PREVALENCE AND FACTORS ASSOCIATED WITH VERNAL KERATOCONJUNCTIVITIS AMONG SCHOOL-GOING LEARNERS BETWEEN THE AGES OF 4 TO 20 YEARS IN THE UMGUNGUNDLOVU DISTRICT

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Submitted in partial fulfillment of the academic requirements for the degree of

Master of Public Health

at the

COLLEGE OF HEALTH SCIENCES

School of Nursing and Public Health

UNIVERSITY OF KWAZULU-NATAL

HOWARD COLLEGE CAMPUS

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December 2023

DECLARATION

I, Bhekizenzo Mncube, declare that:

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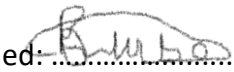
Signed:  Date: 7 December 2023

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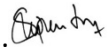
Supervisor: …  …….Date: ……8 December 2023
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DEDICATION

This study is dedicated to all learners suffering from vernal keratoconjunctivitis; their cries for help are also ours as optometrists, striving always to give of our best despite the many challenges.

ACKNOWLEDGEMENTS

I would like to extend my thanks and appreciation to the following people whose invaluable support and contributions have made it possible for me to complete this work:

My sincere thanks to my supervisor Dr Boikhutso Tlou, for his continuous support and guidance throughout the research process.

The KwaZulu-Natal Department of Health for their permission to conduct this research at their facilities.

My gratitude to my colleague Miss R Mosololi, for her time and dedication generously given during this research process.

A special appreciation to my best friend and constant inspiration, Slindile Msane, for her dedication and support throughout this journey.

ABSTRACT

Introduction: Vernal keratoconjunctivitis (VKC) is an allergic external ocular disease characterised by intense itching, hyperaemia, tearing, discharge and photophobia. It occurs bilaterally and can either be tarsal, limbal or in mixed form, is persistent and may cause corneal complications, leading to visual impairment. In sub-Saharan Africa, the prevalence of VKC ranges from 2% to 37%, however, the prevalence of VKC is unknown in South Africa. Risk factors associated with VKC include age, sex, race, environment, climate, exposure to firewood heat and ash particles, exposure to dust, a history of non-ocular allergies, education level, employment status and parental history of ocular and non-ocular allergies. This study will determine the prevalence of, and factors associated with VKC in the uMgungundlovu district of the KwaZulu-Natal province, South Africa.

Study design: A descriptive cross-sectional study was conducted. The study population was school-going learners between the ages of 4 and 20 years in the uMgungundlovu district. Participants were selected from 21 health facilities within the uMgungundlovu district.

Sampling strategy and size: The sample size was estimated using a 95% confidence level, a 5% margin of error, and an estimated population proportion of 50%. A total of 384 participants were required to conduct the study, however, 16 participants were added to account for non-responses and/or withdrawals, making a total of 400 participants. Health facilities were conveniently selected from each sub-municipality within the uMgungundlovu district.

Data collection: Data was collected using a self-administered questionnaire, a visual acuity chart, slit lamp and ophthalmoscope.

Data analysis: Data was entered into Microsoft Excel and imported into SPSS Statistics Package V28 for analysis. A p-value of less than 0.05 was considered statistically significant. A descriptive statistical analysis (means, standard deviations, ranges, frequencies, and percentages) was conducted prior to the inferential analysis. A bivariate analysis using the Chi-square test was conducted between each predictor and outcome variable. All predictor variables found to be significantly associated with the outcome variable ($p<0.05$) were added into the multivariable logistic regression model.

Results: A total of 400 questionnaires were administered to the learners and their parents. There were 255 female participants (63.7%) and 145 (36.3%) male participants with the mean age of 12 years and a standard deviation of 4. The prevalence of VKC was found to be 6% (95%CI: 1.92-1.96),the mixed type being the most common (54.2%). Exposure to firewood ash, heat and smoke was significantly associated with the development of VKC (aOR 24.83, 95%CI: 7.156-86.136, $p<0.01$).

Conclusion: VKC is a public health concern. Strengthening eye health policies to include VKC at primary school level will assist in reducing the effects of VKC.

Keywords: VKC, prevalence, allergies, associated factors, learners, health concern.

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ABBREVIATIONS and ACRONYMS

AKC: Atopic Keratoconjunctivitis

DHIS: District Health Information System

ISHP: Integrated School Health Programme

MDG: Millenium Development Goals

NSAID: Non-Steroids Anti-Inflammatory Drugs

PHC: Primary Health Care

SPSS: Statistical Package for Social Science

VKC: Vernal Keratoconjunctivitis

DEFINITION OF TERMS

Conjunctiva: a thin, clear membrane lining the white part of the eye (sclera) and the inner part of the eyelids.

Cornea: the transparent front part of the eye which accounts for two-thirds of the dioptric power of the eye.

Dust exposure: a minimum of one episode of encounter with environment dust or pollution in the eye that resulted in itching, foreign body sensation or ocular irritation.

Family history of non-ocular allergy: any known allergic diseases that do not involve the eyes, such as asthma, eczema or rhinitis in mother or father, sister and/or brother.

Family history of ocular allergy: any known allergic eye diseases of mother or father, sister and/or brother.

Kerato: of the cornea or related to the cornea.

Limbus: the area where the cornea meets the sclera.

Mixed Vernal Keratoconjunctivitis (VKC) :the combination of both limbal and palpebral VKC symptoms.

Palpebral: of the eyelids or related to the eyelids.

Palpebral Vernal Keratoconjunctivitis: the presence of papillae greater or equal to 1 mm on the palpebral conjunctiva without limbal involvement with itching sensation, discharge, photophobia, redness and tearing.

Sustainable Development Goals: The United Nations agreed upon the sustainable development goals in 2015 as a call-to-action for people all around the world to address the five vital areas of people, planet, prosperity, peace, and partnership by 2030.

Vernal keratoconjunctivitis: the presence of conjunctival papillae greater or equal to 1mm in diameter over the upper tarsal plate and/or limbal hypertrophy with itching sensation, photophobia, discharge, tearing and redness.

CHAPTER 1: INTRODUCTION

1.1 Introduction

Visual impairment is the measurable loss of function of the eye(s) or the vision system which cannot be corrected by any optical or therapeutic means. It can be categorised as mild, moderate, severe and loss of vision, depending on the presenting visual acuity and visual field loss. Approximately 2.2 billion people around the world are afflicted with loss of vision that cannot be corrected [(1)]. Refractive error and clouding of the lens are the leading causes of uncorrectable vision loss, followed by macular degeneration, glaucoma, diabetic retinopathy, corneal opacity and trachoma [(1)]. In South Africa, one in ten people are reported to have loss of vision [(2)]. Corneal opacities together with childhood loss of sight account for four per cent of visual impairment [(3)]. Vernal keratoconjunctivitis (VKC) is among the ocular conditions that interfere with corneal integrity, leading to opacification.

VKC is an allergic, external ocular disease characterised by intense rubbing of the eye, hyperaemia, tearing, discharge, and photophobia, and occurs in both eyes (bilateral) [(4)]. VKC can either be tarsal, limbal or in mixed form. The term 'vernal' is linked to spring and youthfulness, which suggests the condition is more prevalent in children and young adults and is exacerbated during the warmer months of the year. [(5)]. VKC is persistent and can cause corneal complications, leading to visual impairment [(4)]. The disease develops during the first decade of life, subsiding at puberty [(6, 7)]. The etiology of VKC is to date not well understood but is believed to be an immunoglobulin E-mediated process, an interaction between the immune system and hereditary and environmental factors [(6)].

VKC is a worldwide phenomenon with varying incidences. It is more prevalent in Mediterranean areas, South America and Central and West Africa[(7)]. However, it is rare in North America and Europe, more prevalent among young males and is exacerbated in spring and summer [(4, 7, 8)]. In sub-Saharan Africa, the burden of VKC is estimated to be between two to thirty-seven per cent cases among the population at risk,[(9)] while in Europe, the prevalence of VKC was found to be 3.2 per 10000 population in 2013 [(4, 10)]. In 2016 in Ethiopia, the cases of VKC were estimated to be three per cent among the studied population[(7)]. A study conducted in Italy found an association between VKC and atopic manifestations [(27)]. Family

history of non-ocular allergies such as asthma and eczema was associated with VKC in a study conducted in Egypt [19]. A strong association was found between socioeconomic factors and VKC in studies conducted in Rwanda, Nigeria and India [9, 22, 58]. In addition, males are two to four times more likely to develop VKC [42, 48, 49, 53].Moreover, exposure to firewood heat and smoke was associated with VKC [16]. To date, no prevalence studies of VKC have been conducted in South Africa. If left without medical intervention, VKC can lead to corneal scarring, ptosis, astigmatism, keratoconus and loss of sight [4]. The differential diagnosis of vernal keratoconjunctivitis includes atopic keratoconjunctivitis (AKC) and contact lens papillary conjunctivitis [11]. This condition often results in children missing school days and/or sleeping in class, which invariably impacts on their school performance [12].

The management of VKC varies from one practitioner to another due to the lack of standardised treatment protocols [13]. Currently, VKC treatment aims at reducing ocular symptoms and preventing corneal complications. Treatment options include the use of antihistamines, vasoconstrictors, mast cell stabilisers, non-steroid anti-inflammatory drugs (NSAIDs) and steroids [4, 14]. These could be used as monotherapy (antihistamines or mast cell stabilisers only) or as dual-acting agents (the use of antihistamines combined with mast cell stabilisers) depending on the severity of the condition as outlined in the grading scale of Bonini et al. [15] Steroids are reserved for severe cases of VKC and must be used with caution because of their ability to cause complications such as cataracts and glaucoma [13].

1.2 Problem statement

VKC accounts for twenty-one per cent of general eye consultations in sub-Saharan Africa [9]. Moreover, the prevalence of VKC ranges from two to thirty-seven per cent in sub-Saharan Africa and is a major contributor of hospital referrals [5, 9]. The prevalence of VKC was found to be 3% in Egypt, 11% in Ethiopia and 18% in Nigeria [4, 16, 17]. According to our literature search, we could not find any research conducted in South Africa to assess the prevalence of VKC, but in other sub-Saharan African countries which shows that VKC is more common among school-going learners, particularly in rural areas [18, 19]. According to the state of education report in KwaZulu-Natal in 2010, the uMgungundlovu district municipality had seven sub-district municipalities and a total number of 219 807 learners in all grades in the Integrated School Health Programme (ISHP) with a population of 1 095 865 reported by the municipalities

of South Africa [20, 59]. It was noted with concern in the ISHP that some learners were troubled by VKC without receiving any therapeutic help [18]. This is either because clinics are situated far from the school or home, or because the relevant eye drops are not available in the essential drug list of the clinic. This information is based on patient responses when asked why they did not have medication for VKC, since no research has been conducted on this issue. Moreover, treatment for the more severe form of VKC is not available at primary health care clinics (PHC) in South Africa, which requires that patients be referred to either regional or district hospitals. While school health teams mainly focus on minor illnesses, vaccinations and deworming, eye conditions may be overlooked in these predominantly rural settings. The number of VKC cases in the South African population are not known, particularly in the rural settings. This study intends to establish the groundwork to provide basic information on the burden of VKC among school-aged learners and the treatment options available in rural South African settings.

1.3 Significance of the study

The study seeks to determine the prevalence and factors associated with VKC in the uMgungundlovu district, KZN. This will assist policymakers to advocate for the appropriate intervention for the management of VKC in children residing in the rural communities. Moreover, this study will assist in improving strategies to ensure healthy lives, promote well-being and life-long learning opportunities for everyone irrespective of age, and ensure inclusive and equitable quality education as part of the realisation of the Sustainable Development Goals for 2030. The United Nations agreed on the sustainable development goals in 2015 as a call-to-action for people all around the world to address the five vital areas of people, planet, prosperity, peace, and partnership by 2030 [62].

1.4 Research question

What are the prevalence and factors associated with vernal keratoconjunctivitis amongst learners in the uMgungundlovu district schools?

1.5 Aim of the study

To assess the prevalence and factors associated with VKC among learners between the ages of four to twenty years in the uMgungundlovu district.

1.6 Objectives of the study

- To determine the prevalence of VKC among learners between the ages of four to twenty years in the uMgungundlovu district.
- To determine the factors associated with VKC.

1.7 Chapter overview

This study consists of five chapters outlined as follows:

Chapter 1 provides the introduction and background to the study, offering insight into the prevalence and factors associated with VKC in the South African context, particularly in the rural areas of KZN. The chapter discussed the research problem, research question, aim and objectives of the study and its significance.

Chapter 2 outlines the literature reviewed pertaining to discourses on vernal keratoconjunctivitis amongst learners and include discussions on current literature related to the context of the study in SA and globally.

Chapter 3 provides an account of the overall research design, data gathering instruments, data gathering processes, data management and the trustworthiness of the study. It addresses the methodology and the theoretical framework, the study design, study population, sampling method, data collection and analysis.

Chapter 4 presents the study findings in manuscript format and discusses the results inclusive of tables and figures.

Chapter 5 synthesises the study and presents the conclusions regarding the study findings and provides recommendations for further studies, including the limitations.

Chapter 2: LITERATURE REVIEW

2.1 Introduction

This chapter reviewed studies conducted by various scholars on the prevalence of VKC and its associated factors. The literature was sourced from Google Scholar and PubMed from 2010 to 2023. The keywords vernal keratoconjunctivitis, prevalence, and associated factors were used to search the databases.

2.2 The burden of VKC

2.2.1 The global burden of VKC

VKC is a worldwide public health concern with varying occurrences [4, 7]. In Europe, the proportion of the population with VKC is estimated to be between 1.2–10.6 per 10000 population, with Norway having the lowest prevalence of 1.9 and Italy with the highest prevalence of 27.8 per 10000 population [10].

In a hospital-based study conducted in the Gaza Strip, Palestine, in 2012, the prevalence of VKC was found to be seven per cent. Mixed VKC was the most common type diagnosed in 44.5% of the patients, followed by limbal VKC (36.4%) and palpebral VKC (18.2%). The most affected patients in this study (58.5%), were males. Tests conducted for screening and diagnosis of VKC included visual acuity, a dilated fundus examination, pressure within the eye and a slit lamp biomicroscopy [8]. In a cross-sectional study conducted in north Bangalore, India in 2014 to evaluate the proportion of the population with VKC and clinical pattern of VKC, the proportion of VKC cases was eighteen per cent. A questionnaire on VKC-related symptoms was employed together with a visual acuity chart, slit lamp and a posterior segment examination. Similar to the findings of the said Gaza Strip study [8], mixed VKC was the most common type (62%) seen in patients [21].

Studies conducted on VKC showed that its prevalence varied from one area to another. This may have been due to the fact that VKC is more common in hot, dry and windy environments. [22, 23]. Most of the studies were conducted during the spring and summer seasons, where high temperatures exacerbated the symptoms. In addition, the differences in prevalence could have been due to the methodology selected in each study, for example, community-based versus school-based studies. School-based studies tended to underestimate results compared

to community-based studies [24, 25]. A reason for this may have been that many preventative and intervention programmes implemented at schools were mostly concerned with improving health indicators for their learners [26]. Moreover, mixed VKC was the most prevalent in these studies. This might be ascribed to the fact that patients presented themselves at the clinic belatedly, when the VKC had already progressed into the mixed type [27, 28]. Most of the studies were in agreement with the male sex being the risk factor associated with the development of VKC. This could be due to hormonal factors involved in the pathogenesis of VKC [16, 29]. Personal and family history of allergies also played a role in the development of VKC due to the similarities in the immunopathology with VKC, which ultimately led to inflammatory mediators released in the conjunctiva, a probable cause of VKC [23, 30].

2.2.2 The burden of VKC in sub-Saharan Africa

In Africa, Asia and the Middle East VKC accounted for the most hospital referrals among children and accounted for twenty-one per cent of eye clinic consultations in Africa [9]. The prevalence of VKC in Africa varied between two and thirty-seven per cent [9]. The prevalence of VKC was found to be 3% in Egypt, 11% in Ethiopia and 18% in Nigeria [4, 16, 17].

In a cross-sectional study design conducted in Gondar City, northwest Ethiopia in 2016 to assess the prevalence and factors associated with VKC among children under eighteen years of age, 737 children participated in the study. Eye examinations were conducted using a magnifying loop (3x), a penlight torch, a pretest and a structured questionnaire. The study found a VKC prevalence of 5.8% with 81.4% being of the mixed type [7]. This prevalence was higher than that reported in Europe (3.2 per 10000) [10] but was less than that found in Gambela, southwest Ethiopia (11.1%) [16]. This could be because of different hormonal, hereditary and environmental factors that contributed to the development of VKC [13]. Seeking help after the fact may have led to the progression of VKC into the mixed type and hence presented as the most common type [28].

In addition, a case-control study by De Smedt et al. in 2012 studied VKC among schoolchildren in Rwanda where the researchers investigated the clinical presentation and the effects that VKC had on school attendance and the availability of health care. Interviews were conducted with both children and parents using questionnaires related to VKC. The duration and seasonal variation of the disease and educational progress were recorded. Eye examinations were conducted using the LogMar E chart, an auto keratometer and a portable slit lamp. VKC

was then diagnosed using the system for Akpek et al. [32] and standard photographs. Of the 3041 children examined, 121 had VKC and 98.4% of these cases were limbal VKC. This prevalence was consistent with the studies conducted in Egypt (3.3%) and central Ethiopia (5.2%); and possibly because all these studies were school-based. Hormonal variation and hereditary factors may have been the cause for the limbal type of VKC to be the most common [13]. A further 36.4% of children reported missing school for one or more days due to VKC. However, reduced vision was not provided as a reason for missing school. Repeating classes and dropping out of school made no significant difference amongst children with VKC and the case control studies. Concerning seeking medical care, 44.6% of the children with this condition had sought medical intervention and children with educated parents were more likely to access medical eye care [18].

Moreover, another study by De Smedt et al. in 2011 set out to evaluate the prevalence of VKC and its association with living standards in central Africa. A case control study involving 3057 children was conducted in two districts with a dry, hot climate (urban and rural) and two districts with a humid, moderate climate (also urban and rural). The children and their parents and/or guardians were interviewed regarding their socio-economic status, demography, environmental factors and symptoms of VKC. The Living Standards Measurement study method (LSMS) initiated by the World Bank was employed to evaluate the socioeconomic status. Monthly expenditures, the value of the family house, the occupation of the head of the household and the higher educational levels of the household were examined. The results revealed a prevalence of VKC of four per cent, and 32.2% of cases were severe [9]. This prevalence was lower than that reported in Nigeria [17] and was possibly due to Nigerian studies including Grade 0 VKC. In agreement with the study conducted in Rwanda [18], limbal VKC was the most prevalent type here.

In a study carried out in Egypt to assess the prevalence of VKC and how it affects schoolchildren, 3076 patients were recruited using a questionnaire for VKC-related symptoms. They were referred to the Shebin El Koom Hospital and the Menoufia University Hospital for an eye examination. The assessments were conducted using cycloplegic refraction, Illiterate C chart, a slit lamp and fluorescence staining. The prevalence of VKC was found to be 3.3%. This was lower than the prevalence reported in India (18%) [21]. The difference in prevalence could have been due to environmental factors and climate change

which had led to the development of VKC. The mixed form of VKC accounted for 69.8% of the cases while tarsal form accounted for 14.3% of cases and limbal VKC accounted for 15.9% of the cases. Similar to the findings of northwest Ethiopia, late presentation and progression of VKC could have been the cause of mixed VKC being the most prevalent. The majority (73.7%) of children with severe VKC reported difficulties in attending school while 71.1% reported problems with concentration. A further 78.9% of severe cases reported difficulties in doing homework. In agreement with the study by De Smedt et al. in 2012[18], repeating classes showed no significant difference in the children with VKC and the control studies. The study also showed that males (69.8%) were more affected than females (30.2%) [4].

A study similar to the one conducted in northwest Ethiopia in 2015[7] was conducted in Gambela, southwest of Ethiopia in 2018. The aim was to determine the proportion of the learners affected by VKC and its associated factors. A systematic, random sampling technique was employed to recruit 574 children between the ages of two to eighteen who had resided in the town for at least six months, to participate in the study. Data collection was conducted by two optometrists and two ophthalmic nurses using questionnaires, a magnifying loop and a torch. The prevalence of VKC was found to be 11.1%, almost double to that found in northwest Ethiopia [7]. Moreover, this prevalence was higher than that reported in the previous studies [4, 9]. This could be because these studies included both temperate and hot areas while the study in Gambela included solely the hot areas of the region, which might have increased the number of VKC cases [16]. In agreement with the previous studies, mixed VKC was the most common type found. This could be due to the belated diagnosis of VKC after it had progressed into mixed type VKC.

The highest prevalence of VKC was reported in 2014 in a study by De Smedt et al. in Nigeria to determine the proportion of VKC cases and systematic naming of VKC in public primary schoolchildren in which 1228 children participated. A multistage sampling technique was employed to select five primary schools. Eye examinations were conducted by an ophthalmic nurse, an optometrist and an ophthalmologist. VKC was found to be 18.1%, the highest prevalence to be reported in any previous studies. According to the researchers, one of the causes of this high prevalence was the inclusion of Grade 0 (quiescent) and Grade 1 (mild) types of VKC. With the new terminology proposed by this study, only a mixed type of VKC could be referred to as VKC [17]. Mixed VKC was the most popular type diagnosed in this study.

In a pilot study conducted in Swaziland in 2019 to assess VKC among the paediatric HIV population, the prevalence of VKC was found to be 9% [33]. This prevalence was higher than that reported in Gondar City, Rwanda, and in Egypt [4, 7, 9]. The possible justification for this could be that the HIV population had a compromised immune system, making them more prone to ocular complications, including allergic conjunctivitis, compared to the HIV-negative population [34]. This study, however, did not assess the factors predisposing one to VKC.

The prevalence of VKC in sub-Saharan Africa varied from one region to another. The differences in prevalence could be due to urbanisation, which has led to an increase in air pollution and health-related conditions [35]. Mixed VKC was the most prevalent type of VKC, which could be due to the time lapse of patients visiting the clinic when VKC had already progressed to the mixed type. This emphasises the importance of early diagnosis and management.

2.2.3 The burden of VKC in South Africa

Despite a thorough search on Google Scholar and PubMed, the author did not find any studies related to the prevalence of VKC, except for the citation of a study by Forrer in 1995, which could not be retrieved [36]. A possible explanation for this gap could be that many health professionals categorise VKC as an ocular allergy, which leads to incorrect estimates and a skewed representation of the true prevalence of VKC [37]. However, Tselane (2020) conducted a case-control study to evaluate the relationship between VKC and the use of firewood in Ekurhuleni, Gauteng Province, South Africa. A perusal of the medical registers from the Ekurhuleni clinics revealed that 55.8% of participants were patients with VKC [38]. In addition, a study conducted at the KZN McCord Provincial Eye Hospital in 2020 found a significant association between VKC and the HIV-positive status [39]. This is in agreement with a study conducted in India which determined that being HIV positive is associated with VKC [40]. Moreover, a study conducted in Swaziland suggested that health professionals caring for HIV-positive patients should be educated on the risk of VKC to prevent loss of vision. [33]

2.2.4 Risk factors associated with VKC

Several factors are associated with VKC. These factors include age, sex, race, environment, climate, exposure to firewood ash and heat, exposure to dust, a history of non-ocular allergies, education status, employment status, and parental history of ocular and non-ocular

allergies. A history of atopy has been reported in approximately seventy-five per cent of the patients, while two-thirds of the patients report a family history of an allergic disorder [41]. Males are more affected by VKC than females [16].

In a retrospective case series study conducted in Italy, a family history of allergy was noted in 45.1% of the 406 VKC patients. Moreover, non-ocular allergies such as eczema (16.3%), asthma (14.6%), urticaria (4.9%) and rhinitis (30.1%) were significantly associated with VKC [42]. Furthermore, a retrospective chart analysis of 468 patients on the characteristics of the population and clinical profile of VKC among patients attending a tertiary eye care centre in India reported that the average age at presentation was twelve years and personal or family history of allergies were noted in five per cent of patients with VKC [43]. In addition, a survey and a multilevel modelling study conducted in Vietnam found that the health of children in impoverished households was poor compared to the more affluent households; the disadvantage was greater in children between the ages of one to three years [44]. In contrast, a study conducted in 2018 revealed that the mother's employment had a negative impact on the child's health [47]. The association of family and personal history of allergies with VKC could be due to the similarities in immunopathology, including IgE molecules fixation on mast cell surfaces which then release inflammatory mediators in the conjunctiva that probably lead to VKC [30,31]. In addition, non-ocular allergies such as eczema, asthma, urticaria and rhinitis are associated with VKC due to common features in the immune response that release histamine and prostaglandins which bring about a type 1 immune reaction [7,45].

Furthermore, a study by De Smedt et al. in 2011 determined the proportion of VKC cases and its association with socio-economic status in central Africa; the risk factors for VKC were found to be socio-economic, male, and a hot, dry climate [9]. In addition, the study conducted in Gambela in southwest Ethiopia in 2018 found that dust exposure and a previous episode of non-ocular allergies were associated with the development of VKC [16]. These studies are in agreement with the studies conducted in Bangalore [21] and Nashik in India [46]. A possible explanation could be that dust particles can hide inflammatory particles which can cause inflammation when these reach the ocular surface [30]. Males are more prone to VKC due to the increased level of circulating estrone in all VKC groups, but not in healthy patients, suggesting an immunoreactivity associated with underlying hormonal factors [48, 49, 53].

As discussed earlier, Tselane (2020) conducted a case-control study to assess the interaction between VKC and the use of firewood/kerosene in Ekurhuleni (SA). The researcher used a medical register of VKC cases that were reported at public clinics at the Ekurhuleni metropolitan municipality from 2018 to 2019. The researcher found no significant association between VKC and firewood smoke, ash and heat. Moreover, no association was found between VKC and non-ocular allergies. However, dust exposure was significantly associated with VKC [38].

There appears to be a constant agreement concerning factors associated with VKC between global and sub-Saharan Africa. Most of the studies reported a family or personal history of allergy and the male sex as factors associated with VKC [7, 16, 29, 42]. Even though the results are not statistically significant in other studies, the clinical results support the narrative.

2.2.5 Conclusion

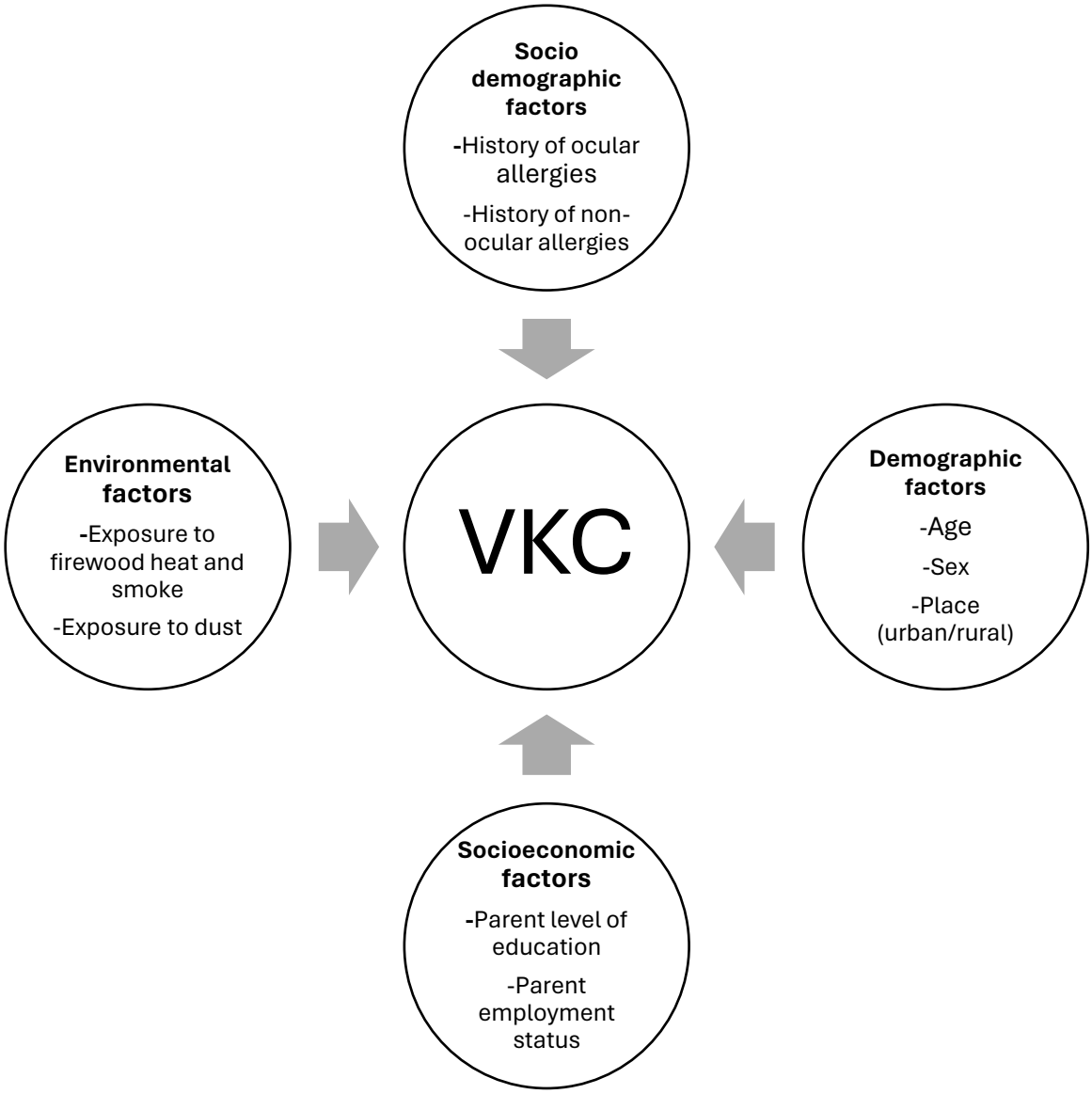
VKC is more common in hot, dry regions, affects more males than females, and is divided into limbal, palpebral and mixed types. The etiology of VKC is not fully understood, however, genetic, socioeconomic and environmental risk factors have been identified as possible causes of VKC. Moreover, T helper cell type 2 and immunoglobulin E (IgE) mediated hypersensitivity reactions play a role in the pathophysiology of VKC. The magnitude of VKC is distributed globally with varying incidences, ranging from 1.2% in Europe to 37% in sub-Saharan Africa. Several studies have pointed out various risk factors for VKC such as age, sex, climate, firewood smoke, exposure to dust, family and personal history of ocular and non-ocular allergies, socioeconomic characteristics, and an HIV positive status.

2.2.6 Conceptual framework

The conceptual framework was used to underpin the study which has been developed from the literature review. It outlines the factors associated with VKC, which include demographic factors, socioeconomic factors and environment factors. The association of socio demographic factors with VKC could be due to the similarities in immunopathology, including IgE molecules fixation on mast cell surfaces which then release inflammatory mediators in the conjunctiva that probably lead to VKC [30, 31]. Demographic factors are associated with VKC due to the onset of VKC, male sex being twice as more affected as females and living in urban or rural areas [48, 49].

In addition, Socio economic factors are associated with VKC due to the fact that educated parents are most likely to seek help for their children compared to uneducated parents. Furthermore, exposure to environment factors like dust was associated with VKC [38]. This conceptual framework link the study with the factors associated with VKC as established in the background and literature review. It also shows the expected relationship between VKC, and factors associated with it. Figure 2 below shows how independent variables (socio demographic, socio economic and environmental factors) interact with a dependent variable (VKC).

Figure 1: Conceptual framework: Factors associated with VKC.



CHAPTER 3: METHODOLOGY

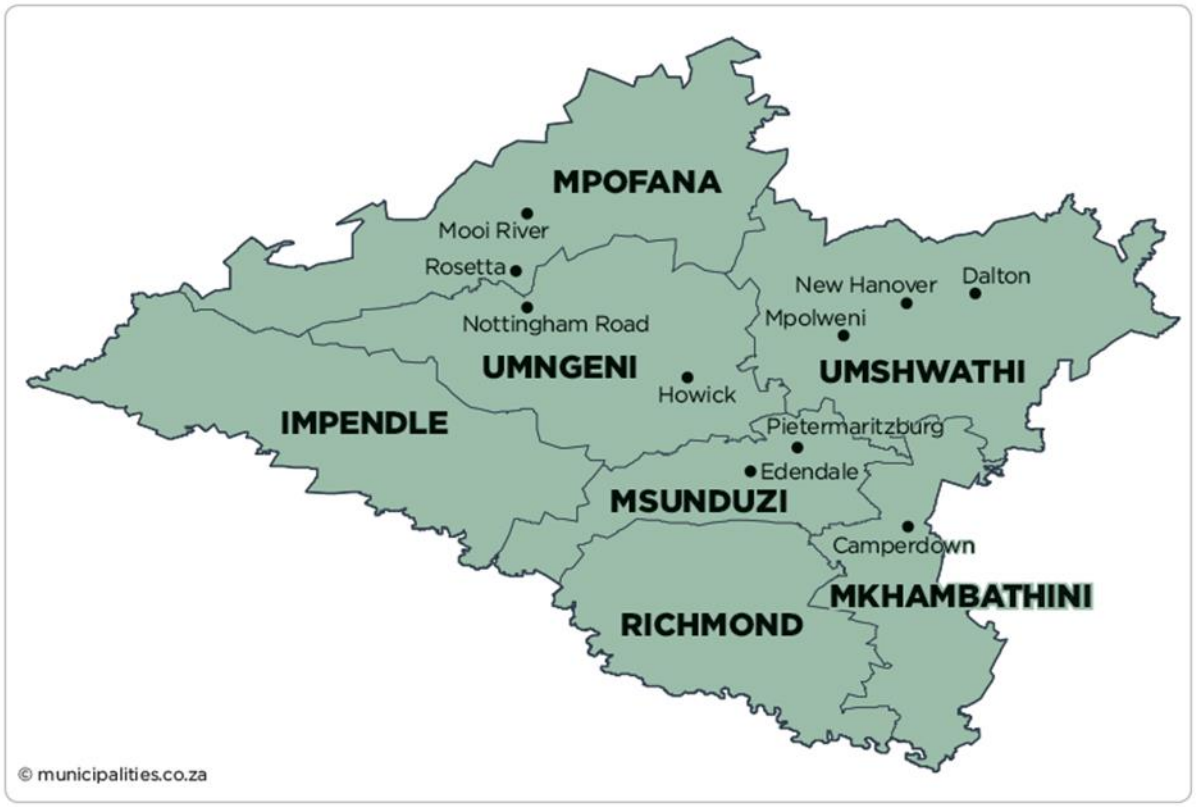
3.1 Introduction

The methodology discussed in this chapter includes the study design, study population, study setting, sampling strategy, data collection and analysis. Measures taken to ensure the validity of the study and ethical considerations will also be reported.

Research site

Figure 1:

Map of uMgungundlovu district municipality



Source: https://municipalities.co.za/map/120/umgungundlovu

As the map above will show, the uMgungundlovu district is a C-category municipality located in the KwaZulu-Natal Midlands with an area of 9602 km^2. It comprises seven local municipalities, namely, Impendle, uMngeni, Msunduzi, Mpofana, Mkhambathini, uMshwathi, and Richmond. The study was conducted at 21 public health facilities within the uMgungundlovu district (KZN). It included eye clinic departments from clinics, community health centres (CHC), and hospitals. Health facilities included Northdale Hospital,

Appelsbousch Hospital, Imbalenhle CHC, Bruntville CHC, Bambanani, Efaye, Mtulwa, Mayizekanye, Crammond, Embo, Gcumisa, Injabulo, Maguzu, Gomane, Nxamalala, Mafakatini, Songonzima, Taylors, Richmond, Ndaleni, and Mbuthisweni clinic. All these facilities are located in rural areas except for Northdale Hospital and Imbalenhle CHC located in urban areas.

3.2 Study period

This study was first approved to be conducted at schools in 2020, however, due to the COVID-19 restrictions, the researcher could not be granted access to the schools. Amendments were made to change the research site from schools to health facilities, which was approved in 2021. The researcher could not register for the 2021 academic year and ethical recertification was obtained on 01 June 2022; the data collection commenced on 06 June 2022 and was concluded on 22 October 2022.

3.3 Study design

A descriptive cross-sectional study was conducted to determine the prevalence and factors associated with vernal keratoconjunctivitis. This type of design is useful in evaluating the relationship between the exposures of individuals (sex, ethnicity) and outcomes and provides information on the prevalence of the disease.

3.4 Study and target population

The uMgungundlovu district has a population of approximately 1 095 865 with a population growth of 1.9% per annum [59]. Sources of income for the population of uMgungundlovu district include the public sector (25%–30%), finance (15%–20%), manufacturing (10%–15%), agriculture (10%–15%), wholesale and retail trade (10%–15%), and transport and storage (10%) [60, 61]. On average the population receives an annual income of R30 000. Regarding education, 93.1% of school learners aged between 5–17 years are in school [20]. The target population was school-going learners between the ages of 4-20 years residing in the uMgungundlovu district, and who had been attending the eye clinic for the past six months.

3.4.1 Exclusion criteria

Subjects with corneal diseases other than VKC were excluded because of the similarities in signs and symptoms, which might lead to a misdiagnosis of VKC. Patients who wore contact lenses were also excluded because of the ability of contact lenses to cause papillary

conjunctivitis, which is a differential diagnosis for VKC. In addition, patients with eye infections were excluded from the study.

3.4.1 Inclusion criteria

School-going learners between the ages of four to twenty residing in the uMgungundlovu district and children whose parents or guardians gave their consent were included in the study. VKC is most common in this age group with the onset usually after the age of five years and a peak incidence between the ages of eleven to thirteen years.

3.5 Sampling strategy and Size

Since the prevalence of VKC was not known in the uMgungundlovu district, the researcher assumed it to be 50%. The study would not be adequately powered for the logistic regression if a small prevalence was used, hence the researcher assumed a prevalence of 50% using a power of 0.8 and a margin of error of 0.05 to adequately power the study. The calculated sample size was 384 participants. A total of 400 participants were recruited after an additional 16 participants to account for non-responses. Probability proportional to size sampling was used to determine the sample size from each facility population size. UMgungundlovu district has a total population of 1 095 865 and Northdale hospital cater for a population of 54882, therefor 5% of the sample size came from Northdale hospital. A non-probability convenience sampling strategy was used to select participants.

3.6 Data sources

3.6.1 Measurement instrument

The questionnaire included demographic information of the study participants (age, sex, place), medical history, VKC status, exposure to dust and firewood smoke, symptoms (itching, tearing, photophobia, discharge, and redness), parents' level of education and employment status, and history of ocular and non-ocular allergies.

3.6.2 Variables measured

3.6.2.1 Individual characteristics

Individual characteristics refer to personal factors relating to the patient. This included age, sex, race, education, environment, health status and ocular history. Ocular history enquires about the active or previous encounter of any eye condition such as cataracts, glaucoma, infection of the eye, surgeries and injuries.

3.6.2.2 VKC status

This included diagnosis and classification of VKC. The diagnosis of VKC was confirmed by the presence of papillae in the upper palpebral conjunctiva or presence of gelatinous limbal infraction and Honer Trantas Dots, and the presence of one or more of the following symptoms, that is, itching, tearing, photophobia, hyperaemia, and a discharge. VKC was then classified as either limbal, palpebral or mixed VKC.

3.6.2.3 VKC symptoms

This section assessed the presenting symptoms in a VKC patient, which were itchiness, tearing, photophobia, discharge and redness. These are common symptoms that patients report when they have allergic conjunctivitis.

3.6.2.4 Exacerbating season

VKC has shown to be a seasonal condition which worsens during the warmer seasons such as spring and summer, and this section also investigated whether the symptoms in fact worsened during the warmer seasons, or during any given season of the year.

3.6.2.5 Associated factors

Studies have shown that several risk factors are associated with the development of VKC. These factors include exposure to dust, exposure to firewood smoke and heat, history of non-ocular allergy and climate conditions. Exposure to one or more of the above factors could trigger the onset of VKC.

3.6.2.6 Socioeconomic status

This section assessed the position of the family on the socioeconomic scale determined by the employment status, level of education and place of residence. Studies have indicated that educated parents are most likely to seek help for their children as living in urban areas often exposes people to health problems due to the high levels of pollution.

3.7 Measures to ensure the validity and reliability of the study

3.7.1 Internal validity

A possible bias identified was that of the sampling bias. This study was intended to be conducted at schools where the learners were to be randomised, but due to the Covid 19 restrictions, the researcher could not be granted access to the schools. Permission was then granted to conduct the study at health facilities. The sampling bias was reduced by dividing

the uMgungundlovu district into its sub-districts and the participants were selected from the sub-district clinics, ensuring that every section of the uMgungundlovu district was included in the study. A specific and close-ended questionnaire was used to avoid inappropriate answers. No incentives were offered to participants and data was sent to the supervisor and statistician to avoid incorrect analysis.

3.7.2 External validity

The study can be generalised to all other public health facilities in uMgungundlovu district in terms of the prevalence and associated risk factors of VKC.

3.8 Data collection technique

On arrival at the public health facility the researcher introduced the study to the participants, explaining the procedure and how to complete the consent forms. The patients who had met the inclusion criteria were requested to voluntarily participate in the study and complete and sign the consent forms. The questionnaires and consent forms were distributed to the participants, whereupon after completion the questionnaires and consent forms were collected by the researcher for capturing and storage. Parents or guardians provided the mandatory consent for patients under the age of eighteen. The researcher also obtained medical and general background history of the patient, which included patient demography and health status. Visual acuity and autorefraction were measured and recorded. A slit lamp biomicroscopy to diagnose VKC and an ophthalmoscopy to assess internal ocular health were conducted and recorded. Parents were requested to provide information regarding their educational level, employment status and history of ocular and non-ocular allergies. The researcher also conducted an eye examination; all the tests conducted were non-invasive and were within the scope of the optometry practice in South Africa. Test results were recorded and entered on both the eye clinic cards and the questionnaires.

3.9 Data management

All data collected were kept confidential and accessed by the researcher only; all the questionnaires were stored in a locked cupboard for safekeeping. Data was transferred onto a Microsoft Excel spreadsheet and then exported into SPSS V28.

3.10 Data analysis

Data was entered into Microsoft Excel and then imported into SPSS V 28 for analysis. A p-value less than 0.05 was considered statistically significant. A descriptive statistical analysis of the data for numerical variables (means, standard deviations, ranges, frequencies and percentages) was initially conducted before the inferential analysis. Regarding categorical variables, a bivariate analysis using the Chi-square test was conducted first between each predictor variable and the outcome variable. All predictor variables found to be significantly associated with the outcome variable ($p<0.05$) were put into the multivariable logistic regression model. Multiple logistic regression was used to identify the factors associated with VKC. Forward and manual method were used to select variables into multivariable model.

3.11 Ethics and permission

3.11.1 Institutional review board

The researcher received ethical approval to conduct this study toward the Master of Public Health degree from the Biomedical Research Ethics Committee (BREC) on 11 August 2020, (BREC/00000793/2019). Ethical recertification was obtained on 01 June 2022.(See Appendix 5).

3.11.2 Gatekeeper permission

The provincial Department of Health in KZN under the Directorate of Health Research and Knowledge Management granted permission for the study to be conducted on 18 November 2020, (NHRD: KZ_202011_011). (See Appendix 6).

3.12 Conclusion

In this chapter, the method used during the research process was discussed. It highlighted the study setting, the study design, the study period, the study population and the sampling. It also discussed the variables measured in the study, the data collection procedures and instruments, the measures taken to ensure the reliability and validity of the study, data management and storage processes, data analysis, the ethical considerations and permissions in this study.

CHAPTER 4: RESULTS

MANUSCRIPT FORMAT

PREVALENCE AND FACTORS ASSOCIATED WITH VERNAL KERATOCONJUNCTIVITIS AMONG SCHOOL-GOING LEARNERS BETWEEN THE AGES OF 4 to 20 YEARS IN THE UMGUNGUNDLOVU DISTRICT

Name and Surname: Bhekizenzo Mncube

Student number: 207503805

A thesis by Manuscript submitted to the Department of Public Health, College of Health Science, University of KwaZulu-Natal in fulfilment of the academic requirements for the degree of Masters in Public Health.

This is to attest that the contents outlined in this thesis are the original research work conducted and reported by the author (Bhekizenzo Mncube). The research work detailed in this thesis has not been previously submitted to any tertiary institution for the award of a degree or diploma.

The use of the work of other researchers, scholars and scientists in this dissertation has been acknowledged accordingly.

As the candidate's supervisor, I have approved this thesis for submission.

Supervisor: Dr B. Tlou

Signed:... ..... Date:..8 December 2023

This dissertation was presented in manuscript format, which included a prepared journal article emanating from the research project in this field.

Research approval

Name of Ethics Committee	Date	Reference Number
1. UKZN Biomedical Research Ethics	11 August 2020	BREC/00000793/2019
2. National Health Research Database	18 November 2020	NHRD:KZ_202011_011

The results of the study presented in this chapter are in manuscript format. The manuscript will be submitted to the *African Vision and Eye Health* (AVEH) journal.

PREVALENCE AND FACTORS ASSOCIATED WITH VERNAL KERATOCONJUNCTIVITIS AMONG SCHOOL-GOING LEARNERS BETWEEN THE AGES OF 4 TO 20 YEARS IN THE UMGUNGUNDLOVU DISTRICT

B.C. Mncube (B. Optom); Dr. B. Tlou (Ph.D.)

ABSTRACT

Introduction

Vernal keratoconjunctivitis (VKC) is an allergic external ocular disease characterised by intense itching, hyperaemia, tearing, discharge and photophobia. It occurs bilaterally and can either be tarsal, limbal or in mixed form. Risk factors associated with VKC include age, sex, race, environment, climate, exposure to firewood smoke and heat, exposure to dust, a history of non-ocular allergies, education level, employment status and parental history of ocular and non-ocular allergies.

Aim: To determine the prevalence and factors associated with VKC among learners between the ages of four to twenty years in the uMgungundlovu district, KwaZulu-Natal, South Africa.

Methods: A descriptive cross-sectional study was conducted. The study population was school-going learners between the ages of 4-20 years in the uMgungundlovu district. The study participants were selected from 21 health facilities in the uMgungundlovu district. Data was collected using a questionnaire. Descriptive and inferential statistics were used to analyse data. Level of significance was set at $p<0.05$.

Results: A total of 400 questionnaires were administered to the learners and parents. There were 255 (63.7%) female participants with the mean age of 12 years and a standard deviation of 4. The prevalence of VKC was found to be 6% (95%CI: 1.92-1.96), with the mixed type VKC being the most common (54,2%). Exposure to firewood ash, smoke and heat was significantly associated with the development of VKC (aOR 24.83, 95%CI: 7.156-86.136, $p<0.01$).

Conclusion: VKC remains a public health concern and the strengthening of eye health policies to include VKC at primary level will assist in reducing the effects of VKC.

INTRODUCTION

Visual impairment is the measurable loss of function of the eye(s) or the vision system which cannot be corrected by any optical or therapeutic means. It can be categorised as mild, moderate, severe and loss of vision, depending on the presenting visual acuity and visual field loss. Globally, approximately 2.2 billion people are troubled with the loss of vision that cannot be corrected [(1)]. Refractive error and clouding of the lens are the leading causes of uncorrectable vision loss, followed by macular degeneration, glaucoma, diabetic retinopathy, corneal opacity and trachoma [(1)]. In South Africa, one in ten people are reported to have loss of vision [(2)]. Corneal opacities together with childhood loss of sight account for four per cent of visual impairment [(3)]. Vernal keratoconjunctivitis (VKC) is among the ocular conditions that interfere with corneal integrity, leading to opacification.

VKC is an allergic external ocular disease characterised by intense rubbing of the eye, hyperaemia, tearing, a discharge, and photophobia, and occurs in both eyes (bilateral) [(4)]. VKC can either be tarsal, limbal or in mixed form. The term 'vernal' implies spring and youthfulness, which means the condition is more prevalent in children and young adults and is exacerbated during the warmer months [(5)]. VKC is persistent and can cause corneal complications leading to visual impairment [(4)]. The disease develops during the first decade of life, subsiding at puberty [(6, 7)]. The etiology of VKC globally and in South Africa is not yet well understood but is believed to be an immunoglobulin E-mediated process, an interaction between the immune system and hereditary and environmental factors [(6)].

Although VKC is a worldwide phenomenon with varying incidences, it is more prevalent in Mediterranean areas, South America and Central and West Africa[(7)]. However, it is rare in North America and Europe, and more prevalent among young males and is exacerbated in spring and summer [(4, 7, 8)]. In sub-Saharan Africa, the burden of VKC is estimated to be between two to thirty-seven per cent cases among the population at risk[(9)] while in Europe, the prevalence of VKC was found to be 3.2 per 10000 population in 2013[(4, 10)], in 2016 in Ethiopia the cases of VKC were estimated to be three per cent among the studied population[(7)]. To date, no prevalence studies of VKC have been conducted in South Africa. If left without medical intervention, VKC can lead to corneal scarring, ptosis, astigmatism, keratoconus and ultimately, loss of sight [(4)]. The differential diagnosis of VKC includes atopic keratoconjunctivitis

(AKC) and contact lens papillary conjunctivitis [11]. This condition often results in children missing school days and/or sleeping in class which invariably impacts on their school performance [12].

The management of VKC varies from one practitioner to another due to the lack of standardised treatment protocols [13]. Currently, VKC treatment aims at reducing ocular symptoms and preventing corneal complications. Treatment options include the use of antihistamines, vasoconstrictors, mast cell stabilisers, non-steroid anti-inflammatory drugs (NSAIDs), and steroids [4, 14]. These could be used as monotherapy (antihistamines or mast cell stabilisers only) or as dual-acting agents (the use of antihistamines combined with mast cell stabilisers) depending on the severity of the condition as outlined in the grading scale of Bonini et al. [15] Steroids are reserved for severe cases of VKC and must be used with caution because of their ability to cause complications such as cataracts and glaucoma [13]. This study will determine the prevalence and factors associated with VKC.

METHODOLOGY

A descriptive cross-sectional study was conducted to determine the prevalence and factors associated with VKC. The target population was school-going learners between the ages of four to twenty years, residing in the uMgungundlovu district and who had attended the eye clinic for the past six months. The study was conducted in twenty-one public health facilities within the uMgungundlovu district, KZN. A non-probability convenience sampling strategy was used to select the participants.

A total of 400 participants who met the inclusion criteria were recruited after an additional sixteen participants were added to account for non-responses. Probability proportional to size sampling was used to determine the sample size from each facility population size. Umgungundlovu district has a total population of 1 095 865 and Northdale hospital cater for a population of 54882, therefor 5% of the sample size came from Northdale hospital. Questionnaires and consent forms were made available by the researcher at the facility on the day of the clinic. After completion, the questionnaires and consent forms were retrieved by the researcher for storage. Data was transferred into a Microsoft Excel spreadsheet and then imported into SPSS V28. A p-value less than 0.05 was considered statistically significant. A descriptive statistical analysis of the data was initially conducted for numerical variables

before the inferential analysis. Regarding categorical variables, a bivariate analysis using the Chi-square test was conducted first between each predictor variable and the outcome variable. All predictor variables found to be significantly associated with the outcome variable ($p<0.05$) were put into the multivariable logistic regression model. Multiple logistic regression was used to identify the factors associated with VKC. Forward and manual method was used to select variables into multivariable model.

Permission to conduct the study was obtained from the Biomedical Research Ethics Committee (BREC) on 11 August 2020, (BREC/00000793/2019). The provincial Department of Health in KZN under the Directorate of Health Research and Knowledge Management granted their permission for the study to be conducted on 18 November 2020, (NHRD: KZ_202011_011).

RESULTS

A total of 400 questionnaires were administered to learners and parents. The study was conducted at different PHC facilities and hospitals in the uMgungundlovu district, South Africa. The participants in this study comprised school-going learners between the ages of 4 to 20 years. A total of 255 (63.7%) female participants took part in this research. The average age was 12 years with a standard deviation of 4.11. Ethnic groups comprised mostly Africans (97.3%). Most of the patients who participated in this study were from rural areas (98.3%). Primary schools had the most participants (48.0%), followed by high schools (46.8%), and preschool (5.3%).

Furthermore, no participants were found to have either a systemic illness or used systemic medication. Moreover, no participants were found to have undergone ocular surgery. Ninety-five participants (23.8%) reported to have been exposed to firewood heat and smoke, while 79.5% were exposed to dust. A further eleven (2.75%) participants reported having non-ocular allergies which included a skin rash, asthma, eczema and sinusitis.

Parents were also asked to answer questions regarding their socioeconomic status and ocular and non-ocular allergies. With regards to education, 12.5% of parents whose children were diagnosed with VKC had a tertiary qualification while 87.5% had a secondary qualification. A further 12.5% of these parents were employed. Moreover, 20.8% of parents whose children

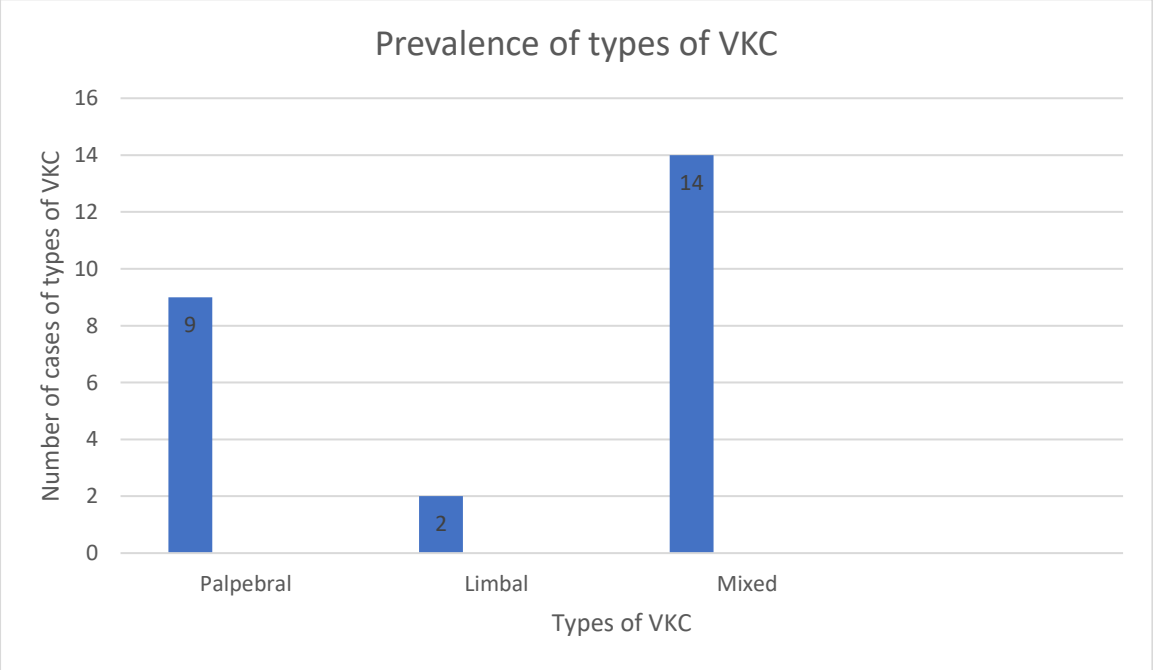
had VKC had a history of non-ocular while 12.5% had history of ocular allergies. Table 1 below depicts the demographic distribution of the participants.

Table 1 :Demographic distribution of the participants

Variable	**Frequency**	**Percentage (%)**
Sex		
Female	255	63.7
Male	145	36.3
Race		
African	389	97.3
Indian	8	2.0
Coloured	3	0.8
Grade		
Preschool (RR-R)	21	5.3
Primary (1-7)	192	48.0
High school (8-12)	187	46.8
Environment		
Rural	393	98.3
Urban	7	1.8
Education level (parents)		
Primary school	2	0.5
High school	373	93.3
University	25	6.3
Employment status		
Employed	44	11.0
Unemployed	356	89.0
Age	**Mean**	**Standard deviation**
	12.04	4.11

Of the 400 participants, twenty-four were diagnosed with VKC (6.0%), (95%CI: 1.92-1.96) while the remainder (94.0%) were diagnosed with other ocular conditions (refractive error, cataract, tropia, ptosis, and glaucoma). Of those diagnosed with VKC, a further thirteen (54.2%) participants were diagnosed with mixed VKC, nine (37.5%) participants were diagnosed with limbal VKC and two (8.3%) of the participants were diagnosed with tarsal VKC. All twenty-four patients reported itching, tearing, photophobia, discharge, and redness as their symptoms throughout the year. Furthermore, among the participants diagnosed with VKC, 87.5% were exposed to firewood smoke and heat, and 95.8% were exposed to dust. Figure 3 below clearly illustrates the prevalence of types of VKC.

Figure 3:Prevalence of types of VKC



Factors associated with VKC were assessed using logistic regression. The thirteen factors put into univariable analysis were age, sex, race, education, environment, exposure to firewood smoke and heat, exposure to dust, a history of non-ocular allergy, parent's age, education level, employment status, and parental history of ocular and non-ocular allergies. From the univariable logistic analysis, only three variables were significantly associated with the occurrence of VKC, namely sex, exposure to firewood smoke and heat and exposure to dust. The multivariable analysis revealed that only the exposure to firewood smoke and heat was independently associated with VKC.

Moreover, the odds of having VKC were 25 times higher in children who were exposed to firewood smoke and heat than those that were not exposed to firewood smoke and heat, (aOR 24.83, 95%CI: 7.16 - 86.14, p<0.01). In addition, the odds of having VKC were higher in males than in females, but was not statistically significant, (aOR 2.19, 95%CI: 0.82 - 5.33, p=0.102). Moreover, the children who were exposed to dust had higher odds of having VKC compared to those who were not exposed to dust, but was also not statistically significant, (aOR 3.53, 95%CI: 0.42 - 29.49, p=0.245). Table 2 below depicts a logistic regression analysis of factors associated with VKC.

Table 2: Logistic regression of factors associated with VKC

Univariable					Multivariable		
Explanatory variables	**Categories of explanatory variables**	**Odds ratio**	**95% Confidence interval**	**p-value**	**Odds ratio**	**95% Confidence interval**	**P-value**
Sex	Female	Ref	-	-	Ref	-	-
	Male	2.185	0.952-5.012	0.065	2.143	0.816-5.334	0.102
Exposure to firewood smoke and heat	Yes	28.568	8.299-98.338	<0.01	24.827	7.156-86.136	<0.01
	No	Ref	-	-	Ref	-	-
Exposure to dust	Yes	6.315	0.840-47.471	0.073	3.525	0.421-29.492	0.245
	No	Ref	-	-	Ref	-	-
Age	-	1.019	0.921-1.127	0.720			
Grade	Primary	0.985	0.326-2.964	0.976			
	Secondary	1.885	0.607-5.851	0.273			
	High	Ref	-	0.341			
Environment	Rural	2.681	0.310-23.214	0.371			
	Urban	Ref	-	-			
Non-ocular allergy	Yes	4.672	0	0.998			
	No	Ref	-	-			
Age (parent)	-	0.994	0.933-1.059	0.853			
Education level (parent)	University	Ref	-	0.451			
	High school	0.437	0.121-1.580	0.207			
	Primary	0	0	0.999			
Employment status	Yes	Ref	-	-			
	No	1.167	0.334-4.084	0.809			
Ocular allergy (parent)	Yes	2.892	0	0.999			
	No	Ref	-	-			
Non- ocular allergy (parent)	Yes	3.197	0	0.999			
	No	Ref	-	-			

DISCUSSION

This cross-sectional study was conducted to determine the proportion of learners affected by VKC and its associated factors among school-going learners between the ages of four to twenty years in the uMgungundlovu district. The prevalence of VKC was found to be 6% (95%CL: 1.92-1.96), with the mixed type being the most common. Risk factors associated with VKC such as age, sex, race, environment, exposure to firewood heat and smoke, dust exposure, personal and family history of non-ocular allergies, family history of ocular allergies, parent's employment status and parent's level of education will also be discussed.

As discussed earlier, the 6% prevalence of VKC found in this study concurs with studies conducted in other countries, which reported a prevalence of 3.3% in Egypt, 5.8% in Gondar City (Ethiopia), 7% in Gaza (Palestine) and 4% in Rwanda [4,7,8 18]. The possible justification for this prevalence could be that VKC is prevalent in hot, dry and windy environments [22, 23]. Parts of South Africa have a semi-arid climate [50], therefore VKC is most likely to develop in such areas. However, this study is contrary to the studies that were conducted in Gambela (Ethiopia) which found the prevalence of VKC to be 11.1% and in Nigeria which found the prevalence of 18% [16, 17]. This could be ascribed to the fact that Ethiopia and Nigeria are both hot, dry, and windy countries, which are the predisposing factors to the development of ocular allergies [22, 23]. In addition, a study conducted in Nigeria included quiescent VKC which has no symptoms. Studies conducted by Leonardi et al. (2006) in Italy and Smedt et al. (2011) in Rwanda have shown that parents are unlikely to take their children to a clinic or hospital before presenting with symptoms [9, 42].

Moreover, the mixed type of VKC accounted for more than half (54.2%) of the cases while the limbal type accounted for 37.5% and tarsal type accounted for 8.3%. This is in agreement with the studies conducted in Egypt, Gondar City, Gaza, and Bangalore which reported a dominance of mixed types of VKC. In Egypt, the mixed type VKC was found to be 69.8% while Gondar had 81.4%, Gaza (44.5%), and Bangalore (62%) [4, 7, 8, 21].The possible justification for these similarities could be that without suitable intervention, tarsal or limbal VKC with time progresses into a mixed type [28]. However, other studies conducted in Rwanda and Butajira (Ethiopia) reported the limbal type of VKC to be the most common. Rwanda reported 98.4% cases of limbal VKC while Butajira reported 58.5% cases of limbal VKC [18, 51]. However, it is not

clear why areas differ in terms of which type of VKC is most common, but other studies have cited hormonal and hereditary factors as possible causes [13].

In addition, all twenty-four patients diagnosed with VKC reported itchy eyes, tearing, photophobia, a discharge and redness as their symptoms. This could be due to hyper-reactivity when dust, wind, sun and other non-specific foreign agents come into contact with the conjunctival mucosa of the eye. [52].This is consistent with the study conducted in Nigeria reporting similar symptoms [17]. Although VKC is a seasonal condition (typically in spring when the weather temperatures begin to rise and plants begin to seed, these are favourable conditions for VKC to develop and/or are exacerbated) as shown in previous studies. [16, 17]. This study has shown that VKC symptoms are present throughout the year. This could be because young children are unable to express and describe their symptoms as clearly as anticipated by clinicians [18].

Furthermore, this study shows that the odds of having VKC are doubled in males than in females. Even though this result is not statistically significant, it is supported by previous studies. In a study conducted in Gambela (Ethiopia), the odds of having VKC in males were 4.23 times higher than in females while a study conducted in India showed that the odds of having VKC were 4 times higher in males than in females [16, 29]. The reason for this could be the presence of oestrogen and progesterone in the epithelium and sub-epithelium receptors of both bulbar and tarsal conjunctiva in patients with VKC, but not in healthy patients, suggesting an immunoreactivity associated with hormonal factors [48, 49]. In addition, research has shown that there are circulating sex hormones in VKC patients which suggests an involvement of sex hormones in the pathogenesis of VKC [53]. In contrast, a study conducted in Nigeria by Ukponmwan in 2003 showed that females were more likely to develop VKC [54]. This could be due to the inclusion of the adult population in the study, since the male to female ratio for males has been shown to be more prone to develop VKC, which decreases with age [55].

Moreover, this study shows that participants who were exposed to dust had higher odds (3.53 times) of having VKC compared to those who were not exposed. Again, although this result was not statistically significant, it is in line with the studies that were conducted previously and referred to in this study. In a study that was conducted in Ekurhuleni (South Africa) the odds of having VKC were almost double in children who were exposed to dust [38], while a

study that was conducted in Egypt showed higher odds of having VKC (10 times) in participants who were exposed to dust than those who were not exposed to dust [4]. In addition, the odds of having VKC were 4.31 times higher in participants who were exposed to dust compared to those who were not exposed to dust in studies conducted in Gondar city and Gambela [7, 16]. A possible explanation could be that dust particles often harbour inflammatory particles which can cause inflammation when they reach the ocular surface [30, 23]. Moreover, research has shown that air pollutants can damage the ocular surface by reducing the pH of the lacrimal fluid and hence cause inflammation [56].

Furthermore, the odds of having VKC were 24.83 times higher in patients who were exposed to firewood smoke, ash particles and heat compared to those who were not exposed. However, the study conducted in Ekurhuleni (South Africa) showed no association between exposure to firewood smoke and heat and VKC [38]. The author cited that Ekurhuleni was an urban area with electricity in the homes, resulting in less exposure to firewood pollution [38]. This result is in agreement with the study conducted in Muranga (Kenya) and north-central Nigeria. In the study conducted in Muranga, 30.8% of children who were exposed to firewood smoke and heat developed allergic conjunctivitis [57], while the study conducted in north-central Nigeria showed that cooking facilities which included the use of firewood, was associated with the development of VKC [58]. The possible justification for this could be that firewood is associated with exposure to smoke, heat, and dust which leads to hypersensitivity, resulting in chronic ocular allergy [7].

Moreover, this study supports the findings of the Ekurhuleni [38] study which found no significant association between a child's history of non-ocular allergy and VKC. Nevertheless, this result shows that children with a history of non-ocular allergies have higher odds (4.67 times) of having VKC compared to those who did not have a history of non-ocular allergy. This is consistent with the studies conducted in Ethiopia and India. In a study conducted in Ethiopia, the odds ratio was four, for developing VKC when the child had a history of non-ocular allergies [7], while in a study conducted in India, a history of non-ocular allergy was a risk factor for the development of VKC [22]. The possible justification could be that patients with non-ocular allergies had similar immunopathology with VKC, including IgE molecules fixation on mast cell surfaces which then released inflammatory mediators in the conjunctiva that probably led to VKC [30, 31].

In addition, this study has found that children whose parents have a history of non-ocular allergies have odds ratio of 3.20 of having VKC compared to children whose parents had no history of non-ocular allergies. Even though this result is not statistically significant, it concurs with other studies conducted in Ethiopia and Egypt. In the study conducted in Ethiopia, the odds ratio for developing VKC when the parents had a history of non-ocular allergies was 3.57 while in a study conducted in Egypt, the odds ratio was 45.25 [7, 19]. It is, however, not clear how a family history of non-ocular allergies leads to VKC, but Bonini et al. in 1995 assumed that VKC was a phenotypic up-regulation of the cytokine gene on chromosome 5q [13].

Due to the sight-threatening consequences posed by VKC, it is important for primary health care workers, particularly optometrists, to understand the clinical presentation of VKC and treatment options available to initiate interventions and referrals where necessary. Equally important is that the school health policy in South Africa should include VKC so as to minimise it effects soonest.

In line with the 2015 Millennium Development Goal (MDG)2, that is, for all children universally to 'achieve universal primary education' by 2015 [60], this study has shown that VKC is a serious public health concern; other studies have shown that VKC impacts on school attendance which may result in children dropping out of school and/or repeating grades. In South Africa, this goal has been achieved by 'securing universal enrolment of all children of all primary school-going age' according to the MDG report of 2015. On the other hand, the MDG 6, which was to 'fight HIV/AIDS, malaria and other diseases' was not met in South Africa. VKC is a disease that is troubling children and young adults, hence affecting educational progress. Therefore, the Department of Health should combat VKC so that children are afforded the opportunity to have an uninterrupted school attendance. Unfortunately, this goal has not been achieved in SA, since VKC resorts under the category of 'other diseases' in MDG 6. This study will assist in alerting national, provincial and local authorities to the prevalence of VKC so that it can be included in health indicators and receive the necessary attention, since it is a sight-threatening disease.

A positive initiative has been initiated in the uMgungundlovu district to achieve the Sustainable Development Goals (SDGs) of 2030. SDG 3 to 'ensure healthy lives and promote well-being for all at all ages' and SDG 4 to 'ensure inclusive and equitable quality education and promote life-long learning opportunities for all' have been initiated with the introduction

of primary health care, eye care and dental care in schools through the visits by the National Health Insurance (NHI) mobile trucks and staff, and the findings of this study will strengthen this initiative and aid towards achieving the said SDGs by 2030.

LIMITATIONS OF THE STUDY

The COVID-19 restrictions of 2020 redirected the study to hospital and clinic-based research sites instead of school-based research, as was initially planned. In schools, some children are not aware that they have VKC and those who are already receiving treatment would have been identified, hence affecting the prevalence found in this study. Randomisation of participants to reduce selection bias was impossible due to the patient numbers attending eye clinics. The paucity of previous studies carried out on the prevalence and associated factors of VKC for the literature review and comparing and contrasting findings with previous studies, was also a limitation. Due to cross-sectional nature of the study, determining the causal inference was a limitation.

STRENGTH OF THE STUDY

During the sampling stage of the study, uMgungundlovu district was divided into its seven sub-district municipalities, then health facilities were selected from each sub-district municipality such that each municipality is represented in the sample (population representation). The results of this study are comparable to other studies conducted globally and in Sub-Saharan Africa (Reproducibility of the study). The study can be generalized and replicable in uMgungundlovu district.

CONCLUSION

The existence of VKC is a public health concern in the uMgungundlovu district. This study has shown that the prevalence of VKC is 6%. In addition, this study has shown that exposure to firewood smoke, heat and ash particles is indeed associated with VKC. The findings of this study indicate that should one be exposed to dust, have a previous episode of non-ocular allergy and a family history of ocular and non-ocular allergies, one is more likely to develop VKC. The study proposes a management plan for VKC in schools and PHC facilities and a standardised treatment protocol nationally.

RECOMMENDATIONS

Since the prevalence of VKC is now known, the study proposes that health education concerning VKC be provided at both schools and clinics. Moreover, it is recommended that a policy is established nationally to assist in the control of VKC. Furthermore, a standardised treatment protocol for VKC is recommended in order to have health care providers managing VKC appropriately. In addition, it is recommended that clinics be provided with basic VKC treatment to assist children while they are waiting for their appointment date at the hospital. It is further recommended that the municipalities supply electricity to homes that are still using firewood to limit its use, effects and clear link with VKC. It is also recommended that a study be conducted in a school setting where children who are not aware that they must seek medical help for VKC can be identified and directed to health facilities nearby.

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CHAPTER 5: RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

Chapter 5 highlighted the findings, limitations and recommendations of the study. The conclusion and suggestions for future research concluded this chapter.

5.2 Review of findings

A total of 400 questionnaires were administered to the learners and their parents. Most of the participants were females between the ages of 4-20 years. Males were more likely to develop VKC when compared to females. The mixed type of VKC was the dominant form.

Factors associated with VKC were not statistically significant, but clinically the results supported previous studies in terms of association.

5.3 Key findings

The prevalence of VKC at the research site was found to be 6% with mixed types of VKC diagnosed in 54.2% of the participants. The odds of having VKC were approximately 2 times higher in males than in females. Exposure to firewood smoke, ash particles and heat was significantly associated with the development of VKC. Furthermore, the study revealed no significant association between VKC and factors such as age, environment, sex, personal and family history of ocular and non-ocular allergies and the educational and employment levels of the parents.

5.4 Limitations of the study

The COVID-19 restrictions of 2020 redirected the study to become hospital and clinic-based instead of school-based as was initially intended. Some learners were unaware that they had VKC and those who were already receiving treatment would have been identified, hence affecting the prevalence found in this study. Randomisation of participants to reduce selection bias was impossible due to the low patient numbers attending the eye clinics. The paucity of previous studies carried out on the prevalence and associated factors of VKC for the literature review and comparing and contrasting findings with previous studies also proved to be a limitation. Due to cross-sectional nature of the study, determining the causal inference was a limitation.

5.5 Conclusion

The existence of VKC is a public health concern in the uMgungundlovu district. This study has shown a VKC prevalence of six per cent. In addition, this study has shown that exposure to firewood smoke, heat and ash particles is clearly associated with VKC. The findings of this study indicate that should one be exposed to dust pollution in the environment, have a personal history of non-ocular allergy, and/or a family history of ocular and non-ocular allergies, one is more likely to develop VKC. The study proposes a management plan for VKC in schools and PHC facilities and a standardised treatment protocol nationally.

The problems in providing an adequate public health service in the rural context was highlighted in this study, suggesting the need for school health teams to be provided with a screening tool for VKC. The study also showed the weaknesses and inadequacies endemic in rural settings. Policy inadequacies were evident where it mattered the most, in schools and clinics, particularly in guiding the care of those afflicted with VKC, ranging from diagnosis and management of VKC to the exclusion of eye health in the integrated management of non-communicable diseases, where eye health is embedded in health programmes. The study contributed to new knowledge in SA on how to resolve issues surrounding the provision of adequate assistance to children and parents regarding the diagnosis and care of VKC. The future bodes well if the NHI continues to support this initiative through the employment of human resource, procurement of equipment and consumables, using NHI fund.

5.6 Recommendations

Since the prevalence of VKC has now been established in South Africa, the study proposes that health education concerning VKC be provided at both schools and clinics. Moreover, it is recommended that a policy is established nationally to assist in the control of VKC. A standardised treatment protocol for VKC is recommended in order to have health care providers managing VKC effectively. In addition, clinics should be provided with basic VKC treatment facilities to assist children while they are awaiting their appointment at the hospital. It is further recommended that the municipalities provide electricity to homes that are still using firewood to limit its use, its effects and its clear link with VKC. It is also recommended that a study be conducted in a school setting where children who are not aware that they must seek medical assistance for VKC can be identified and directed to health facilities.

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APPENDICES

APPENDIX 1: Information document

University of KwaZulu-Natal
School of Nursing and Public Health

Date.....

Dear prospective participant

My name is Bhekizenzo Mncube from the School of Nursing and Public Health at the University of KwaZulu-Natal.

You are being invited to consider participating in a research study which involves determining the proportion of children who has an eye condition known as vernal keratoconjunctivitis. The aim of the study is to determine the proportion of school learners who has this eye condition in the uMgungundlovu district. The study is expected to enrol 400 school learners from rural and urban schools.

Procedure

If you decide to participate in this study, the following procedures will be carried out:

Brief set of questions regarding your vision.

Visual acuity measurements and auto refraction (How well do you see at a distance and near).

Anterior health of the eye.

Internal health of the eye.

None of these procedures are experimental. If you choose to enrol and remain in the study, the duration is expected to be twelve months.

Potential risks and discomfort

There are no risks involved in doing these tests. There will be slight discomfort due to the light shining into your eyes, but it will not last long.

Benefits

You will receive knowledge about the health of your eyes, and you will be screened at no cost for any eye diseases present during your eye examination.

Cost

There is no cost or compensation involved in participating in this study. There is no external funder contributing to this study.

Confidentiality

Whilst all efforts will be made to keep your information confidential, total confidentiality cannot be guaranteed. Your information may be disclosed if required by law or by organisations that inspect this study for quality assurance. In addition, your information will not be used individually, but be used to report group findings.

Participation

Your participation in this study is voluntary. You are encouraged to ask any questions about this research before deciding whether to participate or not. You may withdraw at any point of the study without penalty or facing any consequences.

Should you have any queries or need further information, please feel free to contact the researcher, Bhekizenzo Mncube at 0718816102.

APPENDIX 2: Consent form (child)

University of KwaZulu-Natal
School of Nursing and Public Health

CONSENT FORM

I (parent)……..give consent for my child (name)…….to participate in the study. I have been informed about the study entitled *Prevalence and Factors Associated with Vernal Keratoconjunctivitis among School Children Between the Ages of 4 to 20 Years in the uMgungundlovu District* by Bhekizenzo Mncube.

I understand the purpose and procedures of the study. The aim is to determine the prevalence of vernal keratoconjunctivitis amongst school learners between the ages of 4 to 20 years in the uMgungundlovu district.

I have been given an opportunity to ask questions about the study and have received answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any treatment or care that I would usually be entitled to.

I have been informed about available compensation or medical treatment if an injury occurs to me as a result of the study-related procedures.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher at 0718816102.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers, then I may contact:

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604769 - Fax: 27 31 2604609
Email: BREC@ukzn.ac.za

_____ _____

Signature of Participant Date

_____ _____

Signature of Witness Date

_____ _____

Signature of Translator Date

APPENDIX 3: Consent form (Parent)

University of KwaZulu-Natal
School of Nursing and Public Health

CONSENT

I (parent)…….have been informed about the study entitled *Prevalence and Factors Associated with Vernal Keratoconjunctivitis among School Learners Between the Ages of 4 to 20 Years in the uMgungundlovu District* by Bhekizenzo Mncube.

I understand the purpose and procedures of the study. The aim is to determine the prevalence of vernal keratoconjunctivitis amongst school learners between the ages of 4-20 years in uMgungundlovu district.

I have been given an opportunity to ask questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any treatment or care that I would usually be entitled to.

I have been informed about any available compensation or medical treatment if an injury occurs to me as a result of study-related procedures.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher at 0718816102.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604769 - Fax: 27 31 2604609
Email: BREC@ukzn.ac.za

_____ _____

Signature of Participant Date

_____ _____

Signature of Witness Date

_____ _____

Signature of Translator Date

APPENDIX 4: Questionnaire

University of KwaZulu-Natal
School of Nursing and Public Health

Section 1.

Title: Prevalence and factors associated with vernal keratoconjunctivitis among school learners aged 4 to 20 years in the uMgungundlovu district.

QUESTIONNAIRE

Name of participant: _____ Age: _____

Race: _____

Sex :M / F

Place: Urban/Rural

Health Status

Systemic Illnesses: Y / N If Yes, specify:

_____

Systemic medication: Y / N If Yes, specify:

_____

Any other conditions: _____

Visual Status:

Previous ocular surgery: Y/N

Visual acuity: OD: _____ OS: _____

Autorefraction: OD: _____ OS: _____

Slit lamp assessment : OD: _____OS: _____

Ophthalmoscopy: OD: _____OS: _____

VKC status: OD:_____OS:_____

VKC type: _____

Section 2.

2.1: Symptoms, seasons and factors associated with VKC.

Symptoms									
Itching		Tearing		Photophobia		Discharge		Redness	
YES	NO	YS	NO	YES	NO	YES	NO	YES	NO
Exacerbating season									
Sumer		Winter		Spring		Autumn			
YES	NO	YES	NO	YES	NO	YES	NO		
Associated factors									
Exposure to firewood smoke		Exposure to dust		Non-ocular allergy					
YES	NO	YES	NO	YES	NO				

Section 3.

3.1: Parent

Level of education: Primary school Secondary school Tertiary Education

Employment: Employed Unemployed

History of ocular allergy: Yes No

History of non-ocular allergy: Yes No

APPENDIX 5: BREC Approval letter

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

01 June 2022

Mr Bhekizenzo Cyril Mncube (207503805)
School of Nursing & Public Health
Howard College

Dear Mr Mncube,

Protocol reference number: BREC/00000793/2019
Project title: Prevalence of vernal keratoconjunctivitis amongst school children between the ages of 4-20 years in uMgungundlovu district
Degree Purposes: Masters

RECERTIFICATION APPLICATION APPROVAL NOTICE

Approved:	**11 August 2022**
Expiration of Ethical Approval:	**10 August 2023**

I wish to advise you that you're our application for recertification received on 13 May 2022 for the above study has been **noted and approved** by a subcommittee of the Biomedical Research Ethics Committee (BREC). The start and end dates of this period are indicated above.

If any modifications or adverse events occur in the project before your next scheduled review, you must submit them to BREC for review. Except in emergency situations, no change to the protocol may be implemented until you have received written BREC approval for the change.

The committee will be notified of the above approval at its next meeting to be held on 14 June 2022.

Yours sincerely

.....
Ms A Marimuthu
(for) Prof D Wassenaar
Chair: Biomedical Research Ethics Committee

APPENDIX 6: KZN Provincial Department of Health permission

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

Physical Address: 330 Langalibalele Street, Pietermaritzburg
Postal Address: Private Bag X9051
Tel: 033 395 2805/ 3189/ 3123 Fax: 033 394 3789
Email:
www.kznhealth.gov.za

DIRECTORATE:
Health Research & Knowledge Management

NHRD: KZ_202011_011

Dear Mr B. Mncube
UKZN

Approval of research

1. The research proposal titled '**Prevalence of vernal keratoconjunctivitis among school children between the ages of 4-20 years in uMgungundlovu district.**' was reviewed by the KwaZulu-Natal Department of Health (KZN-DoH).

   The proposal is hereby **approved** for research to be undertaken at Applelsbosch and Northdale Hospital, Bambanani clinic, Brumville, Cramond Satellite, Ebuye, Emoc, Emtulwa, Gourmise, Gomane, Imbalenhle, Injabulo, Mafakatini, Maguzu, Mayizekanye, Mbutuseni, Ndaleni, Nxamalala (Impendle), Richmond, Songonzima and Taylors Hall Clinic.

2. You are requested to take note of the following:
   a. *All research conducted in KwaZulu-Natal must comply with government regulations relating to Covid-19. These include but are not limited to regulations concerning social distancing, the wearing of personal protective equipment, and limitations on meetings and social gatherings.*
   b. *Kindly liaise with the facility manager BEFORE your research begins in order to ensure that conditions in the facility are conducive to the conduct of your research. These include, but are not limited to, an assurance that the numbers of patients attending the facility are sufficient to support your sample size requirements, and that the space and physical infrastructure of the facility can accommodate the research team and any additional equipment required for the research.*
   c. *Please ensure that you provide your letter of ethics re-certification to this unit, when the current approval expires.*
   d. *Provide an interim progress report and final report (electronic and hard copies) when your research is complete to* ***HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200*** *and e-mail an electronic copy to* hrkm@kznhealth.gov.za
   e. *Please note that the Department of Health shall not be held liable for any injury that occurs as a result of this study.*

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

Dr E Lutge
Chairperson, Health Research Committee
Date: 18/11/2020

APPENDIX 7: Ethical Certificate- Introduction to Research Ethics

TRREE

Zertifikat Certificado

Certificat Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Clinical Trials Centre
The University of Hong Kong

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Bhekizenzo Mncube

a complété avec succès - has successfully completed

Introduction to Research Ethics

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2019/02/12

CID : fh82kqqLi

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

FMH Continuing Education Program (5 Credits)
Programme de Formation continue (5 Crédits)

Foederatio Pharmaceutica Helvetiae FPH Programmes de formation continue
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[REV : 20170310]

APPENDIX 8: Ethical Certificate- Informed Consent

Zertifikat
Certificado
Certificat
Certificate

TRREE

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Clinical Trials Centre
The University of Hong Kong

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Bhekizenzo Mncube

a complété avec succès - has successfully completed

Informed Consent

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2019/02/28

CID : 55LJ1f9w4Vz

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

FMH Continuing Education Program (5 Credits)
Programme de Formation continue (5 Crédits)

Foederatio Pharmaceutica Helvetiae FPH Programmes de formation continue
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[REV : 20170310]

APPENDIX 9: Ethical Certificate- Good Clinical Practice

TRREE

Zertifikat Certificado

Certificat Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Clinical Trials Centre
The University of Hong Kong

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Bhekizenzo Mncube

a complété avec succès - has successfully completed

Good Clinical Practice (GCP-E6(R2) 2016)

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2019/03/01

UCID : XhcaeOSCa

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

FMH Continuing Education Program (5 Credits)
Programme de Formation continue (5 Crédits)

Foederatio Pharmaceutica Helvetiae FPH Programmes de formation continue
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[RJIV : 20181124SL]

APPENDIX 10: Ethical Certificate- Research Ethics Evaluation

TRREE

Zertifikat

Certificado

Certificat

Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Clinical Trials Centre
The University of Hong Kong

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Bhekizenzo Mncube

a complété avec succès - has successfully completed

Research Ethics Evaluation

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2019/02/28

CID : MkxxRdxY3o

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

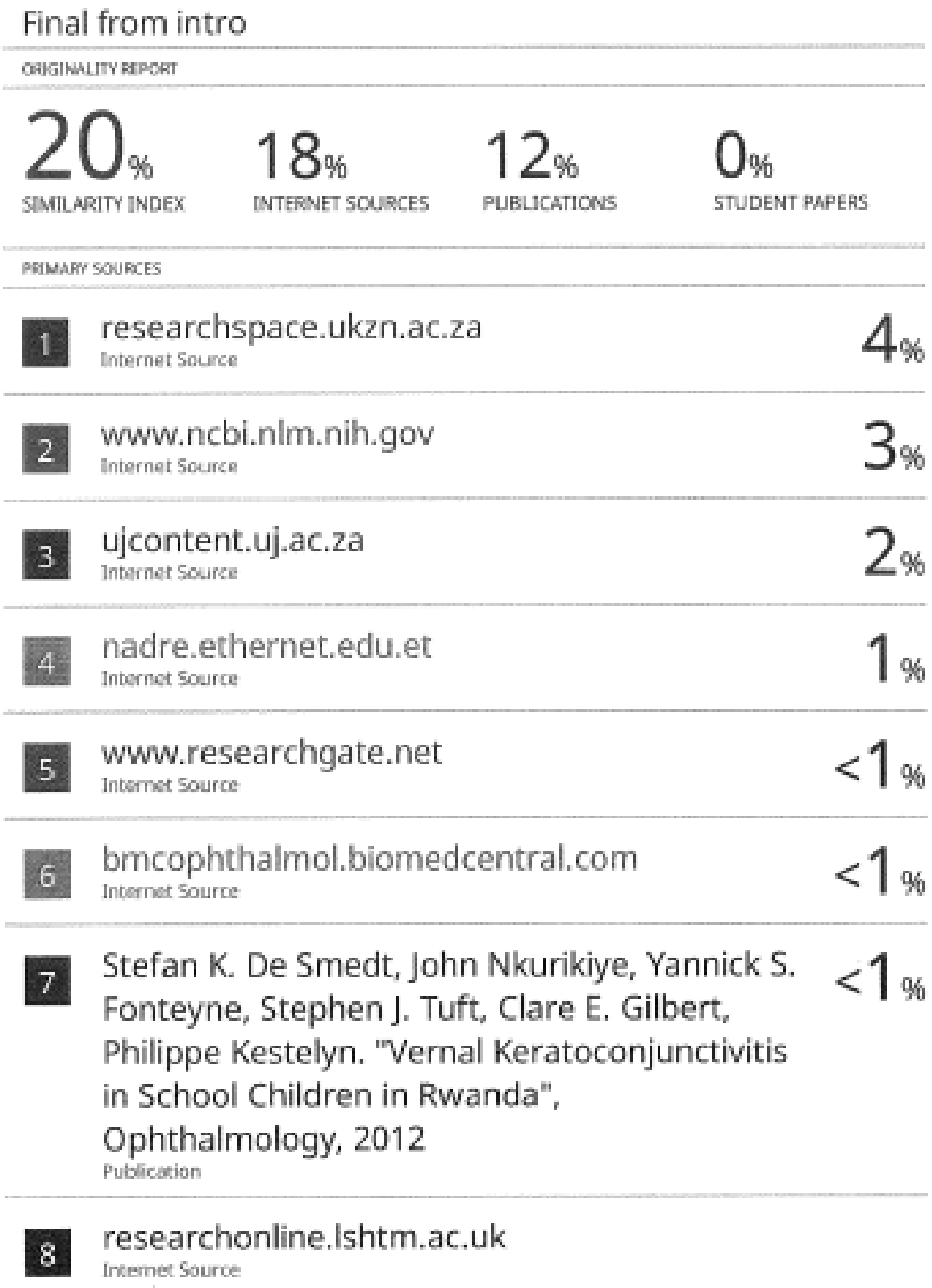
FMH Continuing Education Program (5 Credits)
Programme de Formation continue (5 Crédits)

Foederatio Pharmaceutica Helvetiae FPH Programmes de formation continue
Continuing Education Programme
Programmes de formation continue

Ce programme est soutenu par - This program is supported by :
European and Developing Countries Clinical Trials Partnership (EDCTP) (www.edctp.org) - Swiss National Science Foundation (www.snf.ch) - Canadian Institutes of Health Research (http://www.cihr-irsc.gc.ca/e/2891.html) - Swiss Academy of Medical Science (SAMS/ASSM/SAMW) (www.samw.ch) - Commission for Research Partnerships with Developing Countries (www.kfpe.ch)

[REV : 20170310]

APPENDIX 11: Turnitin Report



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APPENDIX 12: Editor's Certificate

EDITOR'S CERTIFICATE

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PREVALENCE OF VERNAL KERATOCONJUNCTIVITIS AMONG SCHOOL-GOING LEARNERS BETWEEN THE AGES OF 4 TO 20 YEARS IN THE UMGUNGUNDLOVU DISTRICT

AUTHOR: BHEKIZENZO MNCUBE (Student No.: 207503805)

I confirm that I have edited the above dissertation in terms of the following: Title Page, Declaration, Dedication, Acknowledgements, Abstract, Table of Contents, Figures and Tables, Abbreviations and Acronyms, Definition of Terms, References, Appendices and Chapters 1– 5.

The contents were edited via track changes, WhatsApp discussions and emails.

Editorial advice was provided on the following:

- substance and structure
- paragraph, spacing and sentence structure
- language, academic tone, phrasing, presentation of figures and tables
- verbosity, circumlocution, grammar, spelling and punctuation.
- content clarification and format
- overall presentation of content

Changes and clarifications in the body of the text are for the sole discretion of the author.

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DR L M LOMBARDOZZI

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