FACTORS INFLUENCING THE USE OF ZINC SUPPLEMENTATION IN THE
MANAGEMENT OF CHILDHOOD DIARRHOEA AMONG HEALTH PROVIDERS IN
THE NINGO-PRAMPRAM DISTRICT

BY

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MASTER OF PUBLIC HEALTH DEGREE

JULY, 2018
DECLARATION

I, Michael Addo Preko Ntiri hereby declare that this dissertation is a result of my independent work. References to other works have been duly acknowledged. I further declare that this dissertation has not been submitted for the award of any degree in any other Institution or University.

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DEDICATION

This dissertation is dedicated to my wife, Beryl Kafui Kwawukume-Ntiri, my son, Parpah Nyamekye Preko Ntiri and my daughter, Sika Nyameye Effah Ntiri.
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I am eternally grateful to almighty God for the grace and mercies bestowed on me to complete this dissertation. This work would not have been accomplished without the vital contribution of many individuals.

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ABSTRACT

Background: Diarrhoea still presents a substantial burden of disease to children in developing countries even though there are simple and cost-effective treatment options available. Based on available evidence through research the World Health Organization (WHO) and United Nations Children’s Fund (UNICEF) recommended the use of low osmolarity Oral Rehydration Salts (ORS) and zinc for the management of uncomplicated diarrhoea in 2004. Though the use of ORS is fairly widespread in developing countries, same cannot be said of zinc supplementation to date. The 2014 Ghana Demographic and Health Survey confirmed that the use of zinc supplementation was still less than 10% in Ghana.

Objective: This study assessed factors influencing the use of zinc supplementation for the management of childhood diarrhoea among health providers in the Ningo-Prampram district of the Greater Accra region of Ghana.

Method: This study employed a descriptive cross-sectional approach. The study recruited health providers in the Ningo-Prampram district. Structured questionnaires were used to collect data on demographic characteristics, knowledge of zinc supplementation, attitude towards zinc supplementation, health facility related factors and practice of zinc supplementation. Statistical analysis was done to determine measures of association between independent variables and zinc supplementation.

Results: Although all 162 (100%) of the health providers were aware of zinc supplementation only 74.7% (118/158) used zinc in the management of childhood diarrhoea. In a multivariable logistic regression analysis, knowledge index score [aOR = 3.64(95% CI; 1.49-8.92), p-value = 0.005] and availability of zinc in the health facility [aOR = 5.07(95% CI; 1.54-16.69), p-value = 0.008] were shown to be significantly associated with the use of zinc supplementation,
controlling for type of health facility, attitude and having other sources of zinc close to the health facility.

**Conclusion:**

Knowledge and availability of zinc in health facilities are the most significant factors associated with the use of zinc supplementation in childhood diarrhoea. Educating health professionals and making zinc available at health facilities will enhance zinc supplementation in childhood diarrhea.
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LIST OF ABBREVIATIONS

CHPS.................................Community-Based Health Planning and Services
CHW.................................Child Health Week
DHA.................................District Health Administration
DHS.................................Demographic and Health Survey
DHIMS...............................District Health Information Management System
GAPPD..............................Global Action Plan for Pneumonia and Diarrhoea
GDHS...............................Ghana Demographic and Health Surveillance
GHS.................................Ghana Health Service
GSS.................................Ghana Statistical Service
IQR.................................Inter Quartile Range
ORS.................................Oral Rehydration Salt
OR.................................Odds Ratios
aOR.................................Adjusted Odds Ratios
cOR.................................Crude Odds Ratios
OTC.................................Over the Counter
PHC.................................Primary Health Care
SHOPS...............................Strengthening Health Outcomes through the Private Sector
UNICEF............................United Nations Children’s Fund
USAID..............................United States Agency for International Development
WHO.................................World Health Organization
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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Diarrhoea contributes to 9% of all deaths among children under five years worldwide albeit the availability of proven and effective management options (UNICEF, 2016). Out of an estimated 1.7 billion childhood diarrhoea cases occurring worldwide, about 525,000 of children below the age of five years die each year (WHO, 2017).

The greater part of the burden of diarrhoea falls on children living in developing countries. It is estimated that diarrhoea accounts for 25% of all-cause mortality in African children younger than five years (Boschi-Pinto et. al., 2008). The World Health Organization estimates that on average children under five years living in low income countries experience three episodes of diarrhoea annually. Every episode encountered by these children denies them of essential nutrients needed for their growth. Diarrhoea has consequently become a major risk factor for malnutrition and its associated developmental problems in children living in limited resource settings.

In Ghana, severe diarrhoea resulting in dehydration has been identified as one of the major causes of morbidity and mortality among children under five years. The 2014 Ghana Demographic and Health Survey (GDHS) report revealed that children below 6 months who were exclusively breastfed by their mothers were less likely to have episodes of diarrhoea (Ghana Statistical Service, Ghana Health Service, & ICF International, 2015). A review of recent Demographic and Health Survey (DHS) data from some countries in sub-Saharan Africa with high prevalence of diarrhoea including Burkina Faso, Democratic Republic of Congo, Ethiopia,
Kenya, Mali, Niger, Nigeria, Tanzania and Uganda also suggested that children introduced to 
early, exclusive and predominant breastfeeding practices had lower prevalence of diarrhoea 
compared to children who were introduced to complimentary feeding within six months of birth 
(Ogbo et al., 2017). The prevalence of diarrhoea has been shown to increase with age and peaks 
around 12-36 months when children become more mobile or have been introduced to other 
liquids and semi-solid foods (Ghana Statistical Service, Ghana Health Service, & ICF 
International, 2015). The prevalence of diarrhoea has also been shown to be higher in 
communities with inadequate hygiene and sanitation, potable water for drinking and cooking.

WHO and UNICEF’s Global Action Plan for Pneumonia and Diarrhoea (GAPPD) suggested a 
three-pronged approach to tackle the menace of childhood diarrhoeal diseases. The approach is 
hinged on the cardinal pillars of protection, prevention and treatment. Children are to be 
protected through exclusive breastfeeding in the first 6 months after birth, vitamin A 
supplementation and adequate complementary feeding. Preventive strategies involve rotavirus 
vaccination for children, provision of safe drinking water and sanitation, hand-washing with soap 
and other hygienic practices at home. Appropriate treatment for diarrhoea with low osmolarity 
Oral Rehydration Salt (ORS) and zinc supplementation completes the triad. WHO and UNICEF 
(2004) jointly recommended the use of low concentration ORS and zinc supplementation for the 
clinical management of acute diarrhoea. The combination of zinc tablets and ORS reduce the 
duration and severity of diarrhoea and has the potential to mitigate diarrhoea related mortality 
significantly (El-Khoury, Banke & Sloane, 2016). Specifically, acute diarrhoea should be treated 
with ORS prepared with clean water and a 10-14 days supplementation of 20mg dispersible zinc 
tablets (UNICEF, 2016).
Zinc supplementation in clinical management of diarrhoea has been shown to reduce the incidence and prevalence of diarrhoea by 26% and 35% respectively in children older than 11 months (Sazawal et al., 1997). Robberstad, Strand, Black, & Sommerfelt (2004) demonstrated that zinc supplementation significantly improves the cost-effectiveness of standard management of diarrhoea.

ORS has been widely used as an Over-the Counter (OTC) product for diarrhoea since 2005. The use of zinc tablets is still not very popular among health providers in health facilities and community service points despite the many promotional activities championed by various agencies. There has been a lot of effort in recent years to secure an OTC status for zinc tablets in countries with a high prevalence of childhood diarrhoea such that zinc can be sold on demand in pharmacies and licensed chemical shops.

Kung’u et al. (2015) suggested that promoting the use of zinc tablets and ORS through Child Health Week (CHW) programs and providing caregivers samples to try at home has a huge potential to increase the knowledge, attitudes and practice of zinc supplementation as an adjunct to ORS in the management of childhood diarrhoea. Scaling up zinc sensitization activities through CHW programs offers a unique opportunity for health providers and caregivers of children to deepen their knowledge of the role of zinc in the management of childhood diarrhoea and increase the appropriate utilization of zinc supplementation.

Efforts to reduce the burden of diarrhoeal disease can only be successful when health providers are very familiar with scientifically proven therapies such as the use of zinc and ORS, use them frequently and educate caregivers at home on effective management of childhood diarrhoea. Governments of countries with high prevalence of diarrhoea needs to provide adequate support for education promotion on zinc supplementation. The ability to make the appropriate treatment
recommendations a routine practice among health providers in health facilities and communities will reinforce knowledge of prevention and management of childhood diarrhoea (UNICEF, 2016).

1.2 Problem Statement

In 2016, diarrhoea constituted about 8% of all case morbidities, coming after Malaria (35%) and Upper Respiratory Tract Infections (18%) in the Ningo-Prampram district. Children under five years of age accounted for over 30% of diarrhoea cases reported to health facilities in the district for 2016 (Ningo-Prampram District Health Administration, 2017).

Good guidelines on the clinical management of diarrhoea among the vulnerable population remains critical but studies have shown that many children in sub-Saharan African countries are still not getting the appropriate care for diarrhoea even when they visit health facilities (Carvajal-vélez et al., 2016).

Zinc supplementation is still not very popular among health providers in developing countries in spite of all the documented evidence supporting its effectiveness. Carvajal-vélez et al. (2016) revealed that only 52% [range: 34-64%] of children in sub-Saharan Africa diagnosed with diarrhoea in health facilities receive good and effective management of the condition.

Oral rehydration alone has been the most utilized and simple treatment approach to the clinical management of diarrhoea even though the addition of zinc supplementation has been recommended since 2004. According to the 2014 Ghana Health and Demographic Survey (GDHS), out of 45% of diarrhoea cases reported to health facilities for treatment, 65% received ORS and only 7% were given zinc supplementation (GSS/GHS/ICF International, 2015). ORS has been widely accepted for the management of diarrhoea but same cannot be said of zinc
supplementation. This study assessed the factors affecting the use of zinc supplementation by healthcare providers who attend to children under five years with acute uncomplicated diarrhoea in health facilities in the Ningo-Prampram district.

1.3 Justification of the Study

The importance of zinc supplementation in the management of diarrhoea in children under five years cannot be over emphasized. The acceptance of zinc in the management of childhood diarrhoea among health care providers has the potential to reduce the burden of diarrhoea in the community. The knowledge and attitude of health care providers significantly affect health outcomes for all individuals who access health care from these health facilities.

It is hoped that this study will help to identify any existing gaps in the knowledge and attitude of health care providers on the use of zinc supplementation as adjunct therapy in combination with ORS for the management of diarrhoea in children under five years. Information gathered will help the District Health Administration (DHA) and donor agencies in planning for continuing professional development among health care providers who manage children with diarrhoea in the Ningo-Prampram district.

1.4 Research Questions

1. What influences a health provider’s decision not to give zinc supplement to a child with diarrhoea in a public or private health facility?

2. What is the extent of the use of zinc supplementation among health providers who manage children under five years with acute diarrhoea in public and private health facilities?

3. Are zinc supplements for children available in health facilities?
1.5 Study Objectives

1.5.1 General objective
To assess factors influencing the use of zinc supplementation in the management of childhood diarrhoea among health providers in health facilities within the Ningo-Prampram district.

1.5.2 Specific objectives
1. To determine the proportion of health providers who use zinc supplementation for the management of acute diarrhoea in children under five years.
2. To assess the knowledge and attitude of health providers towards the use of zinc supplementation in the management of diarrhoea in children under five years.
3. To determine factors associated with zinc supplementation by health providers.
4. To assess the availability of zinc supplements in health facilities.
1.6 Conceptual Framework

Figure 1. Conceptual framework of factors influencing the use of zinc supplementation in the management of childhood diarrhoea by health providers.

1.6.1 Narrative

This conceptual framework assesses the factors influencing health providers’ decision to use zinc supplementation in managing diarrhoea in children under 5 years. The dependent variable is “use
of zinc supplementation” which is affected by independent variables broadly categorized into health provider demographic characteristics, knowledge on zinc supplementation, attitude towards zinc supplementation and health facility related factors.

The health providers’ demographic characteristics such as qualification, training and work experience are directly linked with knowledge on zinc supplementation and attitude towards the use of zinc supplements. Knowledge on zinc supplementation can directly affect the use of zinc supplement or indirectly through attitude towards zinc supplementation. Health provider attitude towards zinc supplementation can be directly linked to the use of zinc supplement. Availability of treatment guidelines may lead to acquisition of knowledge on zinc supplementation. Availability of zinc supplement in the health facility can also affect the use of zinc supplementation directly.
CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of the Management of Diarrhoea

An exposure to a host of bacterial, viral or parasitic organisms through contaminated water, unhygienic food preparation and disposal of human excreta has been widely associated with diarrhoeal diseases. Rotavirus and *E. coli* are two of the most common pathogens frequently associated with diarrhoea. Reither et al. (2007) isolated rotavirus from the stools 55% of children under five years presenting with diarrhoea to a health facility in Northern Ghana. This and other studies on the association of rotavirus with diarrhoea in children culminated in the adoption of rotavirus vaccination as part of the integrated childhood immunization program in Ghana. Since the introduction of rotavirus vaccine there has been a significant reduction in all-cause diarrhoea hospitalization among children younger than five years (Enweronu-Laryea et al., 2014).

The introduction of ORS since the late 1970s and early 1980s has significantly reduced diarrhoea related morbidity and mortality over the years. ORS has been widely used to prevent diarrhoea related dehydration in acute uncomplicated and persistent diarrhoea. With all the benefits accruing from the use of ORS, WHO’s Department of Child and Adolescent Health and Development and UNICEF continued to support research into improved treatment options for diarrhoea which led to the formulation of low osmolarity ORS (WHO, 2001). The newly improved ORS contained lower concentration of glucose and salts. Low osmolarity ORS prevented transient asymptomatic hyponatremia which was thought to be associated with the use of regular ORS. According to the WHO Drug Information (2002) studies conducted showed that low osmolarity ORS reduced stool output by 20% and the incidence of vomiting by 30% compared to the regular ORS. Due to its enhanced effectiveness, particularly in children with
acute uncomplicated diarrhoea, WHO and its development partners gave recommendations for countries to manufacture and use low osmolarity ORS in place of the previously recommended ORS solution.

The 2004 joint WHO/UNICEF recommendation officially introduced zinc supplementation as an adjunct therapy to oral rehydration in the management of diarrhoea. The recommendation gave guidelines for the management of diarrhoea which essentially included treatment with low osmolarity ORS and zinc tablets. This joint recommendation originated from scientific consensus and recognition that low osmolarity ORS and zinc were vital for averting many diarrhoea related deaths. It was estimated that successful implementation and scaling up of the WHO/UNICEF recommendation for management of diarrhoea could save 400,000 lives annually (Larson et al., 2009). ORS and zinc are relatively inexpensive, safe and easy to use and can considerably reduce diarrhoea related morbidity and mortality (Walker et al., 2009).

Various agencies have developed communication strategies around WHO/UNICEF recommendation to assist in scaling up appropriate and effective management of diarrhoea in younger children. USAID and the Johns Hopkins Center for Communication Programs developed an adaptable communication strategy for ORS and zinc supplementation. The tool was to be adapted by countries for tailored communication to promote ORS and zinc usage among caregivers at home, healthcare providers and governmental agencies that influence health policy directions and to influence behavioral change towards the acceptance of ORS and zinc. The tool provided step-wise approach to creating a communication strategy aimed at generating demand for ORS and zinc for the various target groups (Health Communication Capacity Collaborative, 2014). Greenland et al. (2016) noted that in spite of the fact that people are not familiar with zinc supplementation in most communities, promoting zinc as a remedy for
stopping diarrhoea has proven to be effective in driving caregiver to try zinc for the first time. Caregivers are willing to try zinc because their primary aim is to seek effective solutions to bring immediate relief to children suffering from diarrhoea. It is also important to ensure that zinc tablets are available in health facilities and pharmacies before commencing activities to promote zinc supplementation (Greenland et al., 2016).

Ghana adopted the WHO/UNICEF recommendation of low osmolarity ORS and zinc in 2010. El-Khoury, Banke & Sloane (2016) revealed an increase in the use of ORS and zinc in the management of childhood diarrhoea from 0.8% to 29.2% among pharmacies, private health providers and caregivers in Ghana from 2011 to 2015. The same study also showed a decrease from 66.2% to 29.2% in the unwarranted use of antibiotics in diarrhoea management. All these efforts notwithstanding, the acceptance of ORS and zinc for the management of diarrhoea has not reached its full potential. Abegaz et al. (2016) exposed frequent encounters with inaccurate prescription and giving of instructions on how to administer ORS and zinc tablets among health providers in the management of childhood diarrhoea.

The emergence of rotavirus as a leading cause of severe diarrhoea and dehydration in younger children around the world especially in developing countries brought another dimension to the management of diarrhoea which focused on protection. Prashar, Alexander and Glass (2005) demonstrated that acute gastroenteritis was the common clinical manifestation of diarrhoeal diseases. They further revealed that rotaviruses were the principal etiologic agents for severe acute gastroenteritis related dehydration and many children would experience at least an episode of rotavirus infection prior to attaining the age of 5 years. The World Health Organization recognized that despite improvement in sanitation and hygiene the burden of diarrhoea still remained substantial around the word due to the existence of disease causing pathogens and

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vaccination seemed to be one of the most promising approaches to protect children from severe diarrhea and death due to rotavirus infection (WHO 2000). In clinical trials, two vaccines proved to be effective against severe gastroenteritis and diarrhoea hospitalizations from rotavirus infections. The pentavalent human-bovine strain reassortant vaccine (RotaTeq; Merck) and a monovalent human strain vaccine (Rotarix; GlaxoSmithKline) were subsequently approved in Europe and Americas for rotavirus vaccination (Ruiz-Palacios et al., 2006; Vesikari et al., 2006). Similar clinical trials in developing countries such as Ghana also led to the introduction of rotavirus vaccination to fortify existing vaccine delivery infrastructure and expand coverage. Studies conducted with Rotarix vaccine in southern Ghana posted results of significant reduction in diarrhea related hospitalization among children aged 5 years or younger (Arvay et al., 2009; Enweronu-Laryea et al., 2014). On the basis of evidence gathered from these studies Ghana and other African countries adopted rotavirus vaccination as part of the childhood expanded program of immunization.

2.2 Rationale for Zinc Supplementation in the Management of Diarrhoea

Several hospital and community-based studies in developing countries have shown that zinc supplementation effectively reduces the duration and severity of acute and persistent diarrhoea in children under five years (Canani & Ruotolo, 2006; Lukacik, Thomas, & Aranda, 2008). The precise mechanism of action through which zinc exerts its effect in the management of diarrhoea and acute gastritis has not been fully explained but some studies have speculated that this could be the results of the vital role zinc plays in the preservation of epithelial and tissue integrity via cell growth, the antioxidant property of zinc which prevents free radical damages during the inflammatory response process and the enhancement of cellular immunity to maintain adequate immune function (Holloway, 2000; Liberato, Singh & Mulholland, 2015). The ability of zinc to
aid the transport of water and electrolytes through the intestines has also been highlighted as one of the important attributes enhancing its use in the management of childhood diarrhoea (Shankar & Prasad, 1998; Patel, Dhande & Rawat, 2005). The role of zinc in the synthesis of proteins, growth and differentiation of cells makes it an essential micronutrient for the development of children in general. Prasad (1991) demonstrated that children with zinc deficiency usually have higher risk of developing gastrointestinal infections and diminished immune function. Such children are also known to have structural and functional abnormalities of the gastrointestinal tract. Children naturally get zinc supplementation through dietary intake of foods that are rich in zinc, such as food originating from animals. Zinc deficiency is predominant in developing countries because of limited access to food that are rich in zinc (Prasad, 1991). It is also thought that the binding of zinc to dietary fiber and phytates – found in nuts, legumes and cereals, reduce the rate of absorption of nutritional zinc into the body. Nuts, legumes and cereal are major staple foods in most developing countries, therefore absorption of dietary zinc among children in these countries is low (Aggarwal, Sentz & Miller, 2007; Haider & Bhutta, 2009). Evidently, children from developing countries who need zinc supplementation for growth and the development of their immune system may not get enough from their diet. Zinc supplementation from other sources are needed to make up the deficit. There is evidence to suggest that zinc supplementation is effective when zinc is given alone in the form of tablets or syrups. The efficacy of zinc combined with other micronutrients or food supplements against infectious diseases cannot be fully ascertained (Somé et al., 2015).

Harris & Black (1991) suggested that zinc supplementation which is effective and cheap would be useful in efforts to reduce the unnecessary antibiotics and anti-diarrhoea medication use in the management of diarrhoea in children. This claim was re-affirmed by Patel, Dhande & Rawat
(2003) who showed that the benefit of zinc supplementation in the management of childhood diarrhoea does not only manifest in the clinical effect of reducing morbidity and mortality but also in the significant reduction of hospitalization cost and the elimination of unwarranted use of antibiotics with its cost implications.

There is substantial evidence supporting the effectiveness of zinc supplementation in the clinical management of childhood diarrhoea but only a small percentage of children who really need zinc supplementation have access to it (Walker et al., 2009).

Zinc has been shown to be a beneficial and vital micronutrient for children aged six months or older, living in areas known for high prevalence of zinc deficiency or malnutrition. There is not enough evidence to support the expediency of zinc supplementation in reducing the incidence of infectious diseases among well-nourished children in areas with low prevalence of zinc deficiency (Lazzerini & Wanzira, 2016).

2.3 Factors Affecting the Use of Zinc Supplementation Among Health Providers.

A number of obstacles continue to hinder the extensive implementation of zinc supplementation as an adjunct therapy to ORS in the management of diarrhoea in children under 5 years. Healthcare providers are expected to be at the forefront of the propagation of effective communication strategies for the use of zinc supplementation in management of diarrhoea in vulnerable populations but there is evidence to suggest some concerns in the scientific fraternity about the effectiveness of zinc supplementation. Some of these concerns include the perception among healthcare providers that high zinc intake has the propensity to interfere with the absorption of calcium, iron and other vital micronutrient needed for growth and development (Luther & Dewey, 2003), hence the need to establish optimum dose in the management of diarrhoea in children (Aggarwal, Sentz & Miller, 2007). According to Santosham et al. (2010)
healthcare providers in developing countries, including physician, have not fully appreciated the role of zinc supplementation in the management of diarrhoea in children. Literature has linked the use of zinc supplementation to health provider demography, knowledge and attitude as well as health facility-related factors.

2.3.1 Health provider demographic characteristics

Demographic characteristics of healthcare providers such as qualification, training and years of practice seems to affect the ease of adherence to recommended guidelines for clinical management of their patients. Esezobor, Adeniyi & Ekure (2011) illustrated a high rate of utilization of zinc supplementation among specialist pediatricians and pediatric residents who practiced in teaching hospitals and referral centers where the frequency of contact with diarrhoea patients was very high. The median duration of medical practice for their study population was 13 years post qualification. Such practitioners were expected to demonstrate a high knowledge and practice of evidence-based treatment recommendations. Walker et al. (2015) used multiple logistic regression analysis in a cross-sectional survey among public and private health providers to show that education, experience and training were independently associated with health providers generally having correct knowledge of zinc supplementation and routinely recommending zinc for the management of diarrhoea in children. Other studies have also suggested that the impact of the interventions to improve upon the knowledge, attitude and practice of zinc supplementation is directly related to the educational status of the health provider (Singh et al., 2014).

2.3.2 Health provider’s knowledge of zinc supplementation

Omuemu, Ofuani and Kubeyinje (2012) showed that majority of health care workers in Nigeria were aware of at least one benefit of zinc supplementation in the management of diarrhoea but
not many could tell the types of diarrhoea for which zinc supplementation is indicated. They further acknowledge that training workshops for Primary Heath Care (PHC) workers was one of the effective ways of transferring knowledge of zinc supplementation to frontline health care providers but only a small proportion of respondents had such opportunities. Broadening the knowledge base of PHC workers could be beneficial to compliance with treatment recommendation since they impart such knowledge on mothers and caregivers they come into contact with on daily basis.

A few studies have suggested that an increase in provider knowledge does not automatically translate into improved practice of zinc supplementation. Caregivers of children younger than 5 in the Gambia have been shown to have high knowledge which does not necessarily correlate with their diarrhoea management practices (Silah, Ho & Chao, 2013). Likewise, pharmacy workers in Vietnam also demonstrated a high knowledge of diarrhoea management but their actual practice did not conform to appropriate standard of treatment (Pham et al., 2013). However, Lamberti et al. (2015) revealed that people who received periodic reinforcement of diarrhoea management strategies had much higher odds of prescribing ORS and zinc. This highlights the influence of frequent refresher training and continuing professional development on knowledge and practice of healthcare providers. They also observed a difference in the impact of knowledge on practice between public and private health providers. Private health providers did not receive frequent refresher trainings as much as their public counterparts who get government and donor support for such programs. Private health providers had to rely mostly on pharmaceutical sales representatives for updates on current medical practices which are sometimes skewed towards their products and the contact time for such discussions are too limited to elicit a desired impact on knowledge and practice. It is therefore imperative to consider
frequency and duration of training for a significant association between health provider knowledge and practice of zinc supplementation.

2.3.3 Health provider’s attitude towards zinc supplementation

El-Khoury & Sanders (2012) noted that health providers who tend to use zinc supplementation frequently had a positive perception that zinc is effective, because the diarrhea stopped quickly and the children recovered faster. On the other hand, healthcare providers who are reluctant to use zinc supplementation still believed that antibiotics and anti-diarrhoea medication could work faster than zinc and ORS by relieving the diarrhoea more rapidly. Some healthcare providers also thought the addition of antibiotic or anti-diarrhoea to zinc and ORS was a better treatment option than ORS and zinc alone. Training of health providers on the benefits of zinc supplementation has a direct relationship with their attitude towards zinc supplementation (Singh et al 2014). Health providers who have received any form of training on zinc supplementation exhibited the confidence to practice it in the management of childhood diarrhoea. The training helps to diffuse some of the entrenched posturing on appropriate choice of medications for diarrhoea management.

2.3.4 Health facility-related factors

In India, Lamberti et al. (2015) observed that the probability of a health provider using zinc supplementation was high when they had direct access to the product in their health facilities. Even health providers who were trained to refer caregivers to nearby facilities for zinc supplies in the event of stock-outs, failed to do so (Lamberti et al., 2015). In the absence of zinc within the health facility, health providers are less likely to opt for zinc supplementation in the management of childhood diarrhoea. Running out of zinc stock in the health facility can be a setback for proper diarrhoea treatment in the health facility. Walker et al. (2015) emphasized that
product availability was significantly associated with health provider practice of zinc supplementation as well as the ability to remember the correct dose and duration. Improvement of the supply chain to safeguard sustainable access to zinc supplementation in health facilities would be of necessity. The Sustaining Health Outcomes through the Private Sector (SHOPS) project by USAID in Ghana played a critical role in equipping local manufacturing companies to build their capacity to produce zinc tablets locally for a sustainable supply chain which has improved access to zinc tablets by health facilities significantly (El-Khoury, Banke & Sloane, 2016). A randomized controlled trial which trained health workers and supplied them with zinc and ORS at the health facility almost doubled the proportion of patients who received zinc supplementation in the management of diarrhoea for 3 to 6 months (Sazawal et al., 1997). The intervention reduced the prevalence of diarrhoea and diarrhoea-related hospital admissions significantly.
3.0 METHODS

3.1 Study Area

The study was conducted in the Ningo-Prampram district of the Greater Accra region, located in the south-eastern part of Ghana. The district is further divided into the Ningo and Prampram sub-districts. It is a coastal area bounded to the south by the Gulf of Guinea and the vegetation is mainly coastal savannah. Ningo-Prampram district covers a total land area of about 622.2 square kilometers with a total population of about 80,286 made up of 47.6% males and 52.4% females (Ghana Statistical Service, 2016). The map of the Ningo-Prampram district is shown in Figure 2. Most of the inhabitants of the district are fishermen or subsistence farmers. Other occupations are petty trading, trained artisanship, craftsmanship and a few civil servants, mainly migrant employees of government ministries, departments and agencies.

The district has 10 government or public health facilities made up of 1 Polyclinic, 1 Health Centre, and Community Health Planning Services (CHPS) compounds. There are also functional CHPS zones where health personnel pay regular visit to households in the community. Twenty-one private health facilities comprising clinics, maternity homes, pharmacies and licensed chemical sellers also provide health services to the inhabitants of the district (Ningo-Prampram DHA, 2017).
3.2 Study Population

The Ningo-Prampram DHA had 237 health workers in their register for the year ending 2017. These included both clinical and non-clinical staff from public and private health facilities. One hundred and seventy-eight of these health workers by their job description were identified as health providers who manage clinical conditions in public and private health facilities.

The study was conducted among health providers who work in public and private health facilities located in the Ningo-Prampram district.

A health provider for the purposes of this study was defined as any trained healthcare worker who attends to patients and provides them with clinical care services in a health facility. They include doctors, physician assistants, pharmacists, general nurses, midwives, community health nurses, health assistants and licensed chemical sellers.
3.2.1 Inclusion criteria

1. Health providers in public health facilities (polyclinic, health center, CHPS compound) who provide treatment for patients presenting with general cases.

2. Community health nurses and health assistants in the CPHS zones who visit household to provide healthcare services within the community.

3. Health providers in private health facilities (hospital, clinic, maternity home, community pharmacy and licensed chemical sellers) who attend to patients presenting with common ailments in the community.

3.2.2 Exclusion criteria

1. Health providers who do not treat patients in the health facility.

2. Health providers with less than 3 months working experience.

3.3 Study Design

A descriptive cross-sectional approach was used for this study.

The study was designed as a health facility-based quantitative, cross-sectional study involving health providers who deliver clinical care to children in the Ningo-Prampram district. In this cross-sectional descriptive survey, data collection occurred at a single point in time for each respondent.

Structured questionnaires were administered to health providers in public and private health facilities in the Ningo-Prampram district. Data collected was analyzed for generalization of findings to reflect the views of the target population.

3.4 Study Variables

The dependent variable for this study was “use of zinc supplementation”.
Independent variables measured were captured under 4 main categories – demographic characteristics, knowledge on zinc supplementation, attitude towards zinc supplementation and health facility-related factors. Study variables have been described in Table 1.

3.5 Sampling

All the 178 clinical staff on the DHA register were targeted as “health providers” for the purposes of this study. A purposive population sampling approach was therefore adopted for this study. A list of all health providers who met the inclusion criteria was obtained from the Ningo-Prampram DHA. These individuals were visited in their various health facilities and approached to be part of the study.

3.6 Data Collection Tools and Techniques

A structured questionnaire adapted from literature (Omuemu, Ofuani, & Kubeyinje, 2012; Lopes et al., 2014; Lamberti et al., 2015) and revised to suit the relevant context for this study was used to gather information from health providers. The pre-tested questionnaire was used to collect data on health provider demographic characteristics, knowledge on zinc supplementation, attitude towards zinc supplementation, health facility-related factors and practice of zinc supplementation. To assess the knowledge of health providers, 16 questions were asked on dosage, frequency, duration, side effects and known benefits of zinc supplementation in the management of diarrhoea. The attitude of health providers towards zinc supplementation in the management of childhood diarrhoea was assessed with 6 questions covering suitability, promotion of zinc therapy and perception of cost.

Interviews were conducted in the health facilities of the health providers by trained research assistants. Each respondent was interviewed once.
<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Operational Definition</th>
<th>Scale of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent</td>
<td>Use of zinc supplementation</td>
<td>Prescription of zinc for the management of diarrhoea</td>
<td>Binary</td>
</tr>
<tr>
<td>Independent</td>
<td>Age</td>
<td>Age of health provider at the time of administering questionnaire</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>Sex of health provider (male or female)</td>
<td>Binary</td>
</tr>
<tr>
<td></td>
<td>Qualification</td>
<td>Highest educational level attained by health provider</td>
<td>Categorical</td>
</tr>
<tr>
<td></td>
<td>Work experience</td>
<td>Number of years a health provider has accumulated in that capacity</td>
<td>Categorical</td>
</tr>
<tr>
<td></td>
<td>Knowledge of zinc supplementation</td>
<td>Health provider knowing about the use of zinc supplementation in the management of diarrhoea</td>
<td>Binary</td>
</tr>
</tbody>
</table>
|                        | Appropriate Dose, Frequency and Duration of zinc supplementation | • Dose – 10mg (0-5 months)  
• Frequency – Once daily  
• Duration – 10-14 days  
• 20mg (6-59 months) | Binary               |
|                        | Effectiveness of zinc supplementation          | • Zinc stops diarrhoea quickly  
• Zinc protects children from getting another episode of diarrhoea                     | Binary               |
|                        | Combination of zinc with other medications    | • Zinc can be added to ORS  
• Zinc can be added to other medications                                                  | Binary               |
|                        | Attitude towards zinc supplementation         | • Health provider’s willingness to prescribe zinc  
• Health provider’s perception of cost                                                   | Binary               |
|                        | Health facility-related factors               | • Availability of zinc supplement  
• Accessibility of zinc supplement                                                         | Binary               |
3.7 Pilot Study

The questionnaire was pre-tested in the Shai-Osudoku district of the Greater Accra region among 20 health providers (estimated 11% of target population) who met the inclusion criteria to test for validity, reliability and clarify ambiguous questions. The final questionnaire was then modified to suit the objectives of the study.

3.8 Data Processing and Analysis

3.8.1 Summary of data processing

Data collected with questionnaires was scrutinized for errors and completeness before entering into a Microsoft excel spreadsheet (Microsoft Excel Version 2016). Summary tables and graphs were used for descriptive analysis of data. Means, medians, proportions, percentages and frequencies were used to describe the variables being measured in the study.

A knowledge index score was created for each participant from the 16 knowledge-related questions posed. All 16 knowledge-related questions were assigned a score of 1 for each correct answer and 0 for a wrong or “don’t know” answer. The number of correct answers obtained by each participant was summed up as the participant’s knowledge index score. Participants whose total score was equal or more than the mean score of 10 were classified as “above average” and those who scored less than 10 were classified as “below average”.

An attitude index score was also created by awarding each attitude-related question answered correctly a score of 1 and 0 to a wrong or “don’t know” answer. Correct answers were summed up for each participant as “attitude index score”. Respondents who obtained equal or more than the mean score of 5 were considered as “above average” and those who scored less than 5 were considered as “below average”.
Dataset was kept on a personal laptop computer and backed-up on a separate external hard drive as well as a password-protected Google drive. Completed hard copies of questionnaire have been kept in a secured cabinet under lock and key accessible to only some key personnel of the study team.

3.8.2 Statistical analysis

Data was analyzed with STATA Version 15.0 (College Station, Texas, USA) statistical software. Descriptive analysis of data was expressed in terms of means, medians, frequencies, proportions and percentages and presented in the form of tables and graphs. Chi square test and Fisher’s Exact test were used to measure the association between the dependent variable (use of zinc supplementation) and the independent variables at 95% confidence intervals and a 0.05 level of significance. A multivariable logistic regression analysis was used to determine the strength of association between the use of zinc supplementation and the independent variables at 95% confidence intervals and a 0.05 level of significance.

3.9 Quality Control

Questionnaires were pre-tested in a pilot study for validity and reliability. Research assistants were trained on the data collection tool, confidentiality and data security. Interviews were conducted by trained research assistants who can offer further clarification on the questions to health providers when needed. Filled questionnaires were checked and validated for completeness on daily basis during the data collection period. Double data entry and matching for differences were done before analysis.
3.10 Ethical Considerations

3.10.1 Ethical clearance

Ethical clearance for this study was obtained from the Ethical Review Committee of the Ghana Health Service. The Ningo-Prampram District Health Directorate was informed in writing before the study began. Participants were also provided with contact details of the principal investigator, academic supervisor and the administrator of the Ghana Health Service Ethical Review Committee for any further clarifications on the study.

3.10.2 Informed consent

Written informed consent was obtained from all participants before engaging them in any study related activity. Participants were made to understand that participation was voluntary and they could withdraw their consent at any time during the study. No individual was coerced or induced to participate in this study.

3.10.3 Privacy and confidentiality

All information collected from participants were treated as private and confidential. No identifiers have been stored with data and the identity of respondents were not disclosed during data analysis or report writing.

3.10.4 Risks and benefits

Participants were informed that there would be no direct or harmful risks associated with this study but the completion of questionnaire may take some time of their schedule and answering some of the questions may cause them slight discomfort.

Participants were made to understand that there are no direct individual benefits from the study. No compensation was paid for time spent on filling the questionnaire.
3.10.5 Data safety and storage

Data collected with questionnaires have been kept in a secured cabinet under lock and key. Electronic data has been password protected and stored on a personal computer, external hard drive and Google drive.
CHAPTER FOUR

4.0 RESULTS

4.1 Demographic Characteristics of Health Providers in the Ningo-Prampram District

A total of 162 out of 178 health providers were interviewed for this study, resulting in a response rate of 91%. The remaining 16 (9%) were out of station for various reasons including maternity and study leave. Majority of respondents, 105/162 (64.81%), were female health providers. Health providers who were interviewed aged between 20 and 68 years with 133/162 (82%) in the age range of 20-39 years. One hundred and twelve out of 162 (69%) of health providers had completed tertiary education and the median duration of work experience was 5 years (IQR=6).

Details of demographic characteristics of respondents have been summarized in Table 2.

Table 2. Demographic characteristics of health providers interviewed in the Ningo-Prampram district.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency (N=162)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>57</td>
<td>35.19</td>
</tr>
<tr>
<td>Female</td>
<td>105</td>
<td>64.81</td>
</tr>
<tr>
<td><strong>Age (Years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>31 (11)</td>
<td></td>
</tr>
<tr>
<td>20 to 29</td>
<td>68</td>
<td>41.98</td>
</tr>
<tr>
<td>30 to 39</td>
<td>65</td>
<td>40.12</td>
</tr>
<tr>
<td>40 to 49</td>
<td>17</td>
<td>10.49</td>
</tr>
<tr>
<td>≥50</td>
<td>12</td>
<td>7.41</td>
</tr>
<tr>
<td><strong>Highest level of education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None/Primary</td>
<td>7</td>
<td>4.32</td>
</tr>
<tr>
<td>Secondary</td>
<td>43</td>
<td>26.54</td>
</tr>
<tr>
<td>Tertiary</td>
<td>112</td>
<td>69.14</td>
</tr>
<tr>
<td><strong>Years of experience as a health provider (Years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>5 (6)</td>
<td></td>
</tr>
<tr>
<td>&lt;10</td>
<td>131</td>
<td>80.86</td>
</tr>
<tr>
<td>≥10</td>
<td>31</td>
<td>19.14</td>
</tr>
</tbody>
</table>
As shown in Figure 3, health providers were interviewed from the various categories of public and private health facilities within the Ningo-Prampram district. Twenty-nine out of 162 (17.90%) from polyclinics, 4/162 (2.47%) from the only health centre in the district, 43/162 (26.54%) from CHPS compounds, 35/162 (21.60%) from private clinics, 20/162 (12.35%) each from pharmacies and licensed chemical shops.

![Figure 3. Distribution of respondents by type of health facilities in the Ningo-Prampram district](https://example.com/figure3.png)

**4.2 Awareness of Health Providers on Zinc Supplementation**

All 162 (100.00%) participants interviewed for this study had heard about zinc supplementation in the management of childhood diarrhoea through different media (Table 3). From a multiple response analysis, 83/327 (25.38%) heard about zinc supplementation in radio and television advertisements, 32/327 (9.78%) through publications such as books, journals and newspapers,
75/327 (22.94%) learned about zinc supplementation from colleague health workers, 49/327 (14.48%) knew about zinc supplementation from formal school training and 88/327 (26.91%) from in-service trainings such as workshops and seminars.

Table 3. Awareness of health providers in the Ningo-Prampram district on zinc supplementation in the management of childhood diarrhoea

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency (N=162)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heard about zinc</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>162</td>
<td>100.00</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Source of information</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radio/TV</td>
<td>83</td>
<td>25.38</td>
</tr>
<tr>
<td>Books/Journals/News papers</td>
<td>32</td>
<td>9.78</td>
</tr>
<tr>
<td>Colleague health workers</td>
<td>75</td>
<td>22.94</td>
</tr>
<tr>
<td>School training</td>
<td>49</td>
<td>14.98</td>
</tr>
<tr>
<td>In-service training/seminars</td>
<td>88</td>
<td>26.91</td>
</tr>
<tr>
<td><strong>Total responses</strong></td>
<td>327</td>
<td>100.00</td>
</tr>
</tbody>
</table>

*Multiple responses allowed*

4.3 Knowledge of Health Providers on Zinc Supplementation

One hundred and twenty-six out of 162 (77.78%) of respondents were able to state the dosage of zinc for diarrhoea in children under 6 months accurately but only 94/162 (58.02%) were able to state the correct dosage of zinc for diarrhoea in children from 6 months to 5 years of age. The dosage frequency of zinc was accurately determined by 142/162 (87.65%) but only 123/162 (75.92%) knew the correct duration of zinc supplementation in childhood diarrhoea. One hundred and forty-three out of 162 (88.27%) participants agreed that zinc improves diarrhoea symptoms faster whilst 109/162 (67.27%) thought zinc protects children from subsequent episodes of diarrhoea. Only 53/162 (32.72%) believed that zinc improves appetite of children suffering from a diarrhoea episode.
According to the knowledge index score, 109/162 (67.28%) participants were in the “above average” category and 53/162 (32.72%) were in the “below average” category (Table 4).

Table 4. Knowledge of Ningo-Prampram health providers on zinc supplementation in the management of childhood diarrhoea

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response Category</th>
<th>Frequency (N=162)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dosage of zinc for diarrhoea in children under 6 months of age</td>
<td>Correct</td>
<td>126</td>
<td>77.78</td>
</tr>
<tr>
<td></td>
<td>Incorrect</td>
<td>36</td>
<td>22.22</td>
</tr>
<tr>
<td>Dosage of zinc for diarrhoea in children 6 – 59 months of age</td>
<td>Correct</td>
<td>94</td>
<td>58.02</td>
</tr>
<tr>
<td></td>
<td>Incorrect</td>
<td>68</td>
<td>41.98</td>
</tr>
<tr>
<td>Frequency of zinc supplementation per day</td>
<td>Correct</td>
<td>142</td>
<td>87.65</td>
</tr>
<tr>
<td></td>
<td>Incorrect</td>
<td>20</td>
<td>12.35</td>
</tr>
<tr>
<td>Duration of zinc supplementation</td>
<td>Correct</td>
<td>123</td>
<td>75.92</td>
</tr>
<tr>
<td></td>
<td>Incorrect</td>
<td>39</td>
<td>24.08</td>
</tr>
<tr>
<td>Zinc has unpleasant side effects for children</td>
<td>Yes</td>
<td>50</td>
<td>30.86</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>71</td>
<td>43.83</td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>41</td>
<td>25.31</td>
</tr>
<tr>
<td>Zinc can be given to children with persistent diarrhoea</td>
<td>Yes</td>
<td>148</td>
<td>91.36</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>7</td>
<td>4.32</td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>7</td>
<td>4.32</td>
</tr>
<tr>
<td>Zinc can be given with other medications</td>
<td>Yes</td>
<td>136</td>
<td>83.95</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>15</td>
<td>9.26</td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>11</td>
<td>6.79</td>
</tr>
<tr>
<td>Zinc improves diarrhoea symptoms faster</td>
<td>Yes</td>
<td>143</td>
<td>88.27</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>6</td>
<td>3.70</td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>13</td>
<td>8.02</td>
</tr>
<tr>
<td>Zinc protects children from subsequent episodes of diarrhoea</td>
<td>Yes</td>
<td>109</td>
<td>67.27</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>32</td>
<td>19.75</td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>21</td>
<td>12.96</td>
</tr>
<tr>
<td>Zinc improves appetite of children</td>
<td>Yes</td>
<td>53</td>
<td>32.72</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>48</td>
<td>29.63</td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>61</td>
<td>37.65</td>
</tr>
</tbody>
</table>

**Knowledge index score**

<table>
<thead>
<tr>
<th></th>
<th>Frequency (N=162)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above average</td>
<td>109</td>
<td>67.28</td>
</tr>
<tr>
<td>Below average</td>
<td>53</td>
<td>32.72</td>
</tr>
</tbody>
</table>

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4.4 Attitude of Health Providers Towards Zinc Supplementation

Almost all participants, 159/162 (98.15%) agreed that zinc supplementation is suitable for treatment of childhood diarrhoea, 150/162 (92.55%) supported the use of zinc supplementation and 148/162 (91.36%) were of the opinion that zinc should be considered as an essential drug in the health facilities. Only 17/162 (10.49%) perceived the cost of zinc treatment as expensive and 26/162 (16.05%) also believed that zinc is difficult to administer to children with diarrhoea.

Eighty-eight out of 162 (54.32%) participants and 74/162 (45.68%) were above average and below average respectively in terms of the attitude index score (Table 5).

Table 5. Attitude of health providers in the Ningo-Prampram district towards zinc supplementation in the management of childhood diarrhoea

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response Category</th>
<th>Frequency (N=162)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc is suitable for treatment of diarrhoea in children under 5 years</td>
<td>Yes</td>
<td>159</td>
<td>98.15</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>3</td>
<td>1.85</td>
</tr>
<tr>
<td>Zinc should be promoted for treatment of diarrhoea in children</td>
<td>Yes</td>
<td>122</td>
<td>75.31</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>40</td>
<td>24.69</td>
</tr>
<tr>
<td>Zinc should be used for treatment of diarrhoea in children</td>
<td>Yes</td>
<td>150</td>
<td>92.55</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>12</td>
<td>7.41</td>
</tr>
<tr>
<td>Treatment of diarrhoea with zinc is expensive</td>
<td>Yes</td>
<td>17</td>
<td>10.49</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>145</td>
<td>89.51</td>
</tr>
<tr>
<td>Zinc should be considered as an essential drug for health facilities</td>
<td>Yes</td>
<td>148</td>
<td>91.36</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>14</td>
<td>8.64</td>
</tr>
<tr>
<td>Zinc is difficult to administer</td>
<td>Yes</td>
<td>26</td>
<td>16.05</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>136</td>
<td>83.95</td>
</tr>
<tr>
<td><strong>Attitude index score</strong></td>
<td>Above average</td>
<td>88</td>
<td>54.32</td>
</tr>
<tr>
<td></td>
<td>Below average</td>
<td>74</td>
<td>45.68</td>
</tr>
</tbody>
</table>
4.5 Availability and Use of Zinc Supplements in Health Facilities

One hundred and forty-four out of 162 (88.89%) respondents established the availability of zinc supplements in the various health facilities, whereas 130/162 (80.25%) participants confirmed the presence of other sources of zinc tablets close to their health facilities. Only 5/162 (3.09%) respondents have received complaints from caregivers (parents or guardians of children suffering from childhood diarrhoea) about cost of zinc tablets and 4/162 (2.47%) participants also received complaints from caregivers about availability of zinc tablets (Table 6).

Zinc supplementation was used by 118/158 (74.68%) respondents for the management of childhood diarrhoea within the last three months prior to the interview (Table 6).

The distribution of diarrhoea treatment options preferred by respondents is shown in Figure 4.

Table 6. Availability of zinc supplement in health facilities and use of zinc supplementation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of zinc supplement (N=162)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc tablets are available in the health facility</td>
<td>Yes</td>
<td>144</td>
<td>88.89</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>18</td>
<td>11.11</td>
</tr>
<tr>
<td>There are other sources of zinc tablets close to the health facility</td>
<td>Yes</td>
<td>130</td>
<td>80.25</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>32</td>
<td>19.75</td>
</tr>
<tr>
<td>Caregivers complain about the cost of zinc tablets</td>
<td>Yes</td>
<td>5</td>
<td>3.09</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>157</td>
<td>96.91</td>
</tr>
<tr>
<td>Caregivers complain about availability of zinc tablets</td>
<td>Yes</td>
<td>4</td>
<td>2.47</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>158</td>
<td>97.53</td>
</tr>
<tr>
<td>Use of zinc supplementation (n=158)</td>
<td>Used zinc</td>
<td>118</td>
<td>74.68</td>
</tr>
<tr>
<td></td>
<td>Did not use zinc</td>
<td>40</td>
<td>25.32</td>
</tr>
<tr>
<td></td>
<td>*Missing values</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

*Missing values were excluded from subsequent analysis*
Figure 4. Distribution of treatment options for childhood diarrhoea preferred by health providers in the Ningo-Prampram district

4.6 Factors Associated with Zinc Supplementation

Table 7 shows the measure of association between the outcome variable and some predictor variables that have been shown from literature to have effect on the use of zinc supplementation.

Chi-square test of independence showed no statistically significant association between sex of respondents and use of zinc supplementation (chi-square = 0.047; p = 0.828). Among males, 42/118 (35.59%) used zinc supplementation compared to females, 76/118 (64.41%).

Age of a health provider also had no statistically significant association with the use of zinc supplementation (chi-square = 0.099; p-value = 0.990).

Respondents who completed tertiary education, 87/118 (73.73%) used zinc supplementation compared to secondary education, 27/118 (22.88%) and none/primary education, 4/118 (3.39%)
but there was no statistically significant association between the highest level of education of participants and the use of zinc supplementation (chi-square = 4.940; p-value = 0.074).

The proportion of participants with less than 10 years of work experience who used zinc supplementation was 96/118 (81.36%) compared to 22/118 (18.62%) with 10 years or more work experience. Work experience was not significantly associated with the use of zinc supplementation (chi-square = 0.282; p-value = 0.596).

Among health providers working in public health facilities, 68/118 (57.63%) used zinc supplementation compared to 50/118 (42.37%) health providers working in private health facilities. A statistically significant association was established between the type of health facility (public or private) and the use of zinc supplementation (chi-square = 6.127; p-value = 0.013).

Knowledge index score was found to be significantly related to the use of zinc supplementation (chi-square = 24.977; p-value <0.001). Health providers with knowledge index score of above average, 92/118 (77.97%) used zinc supplementation compared to 26/118 (22.03%) with a knowledge index score of below average.

Seventy-two out of 118 (61.02%) participants who obtained “above average” attitude index score used zinc supplementation compared to 46/118 (38.98%) participants who obtained “below average” attitude index score. A statistically significant association was established between attitude index score and the use of zinc supplementation (chi-square = 6.677; p-value = 0.010).

The proportion of health providers with zinc available in their health facilities who used zinc supplementation was 113/118 (95.76%) compared to 5/118 (4.24%) with zinc available in their
health facilities. Availability of zinc in the health facility was significantly associated with the use of zinc supplementation (chi-square = 23.639; p-value < 0.001).

Table 7.0 Measure of association between predictor variables and use of zinc supplementation among health providers in the Ningo-Prampram district

<table>
<thead>
<tr>
<th>Predictor variable</th>
<th>Used zinc (n)%</th>
<th>Did not use zinc (n)%</th>
<th>Chi-square [P-value]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>42 (35.59)</td>
<td>15 (37.50)</td>
<td>0.047 [0.828]</td>
</tr>
<tr>
<td>Female</td>
<td>76 (64.41)</td>
<td>25 (62.50)</td>
<td></td>
</tr>
<tr>
<td><strong>Age (Years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 to 29</td>
<td>47 (39.83)</td>
<td>17 (42.50)</td>
<td></td>
</tr>
<tr>
<td>30 to 39</td>
<td>49 (41.53)</td>
<td>16 (40.00)</td>
<td>0.099 [0.990*]</td>
</tr>
<tr>
<td>40 to 49</td>
<td>13 (11.02)</td>
<td>4 (10.00)</td>
<td></td>
</tr>
<tr>
<td>≥50</td>
<td>9 (7.63)</td>
<td>3 (7.50)</td>
<td></td>
</tr>
<tr>
<td><strong>Highest level of education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None/Primary</td>
<td>4 (3.39)</td>
<td>2 (5.00)</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>27 (22.88)</td>
<td>16 (40.00)</td>
<td>4.940 [0.074*]</td>
</tr>
<tr>
<td>Tertiary</td>
<td>87 (73.73)</td>
<td>22 (55.00)</td>
<td></td>
</tr>
<tr>
<td><strong>Work experience (Years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;10</td>
<td>96 (81.36)</td>
<td>31 (77.50)</td>
<td>0.282 [0.596]</td>
</tr>
<tr>
<td>≥10</td>
<td>22 (18.62)</td>
<td>9 (22.50)</td>
<td></td>
</tr>
<tr>
<td><strong>Type of health facility</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>68 (57.63)</td>
<td>14 (35.00)</td>
<td>6.127 [0.013]</td>
</tr>
<tr>
<td>Private</td>
<td>50 (42.37)</td>
<td>26 (65.00)</td>
<td></td>
</tr>
<tr>
<td><strong>Knowledge index score</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above average</td>
<td>92 (77.97)</td>
<td>14 (35.00)</td>
<td>24.977 [&lt;0.001]</td>
</tr>
<tr>
<td>Below average</td>
<td>26 (22.03)</td>
<td>10 (25.00)</td>
<td></td>
</tr>
<tr>
<td><strong>Attitude index score</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above average</td>
<td>72 (61.02)</td>
<td>15 (37.50)</td>
<td>6.677 [0.010]</td>
</tr>
<tr>
<td>Below average</td>
<td>46 (38.98)</td>
<td>25 (75.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Zinc available in the health facility</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>113 (95.76)</td>
<td>27 (67.50)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5 (4.24)</td>
<td>13 (32.50)</td>
<td>2.639 [&lt;0.001*]</td>
</tr>
<tr>
<td><strong>Source of zinc close to the health facility</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>102 (86.44)</td>
<td>24 (60.00)</td>
<td>12.931 [0.001]</td>
</tr>
<tr>
<td>No</td>
<td>16 (13.56)</td>
<td>16 (40.10)</td>
<td></td>
</tr>
</tbody>
</table>

*Fisher’s exact test used
Having a source of zinc close to the health facility was also found to be associated with zinc supplementation (chi-square = 12.931; p-value <0.001). Among participants who had other sources of zinc close to their health facilities, 102/118 (86.44%) used zinc supplementation compared to 16/118 (13.56%) who had no other source of zinc close to their facilities.

4.6 Strength of Association Between Predictor Variables and Zinc Supplementation

Table 8 summarizes the strength of association between zinc supplementation and predictor variables in binary and multivariable logistic regression analyses with robust standard error. Crude odds ratios (cOR) and adjusted odds ratios (aOR) were generated from binary and multivariable logistic analyses respectively.

4.6.1 Binary logistic regression analysis

Health providers in private health facilities had 60% reduced odds of using zinc supplementation compared to health providers in public health facilities [cOR = 0.40 (95% CI; 0.19-0.84), p-value = 0.05].

A knowledge index score of “above average” increased the odds of using zinc supplementation by 6.57 folds compared to a knowledge index score of “below average” [cOR = 6.57 (95% CI; 3.00-14.40), p-value <0.001].

Participants with an attitude index score of “above average” had 2.61 increased odds of using zinc supplementation compared to participants with an attitude index score of “below average” [cOR = 2.61 (95% CI; 1.24-5.48), p-value = 0.011].

Availability of zinc in the health facility increased the odds of a health provider using zinc supplementation by 10.88 folds compared to health providers who did not have zinc in their health facilities [cOR = 10.88 (95% CI; 3.56-33.25), p-value <0.001].
Participants who had a source of zinc close to their health facilities were 4.25 folds more likely to use zinc supplementation compared to those who did not have any source of zinc close to their health facilities [cOR = 4.25 (95% CI; 1.86-9.71), p-value = 0.001].

4.6.1 Multivariable logistic regression analysis

Controlling for knowledge and attitude index scores, availability of zinc in health facility and having a source of zinc close to the health facility, there was a 40% reduced odds of health providers in private health facility using zinc supplementation compared to those in public health facilities but this observation was not statistically significant [aOR = 0.60 (95% CI; 0.25-1.42), p-value = 0.245].

There was a statistically significant association between knowledge index score and zinc supplementation controlling for type of health facility, attitude index score, availability of zinc in health facility and having a source of zinc close to the health facility [aOR = 3.64 (95% CI; 1.49-8.92), p-value = 0.005]. Health providers with “above average” knowledge index score had 3.64 increased odds of using zinc supplementation compared to those with “below average” index score.

An “above average” attitude index score increased the odds of using zinc supplementation by 2.24 folds compared to “below average” attitude index score controlling for type of health facility, knowledge index score, availability of zinc in health facility and having a source of zinc close to the health facility. However, the association was not statistically significant [aOR = 2.24 (95% CI; 0.96-5.21), p-value = 0.062].

Availability of zinc in the health facility had a statistically significant association with zinc supplementation, controlling for type of health facility, knowledge index score, attitude index
score and having a source of zinc close to the health facility \([aOR = 5.07 (95\% CI; 1.54-16.69)\), p-value = 0.008\]. Controlling for other predictor variables, availability of zinc in the health facility increases the odds of using zinc supplementation by 5.07 folds compared to zinc not being available in the health facility.

The association of having other sources of zinc close to the health facility with the use of zinc supplementation was not statistically significant in a multivariable logistic regression analysis controlling for type of health facility, knowledge index score, attitude index score and availability of zinc in health facility \([aOR = 2.56 (95\% CI; 0.95-6.87), p-value = 0.063\].

Table 8. Factors associated with the use of zinc supplementation among health providers using logistic regression analysis with robust standard error

<table>
<thead>
<tr>
<th>Predictor variable</th>
<th>Use of zinc supplementation</th>
<th>Use of zinc supplementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>*cOR [95% CI]</td>
<td>P-value</td>
</tr>
<tr>
<td><strong>Type of health facility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>ref</td>
<td>0.015</td>
</tr>
<tr>
<td>Private</td>
<td>0.40 [0.19-0.84]</td>
<td>0.015</td>
</tr>
<tr>
<td><strong>Knowledge index score</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above average</td>
<td>6.57 [3.00-14.40]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Below average</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td><strong>Attitude index score</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above average</td>
<td>2.61 [1.24-5.48]</td>
<td>0.011</td>
</tr>
<tr>
<td>Below average</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td><strong>Zinc available in the health facility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>10.88 [3.56-33.25]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td><strong>Source of zinc close to the health facility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>4.25 [1.86-9.71]</td>
<td>0.001</td>
</tr>
<tr>
<td>No</td>
<td>ref</td>
<td></td>
</tr>
</tbody>
</table>

* *cOR – Crude Odds Ratio
† aOR – Adjusted Odds Ratio
CHAPTER FIVE

5.0 DISCUSSION

5.1 Discussion of Study Findings

This study revealed that all (100%) health providers in the Ningo-Prampram district had heard about the use of zinc supplementation in the management of childhood diarrhoea. The awareness rate of 100% among health providers on zinc supplementation in childhood diarrhoea was high compared to studies in Nigeria, Uganda and India which reported awareness rates ranging from 66% to 86% (Omuemu et al., 2012; El-Khoury & Sanders, 2012; Lamberti et al., 2015). This finding could be attributed to the intensive education and publicity drive by USAID funded Strengthening Health Outcomes through the Private Sector (SHOPS) project and public-sector education drive by the Ghana Health Service (El-Khoury, Banke & Sloane, 2016).

Majority of health providers heard about zinc supplementation through in-service trainings, seminars and workshops (26.9%), radio and television (25.4%) or colleague workers (22.9%). Similar studies in Nigeria and Uganda listed the same sources of information as the major medium through which health workers hear about zinc supplementation (Omuemu et al., 2012; El-Khoury & Sanders, 2012).

Actual usage of zinc supplementation was reported among 74.7% of health providers in the Ningo-Prampram district which was slightly higher than findings from similar studies in Nigeria and India which reported 67.1% and 62% of health providers using zinc supplementation on a regular basis for the management of childhood diarrhoea in Nigeria and India respectively (Esosobor, Adeniyi & Ekure, 2011; Walker et al. 2015).
According to WHO and UNICEF (2004) joint recommendation, ORS and zinc remain the gold standard for the management of acute uncomplicated diarrhoea. Results of this study showed that 67.7% of health providers in the Ningo-Prampram district will prefer this option, nonetheless, there are some 28.6% who will prefer to combine ORS and zinc with antibiotics. El-Khoury, Banke & Sloane (2016), found out that 38.2% of health workers in Ghana prescribe antibiotics in addition to ORS and zinc for acute diarrhoea. Sanders et al. (2013) also reported that 54% of health providers in Benin Republic prescribe antibiotics for the management of acute diarrhoea. The figure for the Ningo-Prampram district is slightly lower and far lower than the national average for Ghana and that of Benin Republic respectively. The finding shows a decreasing trend in the use of antibiotics for the management of diarrhoea which is in conformity with the WHO and UNICEF recommendation.

Less than 80% of health providers were able to determine the appropriate dose and duration of zinc supplementation in childhood diarrhoea, a finding which is consistent with studies in Pakistan and India where 48-67% of health workers could identify the correct dose, frequency and duration of zinc supplementation (Lamberti et al., 2015).

This study revealed that 67.3% of health providers had adequate knowledge of zinc supplementation, similarly a study assessing the knowledge of health workers on zinc supplementation in India also found 66% of them having adequate knowledge on diarrhoea and zinc supplementation (Singh et al., 2014).

Attitude towards the use of zinc supplementation were found to be above average in 54.3% of health providers. Bekele (2015) also reported a similar figure (53.6%) for Ethiopian health workers who had good attitude towards zinc supplementation.
Zinc was reported to be available in 88.9% of health facilities in the Ningo-Prampram district contrary to findings from a study in Guatemala where very low availability of zinc supplements in health facilities has resulted in a paltry 5% use of zinc supplementation in childhood diarrhoea management (Hall-Clifford & Amerson, 2017). High availability of zinc supplements in health facilities can be attributed to the efforts of USAID and other development partners in building the capacity of local manufacturers like M&G Pharmaceuticals to produce enough zinc supplements to cater for the demand on the Ghanaian market (El-Khoury, Banke & Sloane, 2016).

Multivariable logistic regression analysis controlling for relevant variables found only knowledge index score and availability of zinc in health facility significantly associated with the use of zinc supplementation. A health provider with a knowledge index score above average has 3.6 increased odds of using zinc supplementation compared to those with below average knowledge index score. This is slightly higher compared to the adjusted odds ratio of 2.5 (95% CI: 1.90-3.24) reported from a multi-site study in Uttar Pradesh, Bihar and Gujarat, India (Lamberti et al. 2015). According to Lamberti et al. (2015), health professionals who received periodic reinforcement of diarrhoea management strategies had much higher odds of prescribing zinc. This highlights the influence of frequent refresher training and continuing professional development on knowledge and practice of healthcare providers. It is therefore imperative to consider frequency and duration of training for a significant association between health provider knowledge and practice of zinc supplementation.

Availability of zinc in a health facility increased the odds of using zinc supplementation by 5.1 folds among health providers in the Ningo-Prampram district. Comparatively, Lamberti et al. (2015) observed that availability of zinc in health facility increased the odds of zinc
supplementation by 4.8 folds (95% CI: 1.99-11.71). The probability of health providers using zinc supplementation is increased when with direct access to the product in their health facilities. Health providers trained to refer caregivers to nearby facilities for zinc supplies in the event of stock-outs, failed to do so (Lamberti et al., 2015). In the absence of zinc within the health facility, health providers are less likely to opt for zinc supplementation in the management of childhood diarrhoea. Running out of zinc stock in the health facility can be a set-back for proper diarrhoea treatment in the health facility. Improvement of the supply chain to safeguard sustainable access to zinc in health facilities is needed to improve zinc supplementation.

5.2 Strengths and Limitations of the Study

5.2.1 Strengths

- The study managed to reach 91% of target population resulting in an appreciable response rate.
- All categories of health providers in the district who attend to patients were included to allow for responses from a wide variety of health professionals.

5.2.2 Limitations

- There is a higher probability of recall bias since study relied on self-reported information. Self-reported practices may be more subjective and can reduce the validity of the study.
- This is a cross-sectional study therefore a causal relationship cannot be established between significant predictor variables and the use of zinc supplementation in the management of childhood diarrhoea.
- Simple averages were used to determine knowledge index score and attitude index score without any principal component analysis.
CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study has revealed that almost all health providers in the Ningo-Prampram district are aware of zinc supplementation in the management of childhood diarrhoea but only 75% are practicing zinc supplementation on regular basis.

Attitude of health providers towards zinc supplementation is very ordinary.

Controlling for other factors, only knowledge index score and availability of zinc have significant measures of association with the use of zinc supplementation in the management of childhood diarrhoea.

6.1 Recommendations

• The knowledge of health professionals on zinc supplementation should be improved through continuing professional education programs to enhance the use of zinc in the management of childhood diarrhoea.

• Zinc supplements should be made available to all health facilities to enhance zinc supplementation in childhood diarrhea.
REFERENCES


APPENDICES

Appendix 1: Ethical Clearance

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

MyRef: GH/EEC/149/12/17

Research & Development Division
University of Ghana
P. O. Box MB 190
Accra
Tel: +233-302-681109
Fax: +233-302-665424
Email: ghserc@gmail.com
8th April, 2018

Michael Addo Preko Ntiru
University of Ghana
School of Public Health
Legon, Accra

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

<table>
<thead>
<tr>
<th>GHS-ERC Number</th>
<th>GHS-ERC: 149/12/17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Title</td>
<td>Factors Influencing the Use of Zinc Supplementation in the Management of Childhood Diarrhoea among Health Providers in the Ninga-Prampram District</td>
</tr>
<tr>
<td>Approval Date</td>
<td>8th April, 2018</td>
</tr>
<tr>
<td>Expiry Date</td>
<td>7th April, 2019</td>
</tr>
<tr>
<td>GHS-ERC Decision</td>
<td>Approved</td>
</tr>
</tbody>
</table>

This approval requires the following from the Principal Investigator:

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study.
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol.

Signed... [Signature]

DR. CYNTHIA BANNERMAN
(GHS-ERC CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra
Appendix 2: Information Sheet

TITLE: Factors Influencing the Use of Zinc Supplementation in the Management of Childhood Diarrhoea Among Health Providers in The Ningo-Prampram District.

Introduction
You are invited to participate in a study on “Factors influencing the use of zinc supplementation among health providers in the Ningo-Prampram district.”
The study is being conducted by Michael Addo Preko Ntiri, a student of the School of Public Health, University of Ghana. This is purely for academic purposes and forms part of the requirement for the award of a Master of Public Health Degree. The researcher has no conflict of interest in this study.

Procedure
The study will involve answering questions about yourself, your knowledge and practice of zinc supplementation in the management of childhood diarrhoea and questions regarding the availability of zinc supplement in your health facility. Your participation in this research ends after filling the questionnaire.

Benefits and Risks
There will be no monetary or material compensation for the study. There are also no known risks associated with this study but completion of questionnaire may take some time off your schedule and answering some of the questions may cause you slight discomfort.

Confidentiality
Your name and identity are not needed in this study. However, the information you are going to provide will be coded and will be treated as private and confidential. Apart from the researcher and supervisor of this study, no one else will have access to the information you have provided whether in part or whole.

Right to Refuse Participation
Participation in this study is voluntary. You are free to answer part or the entire questionnaire. You can choose to withdraw from the study or stop the interview at any time you want. You can also choose not to answer any question(s) you find uncomfortable. Should you choose not to not to participate, it will not affect you in any way.
Data Safety and Storage
Filled questionnaires will be kept in a secured cabinet under lock and key. Questionnaires will be discarded after a minimum of 3 years after the final dissertation has been graded. Electronic data will be password protected and stored on a personal computer, external hard drive and google drive.

Dissemination of results
The results of this study will be presented as part of a student dissertation to the University of Ghana Graduate School. It may also be presented at seminars and conferences or published in a peer-reviewed journal. However, your identity will not be revealed through any of these dissemination procedures.

Before Giving Consent
Do you have any question(s) you wish to ask about the study?  ☐ Yes  ☐ No
If yes, please indicate your question(s) in the space below:

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If you have any question(s) or further clarification concerning this study and/or the conduct of the researcher and research assistants, please do not hesitate to contact any of the following:

1. Michael Addo Preko Ntiri, Student, School of Public Health, University of Ghana.
   Tel: 0501260926 E-mail: mapntiri@st.ug.edu.gh
2. Dr. Bismark Sarfo, Supervisor, School of Public Health, University of Ghana, Legon.
   Tel: 0269343169 E-mail: bysarfo@ug.edu.gh
3. Mrs. Hannah Frimpong (Administrator), Ghana Health Service Ethical Review Committee Secretariat, Accra. Tel: 0507041223/0243235225
Appendix 3: Informed Consent Form

TITLE: Factors Influencing the Use of Zinc Supplementation in the Management of Childhood Diarrhoea Among Health Providers in The Ningo-Prampram District.

Consent to Participate in the Study
I have read the information sheet provided and understood its content. I have been given a chance to ask questions concerning this study and questions have been answered to my satisfaction.

I voluntarily agree to participate in this study knowing that I have the right to withdraw at any time without any further consequences to me or my career.

Signature of participant: ………………………………..  Date: ………………………..

Contact details: …………………………………..

Details of Interviewer
I, the undersigned, have explained this consent to the respondent in English and that she/he understands the purpose of the study, procedures to be followed as well as the risks and benefits of the study. The participant has fully agreed to participate in the study.

Signature of interviewer:………………………………….  Date: …………………………

Contact details: ………………………………………
Appendix 4: Structured Questionnaire

TITLE: Factors Influencing the Use of Zinc Supplementation in the Management of Childhood Diarrhoea Among Health Providers in The Ningo-Prampram District.

Kindly check the box (☐) in front of the appropriate answer or write the answer in the space provided where applicable.

A. Health provider demographic details

1. What is your gender (sex) ☐ Male ☐ Female
2. What is your age? ________________ years
3. What is your highest level of education completed? ☐ None ☐ Primary Education ☐ Secondary Education ☐ Tertiary Education
4. How long have you worked as a health provider in a health facility? __________ years
5. What kind of health facility do you work in? ☐ Polyclinic ☐ Health Centre ☐ CHPS Compound ☐ CHPS Zone ☐ Private Clinic ☐ Maternity Home ☐ Pharmacy ☐ Licensed Chemical Shop

B. Health provider’s knowledge on zinc supplementation in the management of childhood diarrhoea

6. Have you heard about zinc in the management of diarrhoea? ☐ Yes ☐ No. (If No, proceed to Section D, Question 27.)
7. Where did you hear about zinc in the management of diarrhoea? (Multiple responses applicable)
   ☐ Radio/TV ☐ Books/journals/newspaper ☐ Colleague health workers ☐ School training ☐ In-service workshops/trainings/seminar ☐ Not applicable
8. Can zinc be given to a child with persistent diarrhoea? ☐ Yes ☐ No ☐ Don’t know
9. Can you prescribe zinc for a child who has blood in the stools? ☐ Yes ☐ No ☐ Don’t know
10a. Do you know the dosage of zinc in the management of childhood diarrhoea? ☐ Yes ☐ No (If No, proceed to Question 11.)
10b. What is the dose of zinc for children under 6 months of age? a) _____mg ☐ Don’t know
10c. What is the dose of zinc for children 6 months and older? a) _______mg ☐ Don’t know
11. How many times should zinc be given to a child with diarrhoea in 1 day?
   ☐ Once ☐ Twice ☐ Three times ☐ Four times ☐ Don’t know
12. How many days should zinc be given to a child with diarrhoea? a) ____days ☐ Don’t know
13. Can zinc and ORS be given at the same time for a child with diarrhoea?
    □ Yes    □ No    □ Don’t know

14. Does zinc have any side effects?    □ Yes    □ No    □ Don’t know

15. Can you give zinc with any others medications?    □ Yes    □ No    □ Don’t know

16. Does zinc stop diarrhoea quickly?    □ Yes    □ No    □ Don’t know

17. Does zinc worsen the severity of diarrhoea?    □ Yes    □ No    □ Don’t know

18. Does zinc protect children from getting another episode of diarrhoea in the near future?
    □ Yes    □ No    □ Don’t know

19. Does zinc improve the appetite of the child?    □ Yes    □ No    □ Don’t know

20. Is zinc necessary if diarrhoea episode is mild?    □ Yes    □ No    □ Don’t know

C. Health provider’s attitude towards zinc supplementation

(Kindly circle a figure between 1 to 5 which applies to your response to questions 21 to 26)

<table>
<thead>
<tr>
<th>Statement about zinc and childhood diarrhoea</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>21. Zinc is suitable for treatment of diarrhoea.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>22. Zinc should be promoted for management of childhood diarrhoea instead of anti-diarrhoeal drugs.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>23. Zinc should be used to manage childhood diarrhoea</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>24. Zinc treatment in diarrhoea is too expensive</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>25. Zinc should be considered as one of the essential drugs in the health facility.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>26. Zinc is difficult to administer to children with diarrhoea</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

D. Health provider practice of zinc supplementation

27. Have you treated a child with diarrhoea in the last 3 months?    □ Yes    □ No

28. Have you used zinc for the management of diarrhoea in the last 3 months?    □ Yes □ No
    □ Not Applicable

29. If “No” what was your reason?    □ Zinc was not needed    □ Zinc was not available
    □ Zinc was not affordable    □ Other (specify)________________________

30. Which of these would be your treatment of choice?    □ ORS alone    □ Zinc alone
    □ ORS and Zinc    □ Antibiotics alone    □ ORS and Antibiotics
    □ ORS, Zinc and Antibiotics    □ Other (specify)________________________

E. Health facility related questions
31. Does your health facility stock zinc tablet?  □ Yes  □ No  □ Don’t know

32. Is there a source of zinc tablet close to the health facility?  □ Yes  □ No  □ Don’t know

33. Has a caregiver of a diarrhoea patient reported of failed attempt to get a zinc prescription filled?  □ Yes  □ No  □ Don’t know

34. Has anyone complained to you about the cost of zinc?  □ Yes  □ No  □ Don’t know