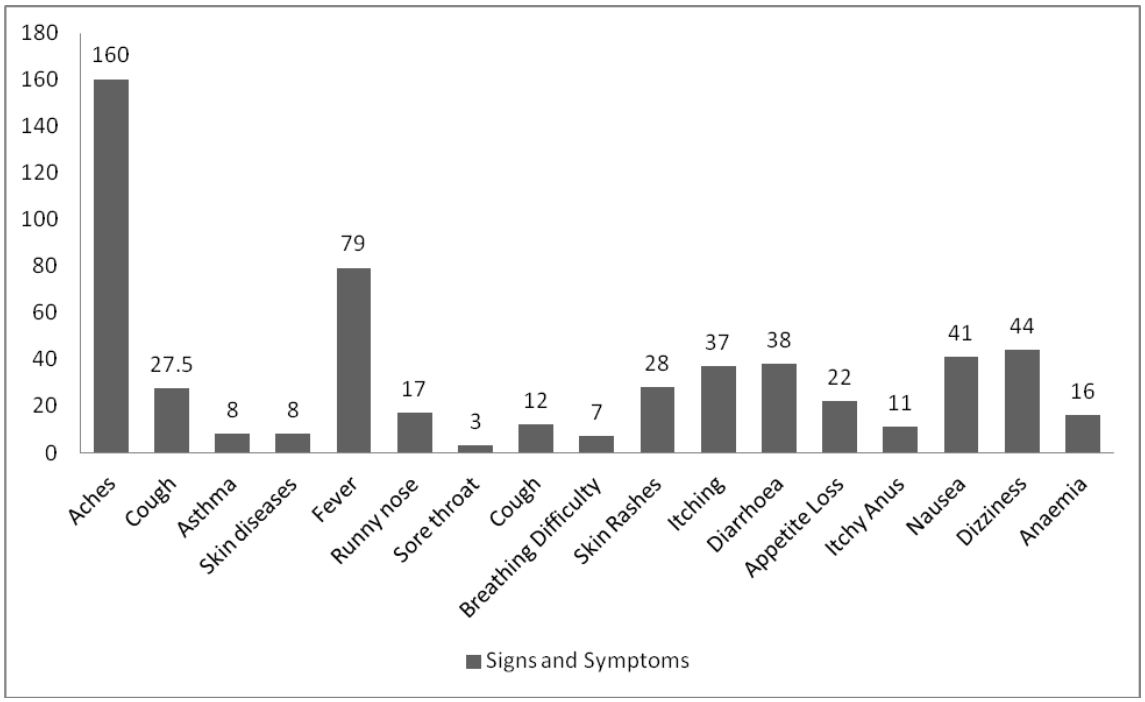

Figure 3: A graph showing the frequency of the various signs and symptoms.

In order to establish association between waste handling and perceived health risk, a bivariate analysis was done with a Logistic Regression Analysis

In the bivariate analysis the only 2 of the covariates that attained significance at $p<0.05$; Wearing PPE Before waste handling and During Waste Handling. Low health risk depicts respondents who fall under only one category and high health risk depicts respondents who fall within 2 or more category.

Respondents who wear protective equipment are 0.65 less likely to be at risk than those who do not. (CI 0.144, 0.851). In addition, respondents who wear personal protective equipment during waste handling are about 10 times more likely to be at a higher risk than those who do not (2.214,10.492)

Table 6: Bivariate analysis of health risk associated with waste handling

Covariates	Low Health Risk Frequency(%)	High Health Risk Frequency(%)	OR	95% CI	P-value
Sex					
Male	9(4.9)	41(22.4)	1		
Female	27(14.8)	106(57.9)	0.862	0.374,1.988	0.727
Age					
< 40	14(7.7)	67(36.6)	1		
≥ 40	22(12.0)	80(43.7)	0.76	0.361, 1.600	0.47
Education					
Less than secondary	29(15.8)	109(59.6)	1		
Secondary and Higher	7(3.8)	38(20.8)	1.444	0.585, 3.567	0.426
Marital Status					
Married	28(15.3)	102(55.7)	1		
Not Married	8(4.4)	45(24.6)	1.544	0.653, 3.651	0.322
Average hours per shift					
Less than 3	7(3.8)	60(32.8)	1		
3 or more	29(15.8)	118(64.5)	0.982	0.391, 2.464	0.969
Stigmatization					

Yes	2(1.1)	10(5.5)			
No	34(18.6)	137(74.9)	0.806	0.169, 3.850	0.787
Personal Protective Equipment Worn Before waste handling					
No	7(3.8)	60(32.8)	1		
Yes	29(15.8)	87(47.5)	0.35	0.144, 0.851	**0.021**
During waste handling					
No	34(18.6)	94(51.4)	1		
Yes	2(1.1)	53(29.0)	9.5	2.214, 10.492	**0.003**
After Waste Handling					
No	34(18.6)	138(75.4)	1		
Yes	2(1.1)	9(4.9)	1.109	0.229, 5.369	0.898

Note: significant p values are in bold, p≤0.05

In the multivariate logistic regression it is seen that respondents who wear personal protective equipment during waste handling are about 11 times more likely to be at a higher health risk than those who do not. (OR=11.091, CI 2.008, 19.254**).**

Table 7: Results of Multiple Logistic Regression of when do respondents wear personal protective equipments and health risk as the dependent variable

Variables in Model	B	SE	Odds ratio	95% CI of Odds ratio		P-value
				Lower Bound	Upper Bound	
Before Waste Handling	0.189	0.583	1.121	0.386	3.784	0.746
During Waste Handling	2.406	0.872	11.091	2.008	19.254	0.006*
After Waste Handling	0.246	0.879	1.279	0.228	7.163	0.779
Constant	0.84	0.553				

*p<0.05

S.E = Standard Error B = the coefficient

CHAPTER FIVE

5.0 DISCUSSION

This chapter discusses in detail the finding of the research. It comprises the experience of sanitation workers in handling waste, the use of personal protective equipment and the perceived health risk of sanitation workers.

Waste handling is detrimental to the health of individuals hence sanitation workers. The study sought to assess health risks associated with waste handling among sanitation workers at Prampram. From this study, it can be said that there is an effect on the health of sanitation workers in the handling of waste. Most of the respondents perceive that they could get sick from handling waste. Majority of sanitation workers had gotten sick at least once since their handling waste. This may be a true reflection of their health status. Going through their records at the Prampram Health Centre, it was realized they were not visiting the centre but had registered with the centre. Some of them went with symptoms and illnesses that were not necessary related to the handling of waste. The majority of the sanitation workers suffer from aches all over their body with the least suffering from sore throat. This is consistent with a study done in Denmark where it was found that a higher incidence rate of musculoskeletal complaints for sanitation workers was reported in Denmark than for the total Danish workforce (Poulsen et al. 1995)

Another study done among municipal workers in Rio de Janeiro depicts the fact that 80% of all workers had suffered an accident during their employment in waste collection; among these, 58% had to be suspended from work for some time (Vellos et al. 1997). Sanitation workers are also exposed to deplorable conditions and experience hardships. In

a study conducted by Porto et al., (2004) on the health conditions of waste pickers at the largest landfill in Rio de Janeiro, it was found that the nature of the working environment generates specific kinds of risks and accidents. The majority (71.7%) of the waste pickers at this site had already suffered an accident. Of the 267 accidents referred to in the study, the majority were related to cuts from glass (37%), followed by perforations due to other materials (19%), and falls (15%). In addition, accidents involving informal recyclers and the landfill operator's machinery are frequent (Porto et al. 2004).

Sanitation workers handling a mixture of waste suffer a lot of health risks (Poulsen et al., 1995). This was also the case of Prampram as has been found in this study. Many studies reveal the risk of having many health effects like respiratory symptoms, allergies, fatigue, musculoskeletal, etc among sanitation workers due to their exposure to hazardous substances (An et al., 1999;) (Poulsen et al., 1995). This may be due to handling and inhaling toxic substances from waste. The findings of this study also revealed that the majority of sanitation workers engage in sanitation work because of money. Their lack of education makes sanitation work suitable for them since no certificate is required for employment. They are employed in order that they gain a livelihood Though some of the workers would want to change jobs if the opportunity be given to them, most of the workers are happy they are involvement is the sanitation field. This may due to the fact that helping their community makes them happy. Also being associated with a company of any sort is a source of belonging to them hence the happiness obtained from sanitation work. A few sanitation workers are indifferent about the job; their focus was not to be idle. Sanitation work is rewarding and respected according to most of the sanitation workers. They therefore do not feel bad about what they do. Surprisingly, stigma was not

a problem among sanitation workers at Prampram in their various sanitation fields. This may be due to the low level of job opportunities at Prampram. However, some were willing to change jobs when given the opportunity. The low and irregular income from sanitation work is insufficient to earn a respectable livelihood and so leaves them vulnerable(Gutberlet & Baeder, 2008).

Even though medina ‘s study on waste management ((Medina, 2001)(Medina, 2005)) stresses on the importance of studying the health effect of informal recyclers involved in the collection and separation of recyclables (2001), there is also the importance of further study of sanitation workers in the formal sector. This is because they both sectors go through the same harsh experience. Also sanitation workers both in the informal and formal sectors are being treated same.

The study also revealed that females are more involved in sanitation work than males. Nonetheless, males are at higher risk of getting health issue than females. Recent findings however suggest that gender difference could influence people’s perception on solid waste management (Ehrampoush and Moghadam, 2005). Females being the majority of waste handlers may suggest that the cleaning is being well done as female jobs are perceived to basically domestic jobs.

The main prevention methods for employee exposure to hazardous materials are engineering and administrative controls. Where these control methods are not in place, personal protective equipment (PPE) is required. Though there is no one to ensure that personal protective equipment are worn during waste handling activities, majority (91.3%) of the respondent wear them. This may be due to the fact that it is being provided for them by the respective companies. Only 8.7% do not wear personal

protective equipment. Most of the respondents who do not wear personal protective equipment claim they feel uncomfortable wearing them. This may be due to the heaviness of some of the equipment and it being made of latex which traps heat(Urie, 2001). This research shows that some personal protective equipment may be uncomfortable and hence harmful.

Some of the respondent said that their PPE were spoilt and hasn't been replaced by the company with which they work. This is unexpected because the company is supposed to periodically worker's personal protective equipment.

. The nose mask prevents them from communicating properly as they work and so acts as a barrier to team work. Also breathing through the nose mask may be a bit uncomfortable as described by Salazar et al. in their study (Salazar et al., 1999). The head gear is not too common due to the fact that most of the sanitation workers claim they don't carry waste on the heads.

PPE are worn correctly by only about 66.5% as they wear it from home while about 26.3% wear during waste handling. Only 7.2% wear it after waste handling which is not the norm.

However, from observation majority of the workers do not wear personal protective as reported in the questionnaire. Most of the sanitation workers wear on or two of the many equipment being used for protection of one's self.

Solid waste management practice in Ghana has been largely focused on the issues of sweeping, collection and disposal with little attention paid to the health status. The

collection methods are based mostly on manual labour, which is less costly than the mechanized collection systems adopted in developed countries.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

This chapter finalizes and summarizes the study findings. They are herein referred to as study conclusions. Following these are suitable recommendations.

6.1 Conclusions

The study demonstrates that:

1. Socio-demographic factors of the sanitation workers do not contribute significantly to the risk of affecting their health.

2. The daily experience of sanitation workers involving waste management was not affecting them since they are not treated bad by the society

3. Sanitation workers are more concerned about money than their health and do not believe that the handling of waste is of much concern.

4. Personal protective equipment is worn by most sanitation workers before sanitation work; a few of them wear it during and after sanitation work. Contact with waste material is therefore prevented and hence any health risk is averted. However the full set of protective equipment is not used.

5. The majority of the sanitation workers perceive that waste can make them sick and so cleaned themselves up after sanitation work.

6. Sanitation workers are not reporting to the Prampram Health Center with symptoms and illness related with sanitation work.

6.2 **Recommendations**

- Policy should be developed concerning the handling and disposal of waste in order for sanitation workers to be protected from hazardous substance as it is known from literature.

- Sanitation workers should be involved in making policies for waste management.

- There should a regulation in various companies for periodic medical checkups for sanitation workers.

- There should be constant provision of personal protective equipment and training. This will help in the education of waste handlers on personal protective equipment and keep them safe.

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APPENDICES

Appendix 1: Sample Informed Consent Form

Project Title: Assessment of Health risk associated with waste handling among sanitation workers at Prampram.

Principal Investigator: Amichia Manza Pauline

Institutional affiliation: School of Public Health, College of Health Sciences, University of Ghana Legon

Procedures: This is an academic research in partial fulfillment for the award of a Master of Public Health (MPH) degree. The purpose of the project is to present data to help determine the health risk involved with waste handling among Sanitation workers. With your permission I would like to collect background data on Sanitation Workers.

Benefits/ Incentives: You may feel uncomfortable with some of the questions we will be posing. However answers to them will provide very vital information to us, the opinion leaders at Prampram and healthcare providers. The information you provide will also help us mitigate the problems associated with the handling of waste. The findings will inform community leaders about which sanitation factors greatly influence the occurrence of ill health for appropriate interventions and also add to existing knowledge.

Right to refuse: This Interview will not take more than an hour and will not be stressful. If you are not comfortable with the interview, you are free not to participate or refuse to answer particular questions. Your refusal to participate or continue with the interview will not deprive you of any benefit you are currently receiving. It is fine to refuse to

participate. However, I kindly ask that you participate since your opinion is needed to solve this problem.

Confidentiality: I will not use your name in any of our records if you agree to participate. Be assured that the information you provide will be handled with confidentiality and analysis of the data will be done at aggregate level to ensure anonymity.

Signature/ Thumbprint of participant …….

Date……. / …… / ……..

Signature of Investigator…….

Date……. / …… / ……..

Appendix 2: Focus Group Guide

TITLE: **an assessment of health risks associated with waste handling among sanitation workers at prampram**

1. What specific Sanitation activity/ies do you perform? Probe
2. What is your opinion about this job? Probe
3. Why are you involved with Sanitation Work? Probe
4. Tell me how do community members often perceive people who are sanitation workers? (Clean and collect toilet and rubbish)
5. Why do they perceive them that way?
6. Does it have any influence on you in any way? How
7. Does the perception affect how they relate to you? In what way?
8. What do you know about a working Gear? Probe
9. Tell me about any waste handling training (especially in an outbreak), including demonstrations you had? Probe
10. What do you think are some of the health risk related to your work?
11. Can you tell me what you know about worm infection? Probe
12. Have you ever had worm infection? How did you know?

Appendix 3: Questionnaire

Project Title: an assessment of health risks associated with waste handling among sanitation workers at Prampram

Survey Information

	Location and Date	
1	Respondent's ID	□□□
2	Respondent's name	
3	Interviewer ID	□□□
4	Date of completion of the instrument	□ □ □ □ □□ □ □ d d m m y y y y

	Consent, Interview Language and Name	
5	Consent has been read out to participant	Yes ☐ No ☐ If NO read consent
6	Consent has been obtained	Yes ☐ No ☐ If yes continue If no End
	CORE: Demographic Information	**Response**
7	Sex (Record Male/Female as observed)	Male ☐ Female ☐
8	Age/Date of birth	Years ☐☐/……
	EXPANDED: Demographic Information	**Response**
9	What is your current level of education?	MSLC ☐ Secondary ☐ Vocational ☐ Tertiary ☐
10	What is your marital status?	Single ☐ Married ☐ Separated/Divorced ☐ Widowed ☐
11	Ethnicity	☐we ☐ Ga/Adangbe ☐Akan ☐ Other/Specify_____
12	Religion	☐ Christian ☐uslim ☐Traditional ☐ Other/ Specify _____
13	Current residence	☐ Own home ☐ Rented ☐ Family house ☐ Shared apartment
	Work history and	**Response**

	Activities	
12	Which Waste Management Company (WMC) do you work for?	☐ Zoom Lion/ ZOIL ☐ Area Council ☐ ACI ☐ Arise and Shine ☐ Others, please specify……
13	What specific Sanitation activity/ies do you perform? Tick all that apply to you	☐ Sweeping ☐ Collection ☐ Transport ☐ Disposal ☐ Other/Specify _____
14	On the average, how many hours per shift do you work?	☐ <1hr ☐ 1 – 2 hrs ☐ 2 – 4 hrs ☐ 5 – 8 hrs ☐ Others/Specify_____
	Experience of Sanitation Workers	**Response**
15	Why are you involved with Sanitation Work?	☐ I enjoy it ☐ For Money ☐ I can't get any other work ☐ Don't want to be idle ☐ Other/ Specify _____
16	What is your opinion about this job?	☐ Unhygienic ☐ Embarrassing ☐ Respected ☐ Difficult ☐ Rewarding ☐ Satisfactory ☐ Other/ Specify _____
17	Do you feel bad working with waste?	☐ Yes ☐ No
18	Are you been stigmatized because of the work you do?	☐ Yes ☐ No If NO go to Question 19 If Yes, Please give an example …….. ……..

		…….. ……
19	If you had the chance would you change jobs?	☐Yes ☐ No
	Personal Protective Equipment	**Response**
20	Do you wear personal protective equipment?	☐ Yes ☐ No If NO go to question 22
21	When do wear personal protective equipment?	☐ Before Waste handling ☐ During Waste handling ☐ After Waste handling
22	What specific protective tool do you use?	☐Headgear/Helmet ☐Nose mask/mouth cover ☐ Over-all coat/ apron ☐ Wellington boot ☐Glove ☐Other/ Specify _____
23	Why don't you wear personal protective equipment?	☐I have to buy it myself ☐ I don't see the need ☐Makes me feel uncomfortable ☐It is spoilt and hasn't been replaced ☐ The company does not provide it
24	Do you think it's important to wear protective equipment?	☐Yes ☐ No
25	Do you believe it protects you from any health risk?	☐ Yes ☐ No
26	Have you ever been trained on the use of Personal Protective Equipment?	☐Yes ☐No

	Waste handling and perceived health risk	**Response**
27	Can physical contact with waste make you sick?	☐Yes ☐ No
28	Do you clean yourself after Sanitation Work?	☐Yes ☐ No
29	How many times have you been sick ever since you started work as a Sanitation Worker?	☐ Never ☐ Once ☐ More than once ☐ Several times ☐can't remember ☐ other/specify _____
30	Do you think the sickness you had is related to the work you do?	☐ Yes ☐ No
31	Did you visit the Prampram Health Centre?	☐ Yes ☐ No
32	Have you experienced any of the following signs and symptoms since you started work as a waste handler?	☐Aches ☐ Cough ☐Asthma ☐Skin diseases ☐ Fever ☐ Runny nose ☐ Sore Throat ☐ Breathing difficulty ☐ Skin Rashes ☐ Itching ☐ Diarrhoea ☐ Appetite Loss ☐ Itchy Anus ☐ Nausea ☐ Dizzines ☐ Anaemia

Appendix 4: Observational Checklist

- Wearing of complete Personal Protective Equipment
- When it is being worn
- How waste is handled
- And what is done after waste handling