SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

LEGON

PREVALENCE AND MANAGEMENT OF OCULAR ALLERGY AMONG CHILDREN AGED UNDER FIVE YEARS ATTENDING THE EYE CLINIC OF OUR LADY OF GRACE HOSPITAL AT BREMAN ASIKUMA, GHANA

BY

BISMARK NYARKO GYEDU

(10806918)

THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF PUBLIC HEALTH DEGREE

OCTOBER, 2020

DECLARATION

I, **BISMARK NYARKO GYEDU**, do hereby declare that apart from references that have been duly acknowledged, this work is the result of my efforts under able supervision and has not been presented for another degree elsewhere either in part or in whole.

29/08/2021

…… ……

BISMARK NYARKO GYEDU Date

(Student)

29/08/2021

…… ……

Dr. EMILIA ASUQUO UDOFIA Date

(Academic Supervisor)

DEDICATION

This research is dedicated to my family, loved ones, and all my lecturers for their various support.

ACKNOWLEDGEMENT

I am grateful to the Almighty God who has been my source of strength for a successful completion of my dissertation. Special thanks goes to my supervisor, Dr. Emilia Asuquo Udofia, for her guidance and support throughout the development of this dissertation.

To the Management and all Eye Clinic staff of Our Lady of Grace Hospital at Breman Asikuma, especially Dr. Yaw Akoto Osei for their approval and assistance in data collection respectively. My appreciation also goes to Bernard Karikari Amoah and Anita Paddy for their various inputs during data analysis.

ABSTRACT

Introduction: Ocular allergy, referred to as allergic conjunctivitis, is characterized by inflammatory responses in the conjunctiva and other ocular surfaces which is mediated by hypersensitivity reaction to allergens. Certain forms of ocular allergy contribute to corneal blindness causing visual impairment in children and placing limitations on the quality of life of children. However, ocular allergies are often under reported and its care either ignored or undermanaged by parents and caregivers.

Objective: The objective of this study is to determine the prevalence and management of ocular allergy among children aged under five years attending the Eye clinic of Our Lady of Grace Hospital at Breman Asikuma.

Methods: A hospital-based retrospective cross sectional study was conducted. Data was collected by desk review of medical folders. Available medical folders of all children aged under five years who were presented for eye care at Our Lady of Grace Hospital between January 2018 and December 2019 were reviewed. Descriptive statistics was done by computing means, frequencies, percentages and proportions. A Pearson chi square test and logistic regression was used to determine association and strength of association between sociodemographic characteristics and Ocular Allergy respectively looking at adjusted odds ratio (aOR) with 95% confidence interval.

Results: The prevalence of ocular allergy and its sight threatening form, vernal keratoconjunctivitis, among children aged under five years was 41.4% and 11.1% respectively. Males were predominantly affected. Majority of the children diagnosed with ocular allergy were between ages 12 months to 36 months and mostly resided in urban areas. Ocular itching, redness of the eyes, tearing, mucoid discharge, and rubbing of the eyes were the commons ocular

complaints reported. On the average, children experienced signs and symptoms of ocular allergy for five months before being sent to the clinic by parents or caregivers for eye care. Mast cell stabilizers were mostly used to manage children with ocular allergy. Age was significantly associated with ocular allergy (χ^2=82.3936; p = 0.000) and children aged 12 to 35 months (aOR = 3.34; 95% CI = 2.35 – 4.75; p = 0.000) and 36 to 59 months (aOR = 4.76; 95% CI = 3.26 – 6.95; p = 0.000) had increased odds of being prone to ocular allergy compared children aged 0 to 11 months.

Conclusion: Findings from this study revealed that the burden of ocular allergy among children aged under five years is high with about a quarter of them being sight threatening. There is a need to create awareness about the condition in the study population and improve early care seeking behavior.

Keywords: Ocular allergy; Vernal keratoconjunctivitis; Visual impairment

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

AKC	Atopic Keratoconjunctivitis
CHB	Childhood blindness
CWC	Child welfare clinic
GPC	Giant papillary conjunctivitis
Gutt	Eye drops
IgE	Immunoglobulin E
ISAAC	International Study of Asthma and Allergy in Childhood
OA	Ocular Allergy
Occ	Ointment
OPD	Outpatient department
OTC	Over the counter
PAC	Perennial allergic conjunctivitis
SAC	Seasonal allergic conjunctivitis
Syr	Syrup
VKC	Vernal Keratocojunctivitis

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

In general, allergy is estimated to affect up to 40% of the people globally (Kyei, Tettey, Asiedu, & Awuah, 2016). Although allergic eye disease or ocular allergy (OA) is the prominent and often debilitating feature amongst them, allergy has the tendency to affect several organ systems resulting in a variety of symptoms in the affected individual (Kahol, Thakur, Gupta, & Saini, 2019). Among children, allergy has been reported to be the third most chronic condition with its ocular component being the main reason children are presented to the health facility for consult (Kyei, 2018).

Ocular allergy, referred to as allergic conjunctivitis, is characterized by inflammatory responses in the conjunctiva and other ocular surfaces which is mediated by hypersensitivity reaction to allergens (Malu, 2014; Mashige, 2017). It has an estimated prevalence of 15-20% globally, though it is more common in hot and dry climates found in the Middle East, Africa, South America and some parts of Asia (La Rosa et al., 2013; Marey, Mandour, El Morsy, Farahat, & Shokry, 2017). Within the past four decades, despite an increasing prevalence of OA due to urbanization and increase in poor air quality, this ocular disorder has not received the needed attention and is often under diagnosed and inadequately diagnosed. This is in spite of those affected often experiencing severe symptoms like severe itching, swelling of the lids, tearing and mucoid discharge (Kahol et al., 2019).

Severe, bilateral, recurrent and potentially sight threatening forms of ocular allergy like vernal keratoconjunctivitis (VKC) usually affects children which starts between 6 and 10 years, involving the conjunctiva and cornea. It often causes moderate to severe visual impairment, and is therefore a condition of public health importance especially in dry and hot regions of Africa with air rich in allergens (Al-Akily & Bamashmus, 2011; Arif, Aaqil, Siddiqui, Nazneen, & Farooq, 2017; Duke, Egbula & Smedt, 2017; Naggalakshmi et al., 2014).

In Africa, the prevalence of VKC is estimated to be between 2 to 6%. The disease commonly affects the conjunctiva and cornea of children and also accounts for about 21% of all general eye clinic attendance in children and a major cause school absenteeism (Duke et al., 2017; Duke, Odey, & De Smedt, 2016). In Ghana, the prevalence of OA has been reported to be 9.1% in a facility based study while studies done within the community reported a prevalence between 7.3% and 39.9% (Kumah, Lartey, Yemanyi, Boateng, & Awuah, 2015; Kyei et al., 2016). In about 40-75% of children who suffer from forms of OA like VKC, there is also an association with atopy-like rhinitis, asthma, hay fever and eczema (Al-Akily & Bamashmus, 2011; Bremond-Gignac et al., 2008; Sushil et al., 2015).

For years, notable efforts such as vitamin A supplementation and measles immunization have been made by public health professionals, non-governmental organizations, donor agencies, eye care professionals and several governments in reducing visual impairment in children in resource limited settings, as visual impairment puts a limitation on the opportunities children have in education and when older, in employment (Courtright, Hutchinson, & Lewallen, 2014). Visual impairment also contributes to child mortality as studies indicate 60% of children die within one year of becoming blind (Courtright,

Hutchinson, & Lewallen, 2011; Alrasheed et al 2016). Caregivers or parents, play a major role in the recognition and management of ocular conditions of children. Therefore, their practices about the child's eye disorder and its management deserves attention in research discourse (Amare & Mullu, 2015; Courtright, Hutchinson, and Lewallen, 2011).

1.2 Problem Statement

In lower and middle- income countries, considerable achievements have been made in the fight against measles, vitamin A deficiency and ophthalmia neonatorum in the last decades such that they are no longer regarded as leading cause of childhood blindness. At the same time conditions like severe forms of OA are now becoming important cause of corneal blindness (Duke et al., 2016), but because of the recurrent nature of symptoms, it is often under reported and the need for treatment ignored by parents and patients. It is also under-diagnosed and hence missed, as clinicians mostly overlook the ocular components of allergy in favor of systemic symptoms (Kahol et al., 2019; Mashige, 2015).

Most prevalence studies focus on ages five and above because most literature suggest OA in children usually begin at age five. However, current clinical observations indicates that more children below the age of five years presents to the hospital with OA including the severe form which is VKC. Parents often bring children with OA to the hospital very late, especially when the condition becomes severe or complicated. This occurs in spite of the existence of frequent interactions between health professionals and the child from birth to five years through CWCs for their childhood immunizations (Mafwiri, Kisenge, & Gilbert, 2014). Consequently, these children are denied treatment or the condition is deemed to be a normal occurrence which does not necessitate ocular care.

Though, the initial course of the disease may be mild and often self-limiting, it can however develop into a severe form with severe itching, photophobia, burning sensation, mucoid discharge, swollen lids, and pain (Ahmed, Ahmed, El Morsy, & Soliman, 2019; Arif et al., 2017; Marey et al., 2017), which disrupts normal school activities as children tend to miss class resulting in poor academic performance (Alemayehu, Yibekal, & Fekadu, 2019). Furthermore, the psychosocial, physical activity and quality of life of the child are affected as they are often restricted from engaging in their preferred activities as a preventive measure in controlling the effects of the disease (Bremond-Gignac et al., 2008; Duke et al., 2016).

In some communities in Africa, there are several beliefs with regards to eye diseases or conditions in children. These beliefs include that certain eye conditions do not need treatment and that ocular conditions occur as a result of eating spicy foods, eggs or clay during pregnancy, witchcraft, looking at the nakedness of a parent, a mother's misbehavior towards the in-laws and angering the ancestors (Mafwiri, Kisenge, & Gilbert, 2014). In instances, where the seriousness of eye conditions are recognized by caregivers, they often make choices which result in poor visual outcomes of the child as they are exposed to orthodox and alternative eye care services within the community (Ayanniyi, Olatunji, Mahmoud, & Ayanniyi, 2010).

Ignoring childhood blindness would have an impact on adult blindness as the number of blind years in children if they survive a lifetime will be higher (Paranjpe et al., 2016), the quality of life is affected, and the cost and loss of productivity incurred by the child and family as a result of the lifetime of blindness is considerable (Kumah et al., 2017).

1.3 Significance of the Study

Childhood eye conditions needs urgent attention. Caregivers and mothers tend to spend more time with the child and have a responsibility to detect danger signs and ensure that they get the right intervention, especially in children who cannot talk. This is important as some of these childhood eye conditions can develop into severe visual impairment or blindness if left untreated (Courtright, Hutchinson, and Lewallen, 2011).

Several studies have been done on OA in Africa and a few in Ghana, but these studies have been mainly prevalence studies focusing on ages above five years. This is perhaps due to most literature suggesting that OA often present in children at age five and above. No study of OA specifically among children aged under five years has been done in Ghana. Due to the risk of visual impairment resulting from OA and its comorbidities and the quest to reduce the burden of avoidable blindness in children especially those aged below five years, it is important to know the burden of OA among this age group and provide interventions particularly at the community level. Within the community, the prime focus is parents and caregivers because they influence the daily living of children and this includes practices that affect the management of childhood conditions including OA.

The results from this study will be helpful in creating awareness on OA especially its prevalence in children aged under five years and in relation to practices of community members. By investigating their practices and taking this into account in caregiver education, early recognition and appropriate care seeking behavior would be enhanced. This would potentially reduce the burden of this disease and enhance child eye health.

1.4 Conceptual Framework

Certain demographic and environmental factors have been shown to influence the occurrence of ocular allergy (Ahmed et al., 2019; Hayilu, Legesse, Lakachew, & Asferaw, 2016). Sex, age, and location are demographic factors that can affect ocular allergy. Among children, vernal keratoconjunctivitis (VKC), a type of ocular allergy has been reported to affect boys more than girls (Kanksi and Bowling, 2016). Studies have shown that ocular allergy is more common in childhood and adolescents and that the severity of some forms of ocular allergy decreases with advancing age (Ahmed et al., 2019; Hayilu et al., 2016; Kubaisi, Samra, & Syeda, 2017; Marey et al., 2017). Location, whether rural or urban, has been shown to induce the prevalence of allergic diseases including ocular allergy (Fisal & Agha, 2020). Poor air quality in urban areas due to air pollutants such as dust, nitrogen oxides from vehicular traffic and soot from factories within these areas can trigger allergic diseases (Miyazaki et al., 2019).

Environmental factors such as household air pollution from cooking fuel, diet, use of OTCs can affect prevalence and severity of ocular allergy. Inefficient combustion of solid fuels (biomass and coal) used for cooking produces particular matter which in high concentrations can cause household air pollution and trigger several airway and allergic conditions (Benoit et al., 2019; Łatka, Nowakowska, Nowomiejska, & Rejdak, 2018). The use of firewood for cooking has been associated with VKC and that children exposed to firewood for cooking are 6.25 times more likely to develop VKC (Hayilu et al., 2016).

Dietary factors may also influence prevalence of ocular allergy. A decrease in the prevalence of symptoms of rhinitis and conjunctivitis has been shown to be associated the intake of calories

from cereal and rice, proteins from cereals, nuts, starch and vegetables (Miyazaki, Fukagawa, Okamoto, & Fukushima, 2020).

In instances where parents or caregivers engage in practices such as applying home-made remedies (e.g breastmilk) and OTCs into the eyes of their children in an attempt to manage their child's eye condition can affect the prognosis of the condition when the child is finally presented to the hospital for professional care (Alrasheed, Naidoo, & Clarke-Farr, 2016; Amiebenomo, Achugwo, & Abah, 2016; Ramai & Pulisetty, 2013; Wade, Iwuora, Lopez, & Muhammad, 2012)

Ocular allergy has been found to be associated with other allergic diseases such as rhinitis, asthma and eczema (Miyazaki et al., 2020). Several studies which have done to find associated systemic allergic conditions of ocular allergy have revealed that patients who were diagnosed with ocular allergy also had asthma, rhinitis and eczema as co-morbidities (Fasasi et al., 2014; Kahol et al., 2019; Wade et al., 2012).

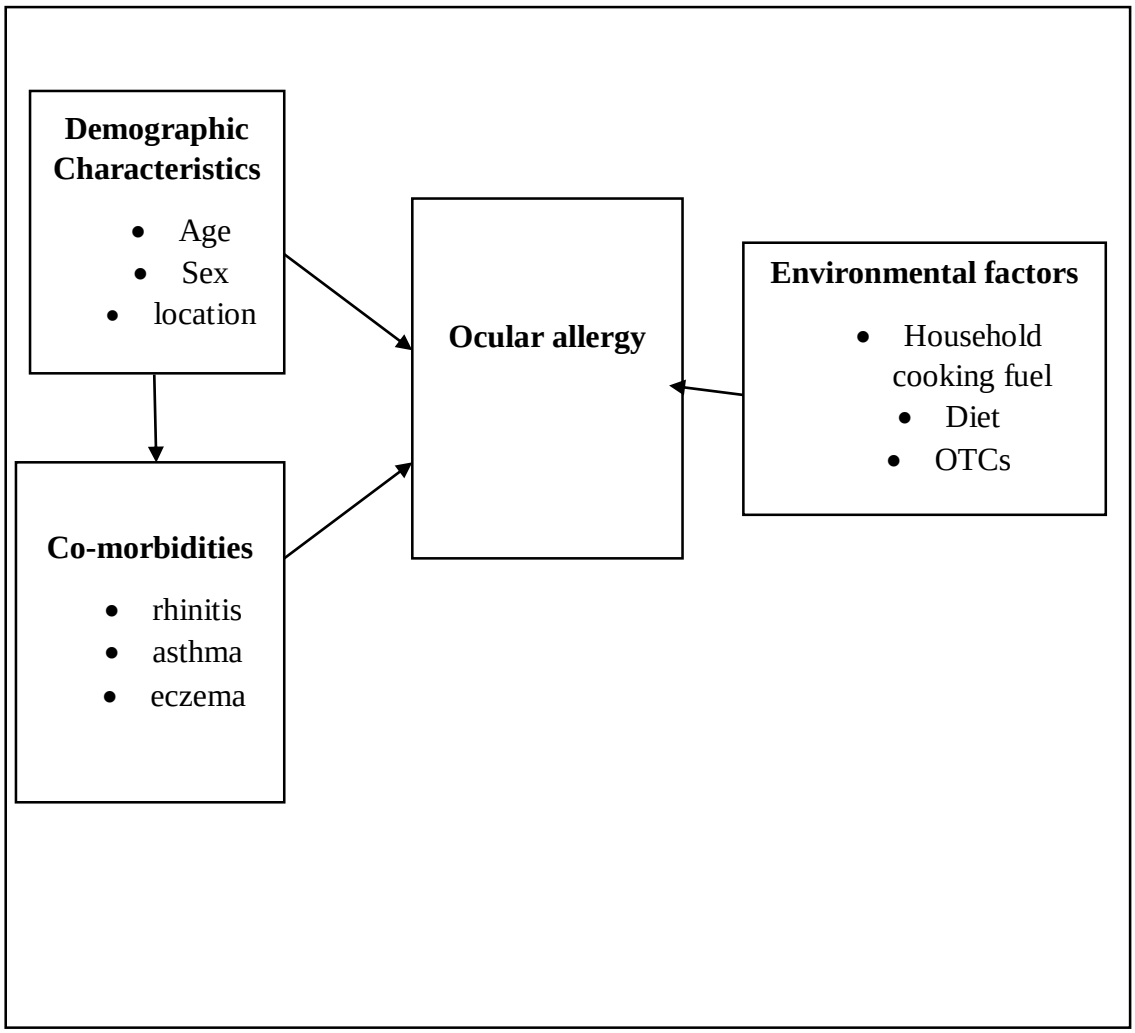

Figure 1.1: A conceptual framework for the study

1.5 Objectives

1.5.1 General Objective

To determine the prevalence of ocular allergy and its management among children aged under five years attending the Eye clinic of Our Lady of Grace Hospital at Breman Asikuma.

1.5.2 Specific Objectives

- To determine the prevalence of ocular allergy and vernal keratoconjunctivitis in children aged under five years.
- To ascertain the clinical characteristics of ocular allergy in children aged under five years.
- To identify common forms of ocular allergy management in children aged under five years at the hospital.
- To determine sociodemographic factors associated with ocular allergy.

1.6 Research Questions

- What is the prevalence of ocular allergy and vernal keratoconjunctivitis in children aged below five years?
- What are the clinical characteristics of ocular allergy among children aged below five years?
- How is ocular allergy in children aged below five years managed in the hospital?
- Is there an association between sociodemographic factors (sex, age, and location) and ocular allergy?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

In this chapter, the epidemiology of ocular allergy, its clinical presentation, and case management are reviewed. Case management of ocular allergy as documented in earlier studies will also be reviewed.

2.2 Search Strategy

Search engines used in the retrieval of existing studies were Google Scholar, African Journals Online, Biomed Central, and CINAHL. In Google scholar, the search term used was, "ocular allergy AND under five AND Africa", which yielded 20,400 results. These results were filtered to restrict publications to between 2011 and 2020, reducing the number of hits to 12,600. The search term was then refined to, "ocular allergy" AND under five AND Africa, yielding 467 results. Preliminary screening of the 467 results was done using titles and 117 articles were selected. Screening using abstracts reduced the number of articles selected to 36. A hand search of the 36 full text articles, resulted in additional in text references of 11 articles bringing the number of articles to 47.

The same search term "ocular allergy" AND under five AND Africa was entered into African Journals Online and Biomed Central search engines yielding 215 and 82 results respectively. This was to identify and review similar research studies done in Africa and in Ghana. These results were filtered to restrict publications to 2010 and 2020 yielding 123 and 69 results from African Journals Online and Biomed Central respectively. After reviewing the titles and abstracts, which most have already appeared in Google Scholar, an additional four articles from

African Journals Online and four from Biomed Central were yielded. The search term "Prevalence AND Management AND 'Allergic conjunctivitis' " was entered into the CINAHL search engine which yielded 840 articles. This yielded additional 21 articles after reviewing titles and abstracts as most of the articles have already appeared in previous search engines. This brought the total number of articles reviewed to 76. Out of the 76 materials reviewed, one was a book, one was a dissertation, one was a demographic and health survey, 22 were journal articles, and 51 were published research papers. Among the published research papers, six were from Ghana. Others done in Africa were from Nigeria (7), Ethiopia (3), Egypt (2), Kenya (2), Sudan (2), Rwanda (2), Gambia (1), Mali (1), Burkina Faso (1), Tanzania (1), and Swaziland (1). The number of reviewed studies done outside Africa that were India (8), Asia Pacific (3), Pakistan (2), Korea (2) Brazil (1), Yemen (1), Japan (1), Iraq (1), USA (1), China (1), and Italy (1).

2.3 Ocular Allergy

OA refers to a group of ocular surface disorders with a main mechanism of hypersensitivity to allergens which produces immune responses and result in symptoms such as redness, itching of the eyes, tearing, mucoid discharge, burning and foreign body sensation (Bielory and Friedlaender, 2008; Kyei et al., 2016; Mashige, 2017).

Clinically, OA presents as mild or moderate symptoms to severe forms which can cause vision loss (Kanksi and Bowling, 2016). They are classified into various subtypes as seasonal allergic conjunctivitis (SAC), perennial allergic conjunctivitis (PAC), vernal keratoconjunctivitis (VKC), atopic keratoconjunctivitis (AKC), contact allergy (CA), and giant papillary conjunctivitis (GPC) (Kubaisi et al., 2017; Kumah et al., 2015; La Rosa et al., 2013). Because

the allergic response mostly affects the conjunctival mucosa due to its direct exposure to environmental allergens, the various ocular allergies are commonly referred to as allergic conjunctivitis (Kubaisi et al., 2017).

SAC is the commonest form of ocular allergy accounting for about 80% of all ocular allergies and affects about 20% of the population (Al-Akily & Bamashmus, 2011; Bilkhu, Wolffsohn, Naroo, Robertson, & Kennedy, 2014; Kari & Saari, 2010). Its occurrence is seasonal in nature usually during dry and hot climates and is associated with plant allergens which are airborne. SAC is usually self-limiting due to type 1 immunoglobulin E hypersensitivity reaction and often referred to as "acute allergic conjunctivitis" (Leonardi, Bogacka, Fauquert, Kowalski, & Groblewska, 2012; Leonardi, Calder, Rondon, & Hellings, 2017; Patel, Arunakirinathan, Stuart, & Angunawela, 2017). It can affect all ages and the commonest symptom is bilateral ocular itching but other symptoms like redness, tearing, ropy discharge, burning sensation and photophobia may be present, and typically accompanied by allergic rhinitis (Katelaris, 2011; La Rosa et al., 2013; Rosario & Bielory, 2011).

PAC is similar to SAC in mechanism and both have similar signs and symptoms though the symptoms in PAC occur throughout the year and tend to be more mild and persistent (Dupuis, Prokopich, Hynes, & Kim, 2020). PAC often results from type 1 hypersensitivity to a variety of environmental or household allergens such as animal dander, molds, dust mites and cigarette smoke (Bielory et al., 2013; Dupuis, Prokopich, Hynes, & Kim, 2020; Leonardi et al., 2012).

As age increases, there is increased occurrence of PAC and symptoms may wax and wane all year round (Bielory et al., 2013; Davis, 2015; Mashige, 2017).

VKC is a chronic, bilateral form of ocular allergy which ranges from mild to severe sight threatening disease. It is more common in the tropics usually in West Africa, along the Mediterranean Sea, and in the Middle East (Marey et al., 2017). The onset of VKC is before

age 10 and more common in boys but has a female preponderance in later onset and tends to exacerbate for several years and wanes during the late teens (Saboo, Jain, Reddy, & Sangwan, 2013; Sushil et al., 2015). Although VKC is associated with atopy, it is mediated by a non-specific hypersensitivity reaction and accounts for the reason why condition can worsen with exposure to sunlight, wind and dust (La Rosa et al., 2013).

Three clinical forms of VKC exists; the palpebral form, the limbal or bulbar form, and the mixed form. The signs of the palpebral form includes the presence of giant papillae on the upper palpebral conjunctiva which has a cobble stone appearance, and thickening of the upper eye lid which may result in mechanical drooping of the lid called ptosis (Al-Akily & Bamashmus, 2011). The limbal or bulbar form presents with Horner-Tranta's dots at the limbus, gelatinous thickening of the limbus and bulbar conjunctival pigmentation. (Bielory et al., 2013; La Rosa et al., 2013; Rosario & Bielory, 2011). In VKC, predominant symptoms include ocular itching, which may be very severe and discomforting, redness, ropy discharge and photophobia (Ahmed et al., 2019; Zubair, 2017). Those with VKC tend to rub their eyes frequently resulting in the ropy discharge and accounts for an increased incidence in keratoconus whiles children of school going age may drop out of school because of severe itching and photophobia (Kahol et al., 2019). Frequent rubbing and inflammation of the palpebral conjunctiva can cause erosion of the cornea epithelium resulting in superficial punctate keratitis (Saboo et al., 2013; Naggalakshmi et al., 2014). When these corneal epithelial defects coalesce, a shield corneal ulcer may form. This also attracts neovascularization of the cornea, worsening the symptoms and affecting vision (Kanksi and Bowling, 2016).

AKC is a bilateral, chronic, severe and sight threatening form of ocular allergy that can persist throughout life and typically presents in adulthood but can develop at any age, and regarded as the ocular form of atopic dermatitis or atopic eczema (La Rosa et al., 2013; Kanksi and Bowling, 2016). About 5% of persons who suffer from AKC suffered from VKC during

childhood (Kanksi and Bowling, 2016). AKC commonly affects males than females and patients with AKC are usually sensitive to a variety of environmental aeroallergens (Dupuis et al., 2020; Kari & Saari, 2014). Ocular signs and symptoms of AKC ranges from mild to severe conjunctival injection and chemosis, swelling of the eye lids, punctate epithelial erosions, persistent epithelial defects, cornea neovascularization, with the absence or presence of Tranta's dots, and giant papillae (La Rosa et al., 2013; A Leonardi et al., 2012) . Scarring of the conjunctiva is common in AKC and scaling or itchy lesions which are eczematous in nature may be found on the eyelids or any other part of the body. AKC patients may also develop cataracts (Kanksi and Bowling, 2016; Katelaris, 2011).

CA also sometimes called allergic contact dermatitis is a non IgE mediated condition with its pattern of involvement depending on contact sites and how severe the reaction is. Substances that can potentially trigger reaction include those applied on the eye or around the eye like cosmetics or medications (La Rosa et al., 2013; Rosario & Bielory, 2011). Symptoms of CA are predominantly itching and lid swelling but may also include conjunctival hyperemia, papillae of the palpebral conjunctiva, chemosis, eczema and redness of the skin of the eyelids, and in some cases thickening and feathering of the eye lid skin due to excessive rubbing. In cases where the cornea is involved, it presents as superficial punctate keratitis or stromal infiltrates (La Rosa et al., 2013; Kanksi and Bowling, 2016).

GPC is a reversible inflammatory condition which is characterized by formation of giant papillae on the upper tarsal conjunctiva due to hypersensitivity of the tarsal conjunctiva to contact lens wear, prosthesis or sutures (Kari & Saari, 2014; Kubaisi et al., 2017). When these external agents are removed, papillae usually resolves, which makes some researchers describes the diseases as not basically an allergic disease but as a response to a mechanical trauma (Komi, 2018; La Rosa et al., 2013).

Notwithstanding, history of itching is typically reported especially when lenses are removed with associated symptoms like blur vision and stringy discharges (Mashige, 2015; Mashige, 2017; Kanksi&Bowling, 2016).

2.4 Prevalence of Ocular Allergy

Globally, the prevalence of ocular allergy is estimated to be 20% of the population and it can affect all age groups but mostly affects children and young adults. Despite this prevalence, there has not been an agreed standard definition and classification of the disease globally (Bore et al., 2014; La Rosa et al., 2013). However, The International Study of Asthma and Allergy in Childhood (ISAAC) Study was designed to analyze the distribution and time trends of allergic diseases across countries in different geographical regions to overcome the challenge of standardization of disease identification and diagnosis (Miyazaki et al., 2020). In the ISAAC Phase III study conducted on 1,059,053 children from 98 countries between 2002 and 2003 showed that the highest prevalence was observed in Africa (18.0%) and Latin America (17.3%) (Miyazaki et al., 2020).

In the United States of America (USA), The National Health and Nutrition Examination Survey (NHANES) III conducted between 1988 and 1994 among 33,994 participants, 40% of the population aged less than 17 years were reported to have allergic symptoms classified as allergic conjunctivitis (Singh, Axelrod, & Bielory, 2010). Japan is noted as one of the hot spots for highest prevalence of allergic conjunctivitis in Asia and a West Japan Study of ISAAC in elementary school children aged six to twelve years conducted in 2012 showed that the prevalence of allergic conjunctivitis was 17.5% (Miyazaki et al., 2020). In a study conducted among school children in Korea, the prevalence of allergic conjunctivitis among preschool, elementary school, middle school, and high school children were 8.5%, 12.3%, 20.3%, and 23.4% respectively (Hye-Sook Lee et al., 2012).

A hospital-based prospective study conducted on 530 children aged less than 15 years within a one year period showed that the prevalence of allergic conjunctivitis for all children and those aged five years and below was 17.9% and 7.37% respectively (Sinha and Dulani, 2017).

In Africa, the prevalence of OA reported in Gambia, Nigeria and Ghana range between 7.3% and 9.1%, whiles other studies have reported a prevalence as high as 39% among children aged between 5 years and 16 years, with a female predominance but suggests that VKC type of OA has a male predilection (Abokyi, Koffuor, Ntodie, Kyei, & Gyanfosu, 2012; Kumah et al., 2015; Malu, 2014; Wade et al., 2012). ISAAC studies performed in Uganda and Nigeria revealed that the prevalence of allergic conjunctivitis in Uganda was 20% and that of rhinoconjunctivitis (combined symptoms of rhinitis and conjunctivitis) was found to be 39% of school children aged 13 to 14 years (Bielory, 2013).

In Ghana, a study conducted in 11 schools among basic school children aged 5 to 16 years in the Kumasi metropolis revealed that, the prevalence of allergic conjunctivitis was 39.9% (Kumah et al., 2015). However, a similar study conducted in 5 basic among basic school children aged 6 to 16 years in the Kwabre East District of Ghana which has a close proximity to Kumasi Metropolis showed that the prevalence of allergic conjunctivitis was 17.3% (Kumah, 2017). This difference in the prevalence of allergic conjunctivitis can be attributed to differences in age range and also sampling techniques. In a study which was also conducted among school children aged 5 to 15 years in South West Nigeria revealed that 19.2% of the children had allergic conjunctivitis (Alabi et al., 2018).

A hospital-based study conducted among 18,896 outpatient turnout in two eye referral centers in Ghana showed that the prevalence of allergic conjunctivitis was 9.1% (Abokyi et al., 2012). Another hospital-based study conducted in Gambia revealed that the prevalence of allergic conjunctivitis was 7.9% (Wade et al., 2012).

The community based studies gave a higher prevalence of allergic conjunctivitis than the hospital-based studies probably because of under-diagnosis in the hospital setting. However, a hospital-based study conducted in Jos, Nigeria showed that, the prevalence of allergic conjunctivitis was 32% and this high prevalence can be attributed to the fact that the study reviewed outpatient turnout over a period of 10 years (Malu, 2014).

2.5 Diagnosis of Ocular Allergy

As low as 10% of patients with symptoms of OA seek medical help and even those who do, do so with over the counter medications (OTC) making OA one of the health problems which has often been underdiagnosed and undermanaged (Bielory et al, 2019).

In advanced countries, diagnostic pathways for ocular allergy is based on meticulous patient history including ocular symptoms such as redness, mucoid discharge, itching, and tearing, duration of symptoms, laterality (monocular or binocular), any allergies, and symptoms of atopic diseases which are usually comorbidities of ocular allergy (Leonardi et al., 2012). In addition, clinical examination of the eye and its adnexa using slit lamp biomicroscope is also done to identify characteristics such as conjuntival papillae, trantas dots, conjunctival injection, and limbal and bulbar hyperpigmentation (Leonardi et al, 2017). In some cases, laboratory tests such as skin prick test, patch test, serum-specific IgE, and tear film function are done to identify allergens that mediate the allergic response (Malu, 2014; Vally, 2017).

In resource limited settings, especially in most countries in Africa, diagnosis of OA is based mainly on detailed questioning placing emphasis on ocular itching as a hallmark symptom, and on clinical findings (Bore et al., 2014).

2.6 Co-morbidities of Ocular Allergy

Ocular allergy can co-exist with other allergic conditions like rhinitis, eczema and asthma. That is, it is likely for a person with airway symptoms to also have additional allergic responses in the ocular surfaces such as the conjunctiva (Kim et al., 2013). In the ISAAC Phase III study, the overall prevalence of rhinitis associated with watery-itchy eyes (rhinoconjunctivitis) across 98 countries was 14.6% for children aged 13 to 14 years (Miyazaki et al., 2020). The ISAAC Study also demonstrated that prevalence of rhinoconjunctivitis across countries varied from 1% to 15% in children aged between 6 and 7 years (Bielory, 2013).

There is usually the presence of asthma and eczema amongst three-quarters of patients with VKC (Ahmed et al., 2019; De Smedt et al., 2011). In a study by Kim et al. (2013) among preschool children in Korea, it was found out that the prevalence of allergic conjunctivitis in children with other allergic diseases was 31.2%. Their study findings also revealed that the prevalence of allergic rhinoconjunctivitis among the preschoolers was 20.2% which is comparable to that in the Phase III Study in children aged six to seven years by the International Study of Asthma and Allergies in Childhood (ISAAC) which was 2.2% to 24.2% (Kim et al., 2013).

The ISAAC Study demonstrates that Allergic rhinoconjunctivitis and Asthma has a close correlation and that the presence of comorbidities of allergic diseases may exacerbate symptoms (Kim et al., 2013). A study conducted among children a North Indian community reported that co-morbidities reported among those with allergic conjunctivitis were rhinitis or hay fever, dermatitis and asthma (Kahol et al., 2019). Another study conducted in Gambia showed that, among those who were diagnosed with allergic conjunctivitis at an outpatient clinic, 1.4 % and 0.2% of them had asthma and atopic dermatitis respectively (Wade et al., 2012).

2.7 Factors Associated with Ocular Allergy

Increased urbanization and industrialization has induced increase in air pollution by particulate matter causing poor air quality to become a major source of morbidity and mortality among populations (Hong et al., 2016). The ocular surface is very sensitive to environmental factors such as high concentrations of toxins in the air (Łatka et al., 2018). The conjunctiva is rich in blood vessels which are constantly exposed to external factors like air pollutants and allergens which mediates an inflammatory response resulting in clinical manifestations like eye irritation, ocular discomfort and conjunctivitis (Yadav, 2019). These suggests that a person's location (rural or urban) can be factor which can be associated with ocular allergy. In a study conducted among school children in rural and urban areas of Iraq, the prevalence of allergic conjunctivitis recorded among urban school children was 21.9% and that of rural school children was 7.4% (Fisal & Agha, 2020).

Exposure to household air pollution can also be a risk factor for several eye conditions including ocular allergy (West et al., 2013). Household air pollution is usually caused by high concentrations of particulate matter produced from inefficient burning of solid fuels for cooking or heating (Onakomaiya et al., 2019). Particulate matter produced from solid fuels (biomass and coal) is linked with adverse health effects like respiratory diseases and ocular irritation and discomfort (Benoit et al., 2019; West et al., 2013). In Ghana, 70% of the population use either wood or charcoal as their cooking fuel (Ghana Demograhic and Health Survey, 2014). Solid fuel produce several air pollutants which significantly serve as risk factors of ocular allergic inflammatory conditions (Miyazaki et al., 2019; West et al., 2013). Household members become exposed to household air pollution from the use of solid fuels which can serve as mediating factors for ocular allergic response. (Onakomaiya et al., 2019). In a study conducted in Gondar city, Ethiopia, the use of kerosene or firewood for cooking was significantly associated with VKC (Hayilu et al., 2016).

Symptoms of SAC and PAC which are the most common types of ocular allergy become exacerbated during spring and summer times due to frequent exposure to allergens such as grass pollen, weed, and mold spores (Kubaisi et al., 2017). Results from a study conducted in India showed that reported precipitating factors for allergic conjunctivitis were dust, smoke, sunlight, grass or weed, dandruff and cream (Kahol et al., 2019). High prevalence of VKC is seen in regions with a dry, hot, and humid weather and with a higher concentrations of aeroallergens (Saboo et al., 2013).

Dietary factors may also affect the prevalence of allergic conjunctivitis as a decrease in the prevalence of rhinoconjunctivitis, eczema and wheeze has been shown to be associated with the intake of calories and proteins from cereals, rice, nuts, starch and vegetables (Miyazaki et al., 2020). Foods such as peanuts and pineapple can trigger allergic conjunctivitis (Abokyi et al., 2012).

2.8 Management of Ocular Allergy

In the management of OA, the main aim is to control or relieve signs and symptoms of the patient and also to improve their quality of life, and in addition, to break the chain between exposure to allergens and inflammatory responses which result in these signs and symptoms (Bielory et al., 2013). Hence, the mainstay management of OA has been non pharmacological and pharmacological measures.

Non pharmacological measures in the management of OA include awareness and avoidance of any known or common allergens or using various ways to reduce environmental exposure such as dust mites, molds, animal dander, smoke, and putting in control measures like ensuring proper ventilation in buildings (Dupuis et al, 2020). It has been reported that, exposure to environmental tobacco smoke increased the risk of OA by up to 20% in children (Kyei, 2018). Patients are also advised to avoid rubbing of the eyes as this causes degranulation of mast cells

and worsens symptoms. Application of cold compresses to reduce swelling of the lids and use of ocular lubricants or artificial tears are other non-pharmacological management of OA. The use of artificial tears dilute the agents of inflammation and also wash out allergens reducing ocular itching and preventing worsening of condition. (Leonardi et al., 2019)

Pharmacological agents used in the management of OA include anti histamines, mast cell stabilizers, combined anti histamines and mast cell stabilizers, and vasoconstrictors, topical steroids and non-steroidal anti-inflammatory drugs (Dupuis et al., 2020; Leonardi et al., 2019; Vally & Irhuma, 2017). Topical steroids are mostly used for short periods and tapered due to the potential of steroid induced glaucoma and development of cataracts (Kubaisi et al., 2017). Topical antibiotics can also be used in conjunction with topical steroids in cases where there are corneal involvement (kanksi & Bowling, 2016; Gerstenblith & Rabinowitz, 2012).

The management of OA has usually been a daunting task which requires a multidisciplinary approach with both primary and secondary health care professionals to properly educate parents and patients concerning the disease (Bielory et al., 2013).

2.9 Perceptions about Ocular Allergy

The perceptions of parents is a very significant role-play in the eye care seeking behavior of parents regarding their children. Children normally do not complain of eye problems and in preverbal children without the detection of signs and symptoms, parents often discount the probability of their children having an eye problem (Ramai & Pulisetty, 2013). In cases where children report symptoms of an eye problem, parents disregard them thinking they are too young to have an eye problem and only taken seriously when the child repeatedly report those symptoms, or symptoms are consistent with those of other siblings or members of the family (Ebeigbe, 2018).

In a study by Kahol et al (2019), it was reported that ocular allergy is overlooked as a disease entity and perceived as normal occurrence in children which does not warrant a physician consult. Despite itching been considered as a hallmark symptom of ocular allergy, it was reported in a study of ocular allergy among school children in Ghana, that, although majority of the school children reported having symptoms of itching resulting in rubbing of eyes and causing inattentiveness in class, their parents had never presented them to the clinic for eye care probably because of poor perception of parents about the condition (Kumah et al., 2015). Alrasheed et al., (2016) reported in their study in South Darfur that, caregivers perceived eye inflammation as part of the child's eye developmental process which will resolve with time.

In other to understand the reason some parents show concern towards eye problems of their children and why others do not, it is imperative to know how parents perceive and behave towards such eye problems (Ebeigbe, 2018)

2.10 Management of Ocular Allergy by Caregivers Prior to Presentation at the Health Facility

How parents manage health conditions is to an extent dependent on the seriousness they attach to the condition and how they perceive the condition, and parents also play a significant role in deciding which type of health care they seek for their children even in cases where they are oblivious of the danger signs and appropriate treatment (Amare, 2015).

In developing countries, parents sometimes resort to homemade remedies , herbal preparations, left over drugs from previous prescriptions, and OTCs in the management of health conditions in their children (Abokyi et al., 2012; Alrasheed et al., 2016; Amiebenomo et al., 2016; Ramai & Pulisetty, 2013; Wade et al., 2012).

In a study done by Ayanniyi et al. (2010) regarding the attitudes and eye care seeking behavior of guardians towards their children, ocular itching was reported as one of the common complains that guardians resort to alternative treatment other than seeking treatment at the eye clinics or hospitals. Another study done by Kahol et al. (2019) regarding the treatment seeking behavior for allergic conjunctivitis in children, it was reported that majority of the children were not presented for physician consult, and even among those who did, treatment were not completed.

Parents or caregivers fail to present their children for management of their eye conditions including ocular allergy because of reasons such as the fear that their children will be made to wear spectacles, prioritizing other diseases over ocular disease, and in some cases failing to appreciate the need to treat such condition as it will not cause any loss of vision (Duke et al., 2016; Ebeigbe, 2018; Senyonjo et al., 2014; Sukati, Moodley, & Mashige, 2018). While some parents and caregivers resort to self-prescribed medications or going to buy drugs from the pharmacy or drug store as first treatment option for OA and other ocular conditions (Abokyi et al., 2012; Ramai & Pulisetty, 2013), others also resort to homemade preparations like tea water, boiling salt water, chili and blood from cuts made around the eyes in the management of ocular condition including OA in their children (Alrasheed et al., 2016). Studies of OA done in Ghana did not ascertain parents and caregivers practices in managing OA in their children prior to hospital attendance. This study intends to fill that gap because such practices by parents or caregivers may have implications on the disease and visual outcomes of their children.

Without proper management of ocular allergy, sight threatening conditions can result which will affect the quality of life of the child (Alemayehu et al., 2019; Marey et al., 2017)..

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter describes the study design, study area and sites, study population, data collection methods and tools, quality control, data management and statistical analysis. Ethical considerations are also addressed in this chapter.

3.2 Study Design

A hospital-based retrospective cross-sectional study was conducted. Secondary data from medical records were reviewed.

3.3 Study Site

The study was conducted in Our Lady of Grace Hospital at Breman Asikuma. The hospital which is located within the Asikuma-Odoben Brakwa District in the Central Region of Ghana was first established as a clinic in 1940 and upgraded to a hospital in 1953. It serves as a district hospital rendering health service to 183 towns and villages with an estimated population of 93,554 within the district. Ajumako, Agona and Assin districts also form part of its catchment area. The hospital has a 104 bed capacity and acts as a referral center to eight health centers, two mission clinics, 14 community clinics and four maternity homes. Services rendered include a 24 hour emergency, out-patient and in-patient departments, pharmacy, public health, ophthalmic services, obstetrics and gynecology, dental, Ear, Nose and Throat, surgeries, psychiatry, laboratory, radiology, and specialist clinics in internal medicine.

The study site was the Eye clinic of Our Lady of Grace Hospital. The Eye Clinic serves as one of the eye care referral centers within the Central region and also a training center for optometry students and ophthalmic nurses. With a staff of an ophthalmologist, optometrists, ophthalmic nurses, opticians, enrolled nurses and health assistants, services provided include ophthalmic surgeries, out-patient consultation, visual field testing and dispensing of optical aids. Average monthly OPD attendance at the clinic is 1600. Cataract, acute eye infections, Glaucoma, Pterygium and ocular trauma are among the cases commonly seen at the Eye Clinic.

3.4 Data Source

Data was extracted from the medical records of all children aged under five years who were attended to at the Eye Clinic of Our Lady of Grace Hospital. The period under review was January 2018 to December 2019. Children diagnosed with ocular allergy without any comorbidity such as ocular trauma, bacterial conjunctivitis, and uveitis by the ophthalmologist and optometrists were considered as ocular allergy cases. The total number of medical folders from which data were extracted for analysis was 814 (503 from 2018 and 311 from 2019) out of 827 folders available for the period under review (Figure 3.1).

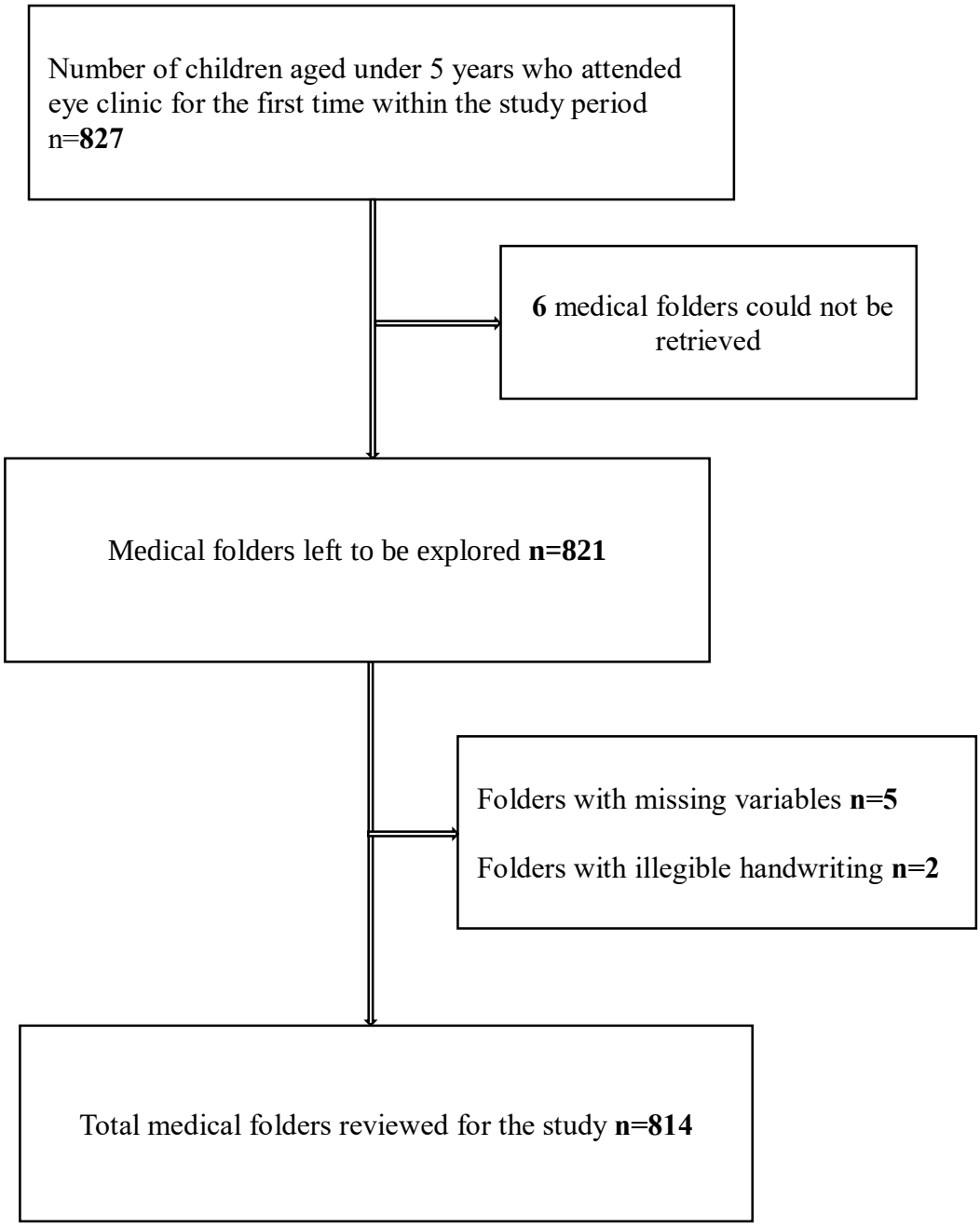

Figure 3.1: Flow chart showing selection process for data extraction

3.5 Data Collection

3.5.1 Study Variables

Two outcome variables and four independent variables were identified in this study.

Table 3.1: Study variables

Variable type	Variable name	Measurement scale	Options
Independent	Age	Ratio	Numerical Categorical
Independent	Sex	Nominal	Categorical
Independent	Location	Nominal	Categorical
Independent	Clinical features	Nominal	Categorical
Dependent	Types of ocular allergy	Nominal	Categorical
Dependent	Types of ocular allergy management	Nominal	Categorical

3.5.2 Data Collection Procedures

Data was collected by desk review of medical folders. Available medical folders of all children aged under five years who were presented for eye care between January 2018 and December 2019 were reviewed. Abstraction forms were developed and used to extract study variables from medical folders and kept as personal copies as medical folders could not be taken home. Information on the demographic characteristics of the children such as age (in months), sex, and location (rural/urban), were extracted.

Date of first attendance to the clinic, presenting complaints, duration of the condition, visual acuity and medical history of the children were also extracted. Extraction of information on ocular findings, diagnoses, the subtype of ocular allergy diagnosed, and forms of management by attending eye care professionals was done.

3.6 Quality Control

To ensure accuracy of data before, during, and after the data collection stages, several measures were put in place.

3.6.1 Training of Research Assistants

Two optometrists and two medical record officers were trained as research assistants to help in data collection in this study. Training included briefing of ethical protocols regarding the study, folder selection, information retrieval, use of abstraction form, and data entry.

3.6.2 Data Collection

The researcher ensured that all the study protocols with its ethical guidelines were followed by the research assistants. This was done through assessment of demonstrations by research assistants on how they will gather data from the medical folders. Each medical folder reviewed was coded using a sticker to differentiate them from those that were yet to be reviewed to prevent repetition of data collected. An abstraction form was used to extract variables from medical folders. After data collection each day, meeting was held between research assistants to review the day's activities, assess completed medical folders and discuss challenges that were faced during the data collection to improve upon subsequent data collection.

3.7 Data Management

To ensure accuracy and completeness of data entry, data collected from medical folders was coded and double entry was done on two different laptops into Excel Spreadsheet after the daily reviews with the team. Any variable necessitating regrouping was done prior to data analysis. A sample of 50 of the medical folders was used to cross check entries to find out if there were any errors, after which data cleaning was done and imported into STATA I/C version 16 for analysis.

3.8 Statistical Analysis

Descriptive statistics for child demographic characteristics, clinical features, types of ocular, and forms of ocular allergy management were presented using frequencies, percentages and proportions. Variables such as patient ocular and medical history, and family ocular and medical history were present in very few of the medical folders that were reviewed and hence could not be analyzed.

Inferential statistics for association between socio-demographic factors and ocular allergy were done using the Pearson chi-square test and Logistic regression analysis. The chi-square statistic and p-value were reported for the chi-square test. Adjusted odds ratios (aOR) and 95% confidence intervals were reported for logistic regression analysis. Statistical significance was assumed at p-value <0.05.

3.9 Ethical Consideration

Ethical considerations in the study included Anonymity and confidentiality, data protection, conflict of interest, and funding.

3.9.1 Permission to Conduct the Study

Institutional clearance was obtained from the Management Board of Our Lady of Hospital at Breman Asikuma.

3.9.2 Confidentiality and Anonymity

All information gathered from medical folders of patients was held with utmost confidentiality.

To ensure anonymity and respect, no names was attached to information gathered and entered for analysis, and also information gathered was used solely for the objectives of this research.

3.9.3 Data Protection

Data was stored on a computer and encrypted with a password known only to the researcher. Following data validation, all data abstraction forms were stored safely in a locked cabinet and the keys kept securely by the researcher. These forms will be destroyed three months after conclusion of the study.

3.9.4 Conflict of Interest

The researcher declares that there is no conflict of interest

3.9.5 Funding

There was no external funding for the research. The researcher funded the entire cost of the research.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

This chapter presents results of data analyzed for the period January 2018 to December 2019. The sociodemographic characteristics of children aged under five years attending the Eye Clinic are presented. Additionally, the prevalence of OA and VKC, as well as factors associated with OA are presented.

4.2 Descriptive Statistics of Children aged under five years

The total number of medical folders reviewed was 814. Out of the 814 medical folders, 454 of them representing 55.8% belonged to males. The mean (sd) age of children aged under five years diagnosed with ocular allergy was 28 months ±15.41. The minimum and maximum age recorded was 1 month and 59 months respectively (Table 4.1). Age was categorized into infants, toddlers and preschoolers because of its wide dispersion of data.

The total number of children diagnosed with ocular allergy was 337 of which 188 were males (55.8%). The modal age for all children diagnosed with ocular allergy was 12-35 months. Toddlers (12-35 months) represented 41.8% of the children with ocular allergy. The modal age for females with ocular allergy was 36-59 months. Majority (67.1%) of the children diagnosed with ocular allergy were from urban areas (Table 4.1).

Table 4.1: Descriptive statistics for children aged under five years with ocular allergy

Characteristic	Ocular Allergy n=337	(%)	No ocular allergy n=477	(%)	Total n=814	(%)
Age in months (M ± SD)	28.12 ± 15.41					
Infants (0-11 months)	71	(21.1)	243	(50.9)	314	(38.6)
Toddlers (12-35 months)	141	(41.8)	144	(30.2)	285	(35.0)
Preschoolers (36-59 months)	125	(37.1)	90	(18.9)	215	(26.4)
Sex						
Female	149	(44.2)	211	(44.2)	360	(44.2)
Male	188	(55.8)	266	(55.8)	454	(55.8)
Location						
Urban	226	(67.1)	312	(65.4)	538	(66.1)
Rural	111	(32.9)	165	(34.6)	276	(33.9)

Among the 337 children diagnosed with ocular allergy, 90 of them presented VKC subtype. This represents 26.7% of all ocular allergy cases diagnosed in the children aged under five years. Males accounted for 61.1% of all VKC cases. The mean (s.d) age of children diagnosed with VKC was 35 months ± 13.48. The modal age of children diagnosed with VKC was 36-59 months. Preschoolers and children from urban areas accounted for 56.7% and 62.2% of all children with VKC respectively (Table 4.2).

Table 4.2: Descriptive statistics for children aged under five years with VKC

Characteristic	Vernal Keratoconjunctivitis n=90 (%)
Sex	
Male	55 (61.1)
Female	35 (38.9)
Age in months (M ±SD)	35.49 ± 13.48
Infants (0-11months)	8 (8.9)
Toddlers (12-35 months)	31 (34.4)
Preschoolers (36-59 months)	51 (56.7)
Location	
Urban	56 (62.2)
Rural	34 (37.8)

4.3 Prevalence of Ocular Allergy and Vernal Keratoconjunctivitis

The prevalence proportion of ocular allergy among children aged under five years was 41.4% (337/814) (Figure 4.2). Appendix C provides detailed information regarding the total number of cases recorded in the study.

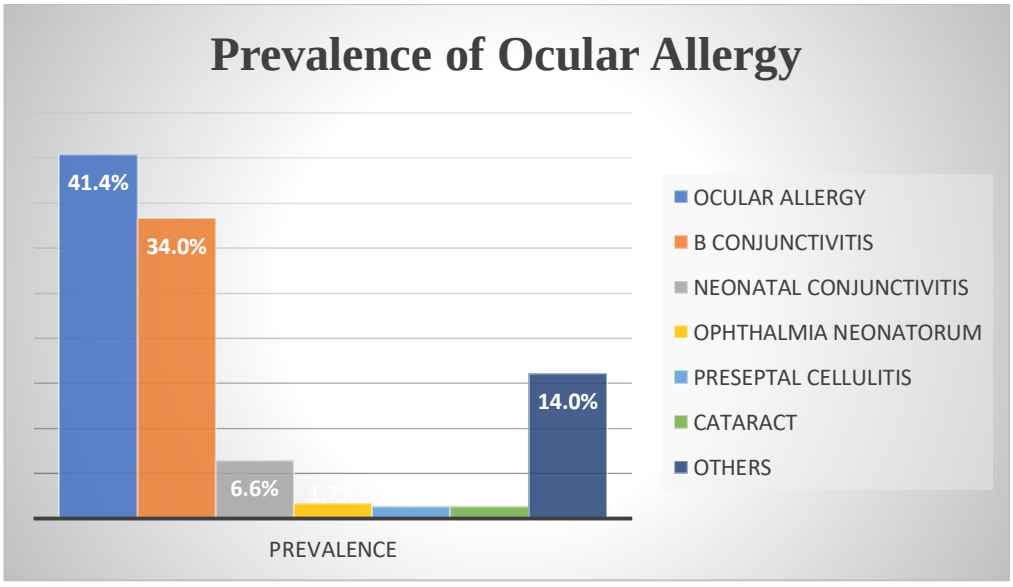

Figure 4.1: Prevalence of Ocular Allergy

The number of VKC type of ocular allergy cases recorded in the 814 medical folders reviewed was 90. This represents a prevalence rate of 11.1%.

4.4 Clinical Characteristics of Children Aged Under five years with Ocular Allergy

4.4.1 Ocular Complaints

A total of 529 ocular complaints were recorded for children under five years diagnosed with ocular allergy. The average number of ocular complaints reported for a child was 1.6, that is, approximately two symptoms per child. Ocular itching was the predominant ocular complaint recorded representing 51.9%. The second most reported symptom was redness of the eye (96) followed by discharges (79), tearing (32), rubbing of eyes (17) and swollen eyelid (11) (Table 4.3).

Table 4.3: Ocular complaints of children aged under five years with ocular allergy

Ocular Complaints n=529	Frequency	%
Itching	275	51.9
Redness	96	18.1
Discharges	79	14.9
Tearing	32	6.0
Rubbing of eyes	17	3.2
Swollen lids	11	2.1
Pain	6	1.1
Burning sensation	6	1.1
Cannot open the eye	2	0.4
Brownish colour of Eyes	2	0.4
Abnormal growth on Eye	2	0.4
Rashes on eyelids	1	0.2

The average duration before contact with the Eye clinic for eye care was 5.38 months (Table 4.4).

Table 4.4: Duration of ocular complaints before contact with Eye clinic

	Mean	Standard Deviation	Minimum	Maximum
Duration before contact with the health facility (in months)	5.38	8.17	0.03	53

4.4.2 Clinical Presentations

Analysis of the medical records of children aged under five years diagnosed with ocular allergy showed that, majority (40.4%) of them presented with conjunctival injection after ocular examination. Other common clinical presentations recorded were brownish conjunctival discoloration (28.2%), limbal hyperpigmentation (9.0%), and limbal hypertrophy (3.9%) (Table 4.5).

Table 4.5: Clinical presentation of children aged under five years with ocular allergy

Clinical Presentation n=337	**Frequency**	**%**
Conjunctival Injection	136	40.4
Brownish Conjunctiva	95	28.2
Limbal Hyperpigmentation	30	9.0
Limbal Hypertrophy	13	3.9
Swollen Eyelids	5	1.5
Discharges	3	0.9
Trantas Dots	3	0.9
Irregular Pupil	1	0.3
Conjunctival Chemosis	1	0.3
Itchy Rashes	1	0.3
Subconjunctival Hemorrhages	1	0.3
Cornea Scar	1	0.3

4.5 Forms of Ocular Allergy Management in Children aged under five years

Types of management recorded in this study were 99.9% pharmacological and 0.1% non-pharmacological. Non-pharmacological management was primarily the application of cold compress. For pharmacological management, an average of two drugs (topical and systemic) were used to manage children aged under five years diagnosed with ocular allergy. Majority (79.4%) of the children were managed with mast cell stabilizer eye drops. Other common types of management for ocular allergy included steroid-antibiotic ointment (55.2%), antihistamine syrups (29.4%), antibiotic ointment (13.9%), and antihistamine eye drops (11%) (Table 4.6).

Table 4.6: Forms of ocular allergy management for children aged under five years

Types of Ocular Allergy Management n=337	**Frequency**	**%**
Pharmacological		
Gutt Mast Cell Stabilizer	269	79.4
Occ Steroid Antibiotic	186	55.2
Syr Antihistamine	99	29.4
Occ Antibiotic	47	13.9
Gutt Antihistamine	37	11.0
Gutt Steroid Antibiotic	32	9.5
Gutt Antibiotic	8	2.4
Gutt Steroid	3	0.9
Gutt Non-steroidal anti-inflammatory drug	2	0.6
Non-pharmacological		
Cold compress	7	2.1

4.6 Factors Associated with Ocular Allergy

Among the variables (age, sex, location), only age had a statistically significant association with ocular allergy (χ^2=78.178; p=0.000) (Table 4.7).

Table 4.7: Chi-square test of association between age, sex, location, and ocular allergy

Variables	Ocular Allergy					
	Present		Absent		Total	
	n=337	%	n=477	%	n=814	%
Age						
0-11 months	71	22.6	243	77.4	314	100
12-35 months	141	49.5	144	50.5	285	100
36-59 months	125	58.1	90	41.9	215	100
Test statistic; p-value	χ^2=78.178; p=0.000					
Sex						
Male	188	41.4	266	58.6	454	100
Female	149	41.4	211	58.6	360	100
Test statistic; p-value	χ^2=0.0000; p=0.995					
Location						
Urban	226	42.0	312	58.0	538	100
Rural	111	40.2	165	59.8	276	100
Test statistic; p-value	χ^2=0.2409; p=0.652					

A logistic regression analysis of age, sex, and location on ocular allergy showed that the odds of children aged 12 to 35 months and 36 to 59 months being affected with ocular allergy were three-fold (cOR = 3.35; 95% CI = 2.36 – 4.76; p = 0.000) and five-fold (cOR = 4.75; 95% CI = 3.26 – 6.94; p = 0.000) as compared to children between 0 to 11 months respectively (Table 4.8). After adjusting for sex and location, this association was still found to be significant for age categories 12 to 35 months (aOR = 3.34; 95% CI = 2.35 – 4.75; p = 0.000) and 36 to 59 months (aOR = 4.76; 95% CI = 3.26 – 6.95; p = 0.000) (Table 4.8).

Table 4.8 Logistic regression of age, sex, and location on ocular allergy

Variables	Ocular Allergy		cOR (95% CI)	p-value	aOR (95% CI)	p-value
	Present n=337	Absent n= 477				
Age						
0-11 months	71(21.1)	243(50.9)	1.00		1.00	
12-35 months	141(41.8)	144(30.2)	3.35 (2.36 - 4.76)	0.000	3.34 (2.35 - 4.75)	0.000
36-59 months	125(37.1)	90(18.9)	4.75 (3.26 – 6.94)	0.000	4.76 (3.26 - 6.95)	0.000
Sex						
Female	149(44.2)	211(44.2)	1.00		1.00	
Male	188(55.8)	266 (55.8)	1.00 (0.76 – 1.33)	0.100	1.02 (0.76 - 1.38)	0.874
Location						
Rural	111(32.9)	165(34.6)	1.00		1.00	
Urban	226(67.1)	312(65.4)	1.08 (0.80 – 1.45)	0.620	1.03 (0.75 - 1.40)	0.865

CHAPTER 5

5.0 DISCUSSION

5.1 Introduction

Ocular Allergy is a chronic condition which can affect the quality of life of a child. VKC which is a type of Ocular Allergy can cause severe visual impairment as a result of associated clinical features like cornea scarring, refractive errors and keratoconus. In Africa, several studies have been done on Ocular Allergy among the general population and in some cases among school children, (Abokyi et al., 2012; Kumah et al., 2015; Malu, 2014; Wade et al., 2012) but none has been done specifically among children aged under five years.

This study focuses on the prevalence and management of ocular allergy, and factors associated with ocular allergy among children aged under five years who were attended to at the Eye clinic of Our Lady of Grace Hospital in Breman Asikuma. The Study period was from January 2018 to December 2019.

5.2 Descriptive statistics of children aged under five years

Previous studies that examined ocular allergy in children have reported the condition in children aged between five and sixteen years (Ahmed et al., 2019; Duke et al., 2016; Hayilu et al., 2016; Kahol et al., 2019; Kumah et al., 2015; Sushil et al., 2015). In Africa, majority of the studies reported ocular allergy among children aged two to eighteen years with a predominance among males (Ahmed et al., 2019; De Smedt et al., 2012; Hayilu et al., 2016; Kumah et al., 2015). In advanced countries, ocular allergy has been reported mostly among children aged six to fourteen years with a predominance among males (Katelaris, 2011). Compared to other studies elsewhere in Africa, the study population was younger in the present study.

5.3 Prevalence of Ocular Allergy and VKC among Children aged under five years

In this study, the prevalence of Ocular Allergy among children aged under five years was found to be 41.4%. This prevalence is higher as compared to a hospital-based study done in similar age group in India with ocular allergy prevalence of 7.37% and that conducted in Korea among preschoolers with a 8.5% prevalence of OA (Sinha and Dulani, 2017; Hye-Sook Lee et al, 2012). The higher prevalence of OA found in this study could be attributed to factors such different geographical location and weather patterns which have shown to induce the prevalence of OA (Miyazaki et al., 2020). Differences or changes in weather patterns affect the distribution, frequency of exposure, and quality of environmental allergens and can affect the distribution and severity of allergic diseases (Hong et al., 2016).

The prevalence of OA in this study is however comparable to a study done in Nigeria by Malu et al., (2014), where the prevalence was found to be 38.4%. Both studies employed similar methodology in which a hospital based retrospective study of patients who were seen and diagnosed of OA were conducted. In both studies, the medicals records of patients who were diagnosed with OA were reviewed. However, the study done by Malu et al., (2014), was for a population involving all age groups in contrast to this present study which focused on children aged below the age of five years.

In a study done in Ghana by Kumah et al., (2014), the prevalence of OA was found to be 39.9%. Though this study was a community based cross sectional study among basic school children, the prevalence is comparable to that found in this present study. Notwithstanding, prevalence in a hospital setting may not give clear picture of the burden of OA as compared to a community setting probably due to underdiagnoses or poor eye care seeking behavior.

The prevalence of VKC among children aged under five years who were attended to at the Eye clinic of Our Lady of Grace Hospital within the study period was 11.1%.

This prevalence can be compared to the 11.1 % prevalence of VKC found in a community-based cross sectional study among a population of 18 years and below by Alemayehu et al., (2019) which employed a systematic random sampling as its methodology.

5.4 Clinical Features of Children Aged Under Five Years with Ocular Allergy

In this study, ocular itching was identified as the predominant presenting complaint recorded for children diagnosed with ocular allergy. Itching of the eyes accounted for 51.9% of the total ocular complaints recorded for all children diagnosed with ocular allergy. Other common ocular complaints were redness of the eyes, mucoid discharges, tearing, rubbing of the eyes and, swollen eye lids. Ocular complaints that were less reported were "brownish colour of the eyes", difficulty in opening the eyes, pain, and burning sensation. Average number of complaints per child with OA was approximately two. This finding is similar to most studies done on OA which has ocular itching as the most predominant symptom such as in Ghana (Abokyi et al., 2012; Kumah et al., 2015), Nigeria (Malu, 2014) and Gambia (Wade et al., 2012). Itching is a pathognomic sign of Ocular Allergy, and in most instances the predominant sign considered where diagnosis of OA is made based on ocular history (Ackerman, Smith, & Gomes, 2016; Saboo et al., 2013). Ocular itching usually results in rubbing of the eyes for relief. Rubbing of the eyes causes further degranulation of mast cells which releases histamine and worsen symptoms. Initial course of OA may be mild and self-limiting but can develop into a severe form with debilitating signs and symptoms (Ahmed et al., 2019; Arif et al., 2017). Signs and symptoms like severe itching and rubbing of the eyes, mucoid discharges, and burning sensation may interrupt with academic work of school going children and can lead to school drop-out (Bielory & Friedlaender, 2008; Marey et al., 2017). Excessive rubbing of the eyes can result in erosion of the cornea epithelium which can cause a shield cornea ulcer.

This can attract neovascularization of the cornea, worsening the symptoms of OA and causing vision loss (Kanski & Bowling, 2016).

In this present study, the average duration preceding a clinic visit for children with OA and VKC was five months and seven months respectively. In some cases parents or caregivers waited for as long as 53 months (4 years) before seeking professional care for their children. This demonstrates the poor eye care seeking behavior of parents or caregivers of children with OA amidst observable signs and symptoms. The poor eye care seeking behavior as evident in the long duration preceding clinic visits at first presentation might suggest a lack of understanding of the disease and its adverse outcomes in children. This underscore the need for targeted education of parents or caregivers to motivate early health care seeking behavior.

Conjunctival injection was the commonest ocular finding on examination of the children diagnosed with OA. It was recorded in 40.4% of the children diagnosed with OA. Other common ocular examination findings were brownish discoloration of the conjunctiva, limbal hyperpigmentation, and limbal hypertrophy. Swollen eyelids, mucoid discharges, and Trantas dots were also recorded ocular examination findings. These ocular findings can serve as a sequelae of clinical features which are sight threatening like cornea scars. In this study, a case of cornea scar was recorded in one of the children diagnosed with OA. Cornea scar destabilizes the transparency of the cornea and prevents light from entering the eye which can result in visual loss (La Rosa et al., 2013). Ocular Allergy is regarded in some literature as a risk factor for dry eye syndrome. These two eye conditions are said to be epidemics of the 21st century (Hom, Nguyen, & Bielory, 2012). Clinical features of OA such as limbal hypertrophy, Trantas dots, conjunctival papillae can cause tear film instability resulting in dry eyes syndrome. Moderate to severe cases of dry eye syndrome can cause blur vision (Hom et al., 2012; Villani, Rabbiolo, & Nucci, 2018).

Ocular Allergy has also been associated with other eye conditions such as refractive errors and keratoconus. Children with chronic OA can have associated refractive errors such as hyperopia, myopia, and astigmatism, for which they will need optical aid to see clearly. This can be a further financial burden on parents when care is not sought early for children with OA (Krishna, 2019). Symptoms of OA experienced for a long duration of time is associated with keratoconus, which is a bilateral, progressive bulging and thinning of the cornea. This can result in progressive myopia and high astigmatism which sight threatening conditions. (Cinar, Fakultesi, & Hastaliklari, 2013; Mugho, 2016) In this study, children with OA might also be at risk of developing other ocular conditions such as Keratoconus due to the long duration preceding clinic visit for eye care.

5.5 Management of Ocular Allergy in Children Aged Under Five Years

In this study, management of OA in children aged under five years was mainly pharmacological. Non-pharmacological management of OA accounted for only 0.1% of all forms of management. For pharmacological management of OA, a child with OA was managed with an average of two different classes of drugs.

Majority of the children (79.4%) were managed with mast cell stabilizer eye drops. The most common mast cell stabilizer used was sodium cromoglicate. Steroid-antibiotic ointments were used to manage more than half of the children with OA, while more than a quarter of the children were managed with antihistamine syrups. Mast cell stabilizers and antihistamines have become the first line drugs in the effective management of OA in children (Bielory et al., 2020, 2013; Bore, 2016). Less than 1% of the children were managed with steroid eye drops probably because of their adverse side effects in children. Non pharmacological management of OA in this study was primarily the use of cold compress to relieve ocular symptoms.

5.6 Factors Associated With Ocular Allergy

In this study, the odds of a child aged under five years being prone to ocular allergy was not associated with being a male or female and their place of residence whether rural or urban. However, males, and those living in urban areas were predominantly affected with OA which is consistent with other studies (Hayilu et al., 2016; Théra et al., 2016). For example a study conducted in Iraq revealed that the prevalence of allergic conjunctivitis among urban school children was higher than that of rural school children (Fisal & Agha, 2020).

Rapid urbanization and industrialization has been shown to produce air pollutants such as nitrogen oxides from vehicular traffic and soot from factories and these air pollutants have been found to be significantly associated with forms of conjunctivitis such as VKC and AKC (Miyazaki et al., 2019, 2020).

Study findings revealed that children below the age of five years were prone to ocular allergy. Specifically, toddlers and preschoolers, were more prone to OA and its subtype VKC than infants. This could be explained by toddlers and preschoolers being more active in terms of movement such as crawling, walking, and jumping. They also like to play and explore their surroundings. They are also weaned by the time they are toddlers and introduced to food varieties other than breast milk. These expose them to diverse allergens which can mediate ocular allergic reactions. Foods such as peanuts, pineapple, rice, cereals and vegetables have been shown to induce allergic diseases (Abokyi et al., 2012; Miyazaki et al., 2020).

Additionally, in low and middle income countries, children within the age bracket of 12 to 59 months are usually with their mothers in the kitchen during cooking hours. These children become exposed to household air pollution from the use of solid fuels which are predominantly used (Onakomaiya et al., 2019). In a study conducted in Gondar city, Ethiopia, the use of kerosene or firewood for cooking was significantly associated with VKC (Hayilu et al., 2016).

In Ghana, 70% of the population use either wood or charcoal as their cooking fuel (Ghana Demograhic and Health Survey, 2014). Solid fuel produce several air pollutants which significantly serve as risk factors of ocular allergic inflammatory conditions (Miyazaki et al., 2019; West et al., 2013).

5.7 Limitations of the Study

Limitations of this study included that, six medical folders could not be retrieved and hence were not reviewed and certain variables such as weight, height, and practices of caregivers towards ocular allergy management prior to hospital attendance which could have been vital for data analysis were not recorded in medical folders. Also, due to the COVID-19 pandemic and its associated restrictions, a community-based cross sectional study which was preferred was substituted with a hospital-based retrospective study.

The contributions of this present study are an estimation of the facility based burden of OA among children aged under five years, creating community awareness about the condition in the study population, and educating community members, parents, and caregivers about how to identify signs and symptoms of OA and seek appropriate eye care for their children.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

In this study, the burden of ocular allergy among children aged below five years was high and it was more evident in toddlers and preschoolers. More than a quarter of the ocular allergy cases were of the VKC type, which can cause moderate to severe visual impairment. This poses a public health concern among children.

The most common ocular complaint recorded for children in this study was ocular itching. On the average, children experienced the signs and symptoms of ocular allergy for at least 5 months before their caregivers sent them to the clinic for eye care and in some cases caregivers waited as long as 4 years. This suggests the poor eye care seeking behavior of parents or caregivers towards their children with ocular allergy. This can lead to other ocular complications with subsequent visual impairment. Other major complaints recorded were redness of the eye, tearing, mucoid discharge and rubbing of the eyes. In line with standard practice, mast cell stabilizers were used as first line management for children diagnosed with ocular allergy.

Even though other studies found a significant association between sex and ocular allergy, this study found otherwise.

6.2 Recommendations

1. Hospitals and other health care facilities should include eye examination as part of child welfare clinics. This will help identify cases of ocular allergy and other sight threatening eye conditions in children aged under five years.

2. The Ghana Health Service and the District Hospital Staff should engage in more community outreaches to create awareness on the burden of ocular allergy in children and its implication on the visual outcome and quality of life of children. This is to enhance early care seeking behavior of caregivers for their children.
3. There is a need for studies by research institutions into caregiver factors and environmental factors that may serve as risk factors for ocular allergy in children aged under five years in Ghana.

REFERENCES

Abokyi, S., Koffuor, G. A., Ntodie, M., Kyei, S., & Gyanfosu, L. (2012). Epidemiological profile and pharmacological management of allergic conjunctivitis : A study in Ghana. *Int J Pharm Biomed Res*, *3*(4), 195–201.

Ahmed, S. ., Ahmed, K. E. G., El Morsy, O., & Soliman, S. (2019). Epidemiology of Vernal Keratoconjunctivitis (VKC) among children aged (12–15) years - Menofia Governorate, Egypt. *Delta Journal of Ophthalmology*, *20*(1), 1. https://doi.org/10.4103/djo.djo_42_18

Al-Akily, S. A., & Bamashmus, M. A. (2011). Ocular complications of severe vernal keratoconjunctivitis (VKC) in Yemen. *Saudi Journal of Ophthalmology*, *25*(3), 291–294. https://doi.org/10.1016/j.sjopt.2011.02.001

Alabi, A. S., Aribaba, O. T., Alabi, A. O., Ilo, O., Onakoya, A. O., & Akinsola, F. B. (2018). *Visual Impairment and Ocular Morbidities among Schoolchildren in Southwest , Nigeria*. 3–8. https://doi.org/10.4103/npmj.npmj

Alemayehu, A. M., Yibekal, B. T., & Fekadu, S. A. (2019). Prevalence of vernal keratoconjunctivitis and its associated factors among children in Gambella town, southwest Ethiopia, June 2018. *PLoS ONE*, *14*(4), 1–12. https://doi.org/10.1371/journal.pone.0215528

Alrasheed, S. H., Naidoo, K. S., & Clarke-Farr, P. C. (2016). Childhood eye care services in South Darfur State of Sudan: Learner and parent perspectives. *African Vision and Eye Health*, *75*(1), 1–13. https://doi.org/10.4102/aveh.v75i1.315

Amare, D. (2015). Mothers'' Attitude Towards Childhood Diarrhea Management and Prevention in Under Five Children in Fenote Selam Town, West Gojjam, Amhara, Northwest Ethiopia. *Science Journal of Public Health*, *3*(3), 398.

https://doi.org/10.11648/j.sjph.20150303.25

Amiebenomo, O., Achugwo, D., & Abah, I. (2016). Parental knowledge and attitude to children's eye care services. *Nigerian Journal of Paediatrics*, *43*(3), 215. https://doi.org/10.4314/njp.v43i3.11

Arif, A. S., Aaqil, B., Siddiqui, A., Nazneen, Z., & Farooq, U. (2017). Corneal Complications And Visual Impairment In Vernal Keratoconjunctivitis Patients. *Journal of Ayub Medical College, Abbottabad : JAMC*, *29*(1), 58–60.

Benoit, K., Windinpsidi, S. P., Tieba, M., Adama, S., Seni, K., & Blaise, S. (2019). Exposure to Conditions of High Concentrations of Indoor Air Pollutants and Prevalence of ARIs in Children under 5 Years of Age , in Ouagadougou / Burkina Faso. *J Environ Sci Public Health:* 3(3), 298–314. https://doi.org/10.26502/jesph.96120065

Bielory, L. (2013). Increasing the knowledge base of ocular allergy epidemiology. *J Pediatr (Rio J) 89*(4), 4–5. https://dx.doi.org/10.1016/j.jped.2013.01.001

Bielory, L., Delgado, L., Katelaris, C. H., Leonardi, A., Rosario, N., & Vichyanoud, P. (2020). ICON: Diagnosis and management of allergic conjunctivitis. *Annals of Allergy, Asthma & Immunology*, *124*(2), 118–134. https://doi.org/10.1016/J.ANAI.2019.11.014

Bielory, L., & Friedlaender, M. H. (2008). Allergic Conjunctivitis. *Immunology and Allergy Clinics of North America*, *28*(1), 43–58. https://doi.org/10.1016/j.iac.2007.12.005

Bielory, L., Meltzer, E. O., Nichols, K. K., Melton, R., Thomas, R. K., & Bartlett, J. D. (2013). An algorithm for the management of allergic conjunctivitis. *Allergy and Asthma Proceedings*, *35*(5), 408–420. https://doi.org/10.2500/aap.2013.34.3695

Bilkhu, P. S., Wolffsohn, J. S., Naroo, S. A., Robertson, L., & Kennedy, R. (2014). Effectiveness of Nonpharmacologic Treatments for Acute Seasonal Allergic

Conjunctivitis. *Ophthalmology*, *121*(1), 72–78. https://doi.org/10.1016/j.ophtha.2013.08.007

Bore, M, Ilako, R., Kariuki, M., & Nzinga, J. (2014). Clinical evaluation criteria of ocular allergy by ophthalmologists in Kenya and suggested grading systems. *Joecsa*, *18*(1), 35–43.

Bore, Millicent. (2016). Managing ocular allergy in resource-poor settings. *Community Eye Health Journal:* 29(95), 47–49.

Bremond-Gignac, D., Donadieu, J., Leonardi, A., Pouliquen, P., Doan, S., Chiambarretta, F., … Aymé, S. (2008). Prevalence of vernal keratoconjunctivitis: A rare disease? *British Journal of Ophthalmology*, *92*(8), 1097–1102. https://doi.org/10.1136/bjo.2007.117812

Cinar, Y., Fakultesi, T., & Hastaliklari, G. (2013). Effects of vernal and allergic conjunctivitis on severity of keratoconus. *Int J Ophthalmol*;6(3):370-37 https://doi.org/10.3980/j.issn.2222-3959.2013.03.21

Courtright, P., Hutchinson, A. K., & Lewallen, S. (2014). Visual impairment in children in middle- and lower ? income countries. *Arch Dis Child* . https://doi.org/10.1136/archdischild-2011-300093

Davis, S. (2015). Topical treatment options for allergic conjunctivitis. *South African Family Practice*; *57*(4), 10–15.

De Smedt, S. K., Nkurikiye, J., Fonteyne, Y. S., Tuft, S. J., Gilbert, C. E., & Kestelyn, P. (2012). Vernal Keratoconjunctivitis in School Children in Rwanda. *Ophthalmology*; 119:1766–1772. https://doi.org/10.1016/j.ophtha.2012.03.041

De Smedt, S., Nkurikiye, J., Fonteyne, Y., Hogewoning, A., Van Esbroeck, M., De Bacquer, D., … Kestelyn, P. (2011). Vernal keratoconjunctivitis in school children in Rwanda and

its association with socio-economic status: A population-based survey. *American Journal of Tropical Medicine and Hygiene*, *85*(4), 711–717. https://doi.org/10.4269/ajtmh.2011.11-0291

Duke, R. E., Egbula, E., & Smedt, S. De. (2017). Clinical features of vernal keratoconjunctivitis: A population study of primary school children in Nigeria. *Journal of Epidemiological Research*, *3*(2), 44. https://doi.org/10.5430/jer.v3n2p44

Duke, R. E., Odey, F., & De Smedt, S. (2016). Vernal Keratoconjunctivitis in Public Primary School Children in Nigeria: Prevalence and Nomenclature. *Epidemiology Research International*, *2016*, 1–6. https://doi.org/10.1155/2016/9854062

Dupuis, P., Prokopich, C. L., Hynes, A., & Kim, H. (2020). A contemporary look at allergic conjunctivitis. *Allergy, Asthma & Clinical Immunology*. https://doi.org/10.1186/s13223-020-0403-9

Ebeigbe, J. A. (2018). Factors influencing eye-care seeking behaviour of parents for their children in Nigeria. *Clinical and Experimental Optometry*, *101*(4), 560–564. https://doi.org/10.1111/cxo.12506

Fasasi, M. K., Abdul Kabr, A.A., Hamza, B.A., Richard, A.I., Sadiat, S.E., & Abdulfattah, I. (2014). Allergic conjunctivitis in a tertiary eye hospital , Nigeria. *Journal of Kathmandu Medical College*. *3*(4), 149–152.

Fisal, N., & Agha, S. (2020). Conjunctivitis among Rural and Urban School Children in Erbil Governorate/Iraq. *Diyala Journal of Medicine*. *18*(1), 58–69. https://doi.org/10.26505/DJM.18014850804

GSS; GHS; ICF International. (2015). Ghana demographic health survey. *Demographic and Health Survey 2014*, 530. https://doi.org/10.15171/ijhpm.2016.42

Hayilu, D., Legesse, K., Lakachew, N., & Asferaw, M. (2016). Prevalence and associated factors of vernal keratoconjunctivitis among children in Gondar city, Northwest Ethiopia. *BMC Ophthalmology*, *16*(1), 4–9. https://doi.org/10.1186/s12886-016-0345-7

Hom, M. M., Nguyen, A. L., & Bielory, L. (2012). Allergic conjunctivitis and dry eye syndrome. *ANAI*, *108*(3), 163–166. https://doi.org/10.1016/j.anai.2012.01.006

Hong, J., Zhong, T., Li, H., Xu, J., Ye, X., Mu, Z., & Lu, Y. (2016). Ambient air pollution , weather changes , and outpatient visits for allergic conjunctivitis : A retrospective registry study. *Nature Publishing Group*, (April), 1–8. https://doi.org/10.1038/srep23858

Kahol, P., Thakur, M., Gupta, A., & Saini, S. K. (2019). Prevalence, morbidity and treatment seeking behavior for allergic conjunctivitis in children in a North Indian community. *Clinical Epidemiology and Global Health*, *7*(2), 239–245. https://doi.org/10.1016/j.cegh.2018.07.001

Kari, O., & Saari, K. M. (2010). Updates in the treatment of ocular allergies. *Journal of Asthma and Allergy*. 2010:3, 149–158. https://doi.org/10.2147/JAA.S13705

Kari, O., & Saari, K. M. (2014). Diagnostics and New Developments in the Treatment of Ocular Allergies. *Curr Allergy Asthma Rep (2012)* 12:232–239. https:// doi.org/ 10.1007/s11882-012-0252-9

Katelaris Constance H. (2011). Ocular allergy in the Asia Pacific region. *Asia Pacific Allergy*, *1*(3), 108–114. https://doi.org/10.5415/apallergy.2012.2.3.210

Kim, H. Y., Kwon, E. B., Baek, J. H., Shin, Y. H., Yum, H. Y., Jee, H. M., … Han, M. Y. (2013). Prevalence and comorbidity of allergic diseases in preschool children. *Korean Journal of Pediatrics*, *56*(8), 338–342. https://doi.org/10.3345/kjp.2013.56.8.338

Komi, D. E. A. (2018). Clinical implications of mast cell involvement in allergic

conjunctivitis. *Allergy*. 2018; 73: 528–539. https://doi.org/10.1111/all.13334

Krishna, C. (2019). A Cross-sectional Study of Refractive Errors in Vernal Keratoconjunctivitis A Cross-sectional Study of Refractive Errors in Vernal. *Opthalmology and Allied Sciences*. 2019; 4(2): 60-65. https://doi.org/10.21088/oas.2454.7816.4218.1

Kubaisi, B., Samra, K. A., & Syeda, S. (2017). Ocular Allergy : an Updated Review. *Journal of Allergy and Immunology Ocular Allergy*. 2017; 1:002 .

Kumah, D. Ben. (2017). Knowledge of Childhood Blindness among Mothers Visiting a Children's Hospital in the Kumasi Metropolis, Ghana. *Advances in Ophthalmology & Visual System*, *7*(3), 3–7. https://doi.org/10.15406/aovs.2017.07.00221

Kumah, D. Ben, Lartey, S. Y., Yemanyi, F., Boateng, E. G., & Awuah, E. (2015). Prevalence of allergic conjunctivitis among basic school children in the Kumasi Metropolis (Ghana): A community-based cross-sectional study. *BMC Ophthalmology*, *15*(1), 1–5. https://doi.org/10.1186/s12886-015-0053-8

Kyei, S. (2018). Ocular allergy: An underestimated disorder of the 21st century. *Current Allergy and Clinical Immunology*, *31*(3), 170–177.

Kyei, S., Tettey, B., Asiedu, K., & Awuah, A. (2016). Knowledge and awareness of ocular allergy among undergraduate students of public universities in Ghana. *BMC Ophthalmology*, *16*(1), 1–8. https://doi.org/10.1186/s12886-016-0366-2

La Rosa, M., Lionetti, E., Reibaldi, M., Russo, A., Longo, A., Leonardi, S., … Reibaldi, A. (2013). Allergic conjunctivitis: A comprehensive review of the literature. *Italian Journal of Pediatrics*, *39*(1), 1–8. https://doi.org/10.1186/1824-7288-39-18

Łatka, P., Nowakowska, D., Nowomiejska, K., & Rejdak, R. (2018). How air pollution

affects the eyes — a review. *Ophthalmol J*. 2018; 3(2): 58–62. https://doi.org/10.5603/OJ.2018.0032

Leonardi, A, Bogacka, E., Fauquert, J. L., Kowalski, M. L., & Groblewska, A. (2012). Ocular allergy : recognizing and diagnosing hypersensitivity disorders of the ocular surface. *Allergy*. 2012; 67: 1327–1337. https://doi.org/10.1111/all.12009

Leonardi, A, Calder, V., Rondon, F. M. C., & Hellings, M. J. P. (2017). Diagnostic tools in ocular allergy. *Allergy*. 2017;72:1485–1498. https://doi.org/10.1111/all.13178

Leonardi, Andrea, Kowalski, M. L., Silva, D., Perez, D., Bozkurt, B., Calder, V., … Rondon, C. (2019). Management of ocular allergy. *Allergy*;74:1611–1630. https://doi.org/10.1111/all.13786

Mafwiri, M. M., Kisenge, R., & Gilbert, C. E. (2014). A pilot study to evaluate incorporating eye care for children into reproductive and child health services in Dar-es-Salaam, Tanzania: A historical comparison study. *BMC Nursing*, *13*(1), 1–11. https://doi.org/10.1186/1472-6955-13-15

Malu, K. (2014). Allergic conjunctivitis in Jos-Nigeria. *Nigerian Medical Journal*, *55*(2), 166. https://doi.org/10.4103/0300-1652.129664

Marey, H. M., Mandour, S. S., El Morsy, O. A., Farahat, H. G., & Shokry, S. M. (2017). Impact of Vernal Keratoconjunctivitis on School Children in Egypt. *Seminars in Ophthalmology*, *32*(5), 543–549. https://doi.org/10.3109/08820538.2015.1123737

Mashige, K. P. (2015). A review of the management of ocular allergy. *Current Allergy and Clinical Immunology*; *28*(4), 275–281.

Mashige, Khathutshelo Percy. (2017). Ocular allergy. *Health SA Gesondheid*; *22*: 112–122. https://doi.org/10.1016/j.hsag.2016.07.001

Miyazaki, D., Fukagawa, K., Fukushima, A., Fujishima, H., Uchio, E., Ebihara, N., … Inoue, Y. (2019). Air pollution significantly associated with severe ocular allergic inflammatory diseases. *Scientific Reports*, *9*(1), 1–9. https://doi.org/10.1038/s41598-019-54841-4

Miyazaki, D., Fukagawa, K., Okamoto, S., & Fukushima, A. (2020). Allergology International Epidemiological aspects of allergic conjunctivitis. *Allergology International*, *69*(4), 487–495. https://doi.org/10.1016/j.alit.2020.06.004

Mugho, S. (2016). Prevalence of Keratoconus in Patients With Allergic Conjunctivitis Attending Kenyatta National Hospital Eye Clinic.

Naggalakshmi, V.S., Mishra, P., Manavalan, S., Sridevi, V., Dineshbabu, G., Ramya, M., Manalil, A.G., & Rana, P. (2014). Vernal Keratoconjuctivitis: a Review. *Journal of Evolution of Medical and Dental Sciences*, *3*(54), 12477–12486. https://doi.org/10.14260/jemds/2014/3650

Onakomaiya, D., Gyamfi, J., Iwelunmor, J., Opeyemi, J., Oluwasanmi, M., Obiezu-Umeh, C., … Olopade, C. (2019, May 1). Implementation of clean cookstove interventions and its effects on blood pressure in low-income and middle-income countries: Systematic review. *BMJ Open*, Vol. 9. https://doi.org/10.1136/bmjopen-2018-026517

Patel, D. S., Arunakirinathan, M., Stuart, A., & Angunawela, R. (2017). *Allergic eye disease*. *4706*, 1–11. https://doi.org/10.1136/bmj.j4706

Ramai, D., & Pulisetty, T. (2013). Maternal And Caregiver Perceptions To Childhood Eye Care In Ghana. *Internet Journal of Epidemiology*, *11*(1), 1. https://doi.org/10.5580/IJE.1588

Rosario, N., & Bielory, L. (2011). Epidemiology of allergic conjunctivitis. *Current Opinion*

in Allergy and Clinical Immunology, *11*(5), 471–476. https://doi.org/10.1097/ACI.0b013e32834a9676

Saboo, U. S., Jain, M., Reddy, J. C., & Sangwan, V. S. (2013). Demographic and clinical profile of vernal keratoconjunctivitis at a tertiary eye care center in India. *Indian Journal of Ophthalmology*, *61*(9), 486–489. https://doi.org/10.4103/0301-4738.119431

Senyonjo, L., Lindfield, R., Mahmoud, A., Kimani, K., Sanda, S., & Schmidt, E. (2014). Ocular morbidity and health seeking behaviour in Kwara State, Nigeria: Implications for delivery of eye care services. *PLoS ONE*, *9*(8). https://doi.org/10.1371/journal.pone.0104128

Singh, K., Axelrod, S., & Bielory, L. (2010). The epidemiology of ocular and nasal allergy in the United States, 1988-1994. *Journal of Allergy and Clinical Immunology*, *126*(4), 778-783.e6. https://doi.org/10.1016/j.jaci.2010.06.050

Sinha, A., & Dulani, S. (2017). Pattern of pediatric ocular morbidity in tertiary care eye hospital of central India. *Indian Journal of Clinical and Experimental Ophthalmology*, 3(3), 282-286. https://doi.org/10.18231/2395-1451.2017.0070

Sukati, V. N., Moodley, V. R., & Mashige, K. P. (2018). Knowledge and practices of parents about child eye health care in the public sector in Swaziland. *African Journal of Primary Health Care & Family Medicine*, *10*(1), e1–e13. https://doi.org/10.4102/phcfm.v10i1.1808

Sushil, O., Jain, V., Ranjan, R., Reena, S., Singh, B., & Shukla, D. (2015). Profile of vernal keratoconjuctivitis in paediatric age group in central India. *Indian Journal of Clinical and Experimental Ophthalmology*, *1*(4), 228. https://doi.org/10.5958/2395-

1451.2015.00019.0

Théra, J., Hughes, D., Tinley, C., Bamani, S., Traoré, L., & Traoré, J. (2016). Original Research Article Magnitude of vernal kerato conjunctivitis among school children in Koulikoro. *Sch. J. App. Med. Sci.*; *4:*180–182.

Vally, M., & Irhuma, M. O. E. (2017). Allergic Conjunctivitis. *South African Family Practice*; *59*(5): 5–9.

Villani, E., Rabbiolo, G., & Nucci, P. (2018). Ocular allergy as a risk factor for dry eye in adults and children. *Curr Opin Allergy Clin Immunol*. 18(5), 398–403. https://doi.org/10.1097/ACI.0000000000000471

Wade, P. D., Iwuora, A. N., Lopez, L., & Muhammad, M. A. (2012). Allergic conjunctivitis at Sheikh Zayed regional eye care center, Gambia. *Journal of Ophthalmic and Vision Research*, *7*(1), 24–28.

West, S. K., Bates, M. N., Lee, J. S., Schaumberg, D. A., Lee, D. J., Adair-rohani, H., … Araj, H. (2013). Is Household Air Pollution a Risk Factor for Eye Disease ? *Int. J. Environ. Res. Public Health*; 10:5378–5398. https://doi.org/10.3390/ijerph10115378

Yadav, V. (2019). Impact of Environmental Factors on Eye Health. *Mediterranean Journal of Basic and Applied Sciences (MJBAS)*. *3*(4), 37–46.

Zubair, M. (2017). Vernal Kerato-conjunctivitis , Clinical & Demographic Patterns. *Ophthalmology Update*; 15(3): 343-346

Appendix A: Abstraction Form

HOSPITAL MEDICAL RECORD ABSTRACTION FORM

Date of abstraction

____ ____/____ ____/____ ____

D D M M Y Y

Abstractor's initials

____ ____ ____ ____

SECTION A: PATIENT DEMOGRAPHICS

A1. Patient's Medical Record Number (**MRN**):

A2. Date of birth (**DOB**) _ _ /_ _ /_ _

D M Y

A3. Date of attendance (**DOA**) _ _ /_ _ /____

D M Y

A4. Age (in months)…….

A5. Sex M/F…….

A6. Weight (Kg)……

A7. Location……

B. MEDICAL HISTORY

B1. Presenting complaints (**PC**)……

B2. History of presenting complaints (**HPC**)……

B3. On direct Questions (**DQ**)……

B4. Patient ocular history (**POH**)……

B5. Patient medical history (**PMHx**)……

B6. Family ocular history (**FOHx**)……

B7. Family medical history (**FMHx**)……

B8. Allergies……

C. OCULAR FINDINGS

C1. Visual acuity (**VA**) RE…… LE ……

C2. Clinical presentation (**CP**)……

……

……..

……

C3. Diagnosis (**Dx**) 1…….

2……

3…….

C4. Management (**Mgt**) 1…….

2……

3……

C5. Number of reviews attended within the first 3 months after initial diagnosis (**NOR**)……

Appendix B: Permission to conduct the study

NATIONAL CATHOLIC HEALTH SERVICE
Cape Coast Archdiocesan Health Directorate

Tel: 233-558-338-460/233-243-508-830
Email: ourladyofgrace@gmail.com
olgh@.nchs.org.gh

Our Lady of Grace Hospital
P. O. Box 3
Breman - Asikuma – C/R

Our Ref:

Your Ref:

26th October, 2020

THE HEAD OF DEPARTMENT
DEPARTMENT OF POPULATION, FAMILY AND REPRODUCTION HEALTH
UNIVERSITY OF GHANA

DEAR SIR /MADAM,

APPROVAL LETTER

With reference to your letter dated 5th May, 2020, I write to grant your student BISMARK NYARKO GYEDU, official permission to conduct his research on the topic "Prevalence of ocular allergy and management patterns in children less than five years at Our Lady of Grace Hospital".

As an institutional requirement, we would want him to submit a copy of the research findings so it can guide us in clinical practice.

Counting on your co-operation.

Yours faithfully,

Dr. Joachim Bruku Eshun (PhD.)

(Health Service Administrator)

MOTTO: IN GOD IS OUR HELP AND HEALTH

Appendix C: Ocular conditions in children aged under five years

DIAGNOSIS	FREQ	PREVALENCE
Ocular Allergy	337	41.4%
B Conjunctivitis	277	34.0%
Neonatal Conjunctivitis	54	6.7%
Ophthalmia Neonatorum	14	1.7%
Preseptal Cellulitis	10	1.2%
Cataract	9	1.1%
Hyposphagma	8	1.0%
Ulcerative Keratitis	8	1.0%
Acute Haemorrhagic Conjunctivitis	7	0.9%
Alternating Esotropia	5	0.6%
Blepharitis	6	0.7%
Congenital Cataract	5	0.6%
Periorbital Cellulitis	5	0.6%
Traumatic Conjunctivitis	5	0.6%
Congenital Glaucoma	4	0.5%
Retinoblastoma	4	0.5%
Cornea Foreign Body	2	0.3%
Corneal Laceration	1	0.1%
Corneal Scar	2	0.3%
Normal Eye	3	0.4%
Anterior Blepharitis	2	0.3%
Chalazion	2	0.3%
Chemical Conjunctivitis	2	0.3%
Conjunctival Foreign Body	2	0.3%
Conjuctival Dermoid Cyst	1	0.1%
Conjunctival Cyst	2	0.3%
Eyelid Cyst	2	0.3%
Secondary Glaucoma	2	0.3%
Uveal Prolapse	2	0.3%
Accommodative Esotropia	1	0.1%
Anterior Staphyloma	1	0.1%
Chemical Injury	1	0.1%
Complicated Cataract	1	0.1%
Congenital Ptosis	1	0.1%
Conjunctivitis	1	0.1%
Cortical Blindness	1	0.1%

DIAGNOSIS	FREQ	PREVALENCE
Epidermoid Cyst	1	0.1%
External Hordeolum	1	0.1%
Intermittent Esotropia	2	0.3%
Maculopathy	1	0.1%
Melanocytoma	1	0.1%
Membraneous Conjunctivitis	1	0.1%
Microphthalmos	1	0.1%
Optic Atrophy	1	0.1%
Orbital Tumour	1	0.1%
Periocular Laceration	1	0.1%
Periorbital Haematoma	1	0.1%
Pseudomembranous Conjunctivitis	1	0.1%
Punctate Keratits	1	0.1%
Refractive Error	1	0.1%
Retinal Detachment	1	0.1%
Subconjunctival Haemorrhage	1	0.1%
Traumatic Cataract	1	0.1%
Traumatic Optic Atrophy	1	0.1%
Total	**814**	**100.0**