FACTORS ASSOCIATED WITH OCCUPATIONAL ALLERGIC
CONJUNCTIVITIS AMONG SCHOOL TEACHERS IN BAHATI DIVISION,
NAKURU NORTH DISTRICT, KENYA

BY

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SCIENCES OF KENYATTA UNIVERSITY

August, 2011
DECLARATION

This thesis is my original work and has not been presented for a degree in any other university or any other award.

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This work is dedicated to my husband Thomas and my daughters Purity, Neema, Abigail and Melissa. My success is their success.
ACKNOWLEDGEMENTS

I thank God the almighty for bringing me this far in my studies. I am also greatly indebted to my supervisors, Dr. M. N. Keraka and Dr. D. M. Muia, for their insightful and constructive criticism and encouragement throughout the duration of this study. They were always available for consultations when I was stuck. I am also grateful to Dr. Bon Oirere for his guidance during the initial stages of developing the proposal and Dr. R. Wanjau for her guidance during the corrections of the thesis.

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CASE DEFINITION

The diagnosis of allergic conjunctivitis in this study was done empirically based on the symptoms. A person was considered to be suffering from allergic conjunctivitis if he/she had itchy eyes and other symptoms of allergic conjunctivitis such as redness of the eye, swelling, tearing, irritation and discomfort.
## ABBREVIATIONS AND ACRONYMS

<table>
<thead>
<tr>
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<th>Description</th>
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<tr>
<td>AKC</td>
<td>Atopic Keratoconjunctivitis</td>
</tr>
<tr>
<td>BMF</td>
<td>Burnt Material for Fuel</td>
</tr>
<tr>
<td>C5a</td>
<td>Component of Complement</td>
</tr>
<tr>
<td>CD4</td>
<td>Inflammatory T-cells</td>
</tr>
<tr>
<td>CD8</td>
<td>Cytotoxic T-cells</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
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<tr>
<td>CL</td>
<td>Confidence Level</td>
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<tr>
<td>DALYs</td>
<td>Disability Adjusted Life Years</td>
</tr>
<tr>
<td>DC</td>
<td>District Commissioner</td>
</tr>
<tr>
<td>DEO</td>
<td>District Education Officer</td>
</tr>
<tr>
<td>DPHO</td>
<td>District Public Health Officer</td>
</tr>
<tr>
<td>FC</td>
<td>Fragment-Crystallisable</td>
</tr>
<tr>
<td>GOK</td>
<td>Government of Kenya</td>
</tr>
<tr>
<td>GPC</td>
<td>Giant Papillary Conjunctivitis</td>
</tr>
<tr>
<td>H1</td>
<td>Histamine receptor that activates allergic reaction</td>
</tr>
<tr>
<td>IgE</td>
<td>Immunoglobulin E</td>
</tr>
<tr>
<td>IL</td>
<td>Interleukin</td>
</tr>
<tr>
<td>ILO</td>
<td>Internal Labour Organisation</td>
</tr>
<tr>
<td>KBS</td>
<td>Kenya Bureau of Standards</td>
</tr>
<tr>
<td>MOH</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>PAC</td>
<td>Perennial Allergic Conjunctivitis</td>
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<tr>
<td>RBC</td>
<td>Red Blood Cells</td>
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SAC- Seasonal Allergic Conjunctivitis
Th0- Undifferentiated or primitive lymphocytes
Th1- T-helper cells involved in allergic reactions
Th2- Inflammatory T-cells
TSC- Teachers Service Commission
VKC- Vernal Keratoconjunctivitis
WHO- World Health Organisation
ABSTRACT

Hundreds of million of people throughout the world work under unsafe conditions resulting in occupational diseases and allergies. Allergic conjunctivitis is a common problem affecting about 20% of the world’s and Kenyan population. Untreated allergic conjunctivitis can cause injury to the conjunctiva and the eye lids while some of the drugs used to treat can cause life threatening diseases or can be sight threatening. It is therefore important to avoid those factors that cause the allergic conjunctivitis as a way of controlling and preventing it. This study sought to investigate the factors that influence the development of occupational allergic conjunctivitis among the school teachers of Bahati Division. The study was cross sectional and comparative in nature. A total of 246 school teachers and 246 non teachers were selected randomly. Questionnaires were used to collect information about the presence or absence of allergic conjunctivitis among the respondents. The SPSS software package (version 12.0 for windows) was used for data analysis. The results showed that 51.2% teachers and 25.6% non teachers suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic conjunctivitis (p<0.05 at 95% CL). There was no association between knowledge and development of allergic conjunctivitis (p>0.05 at 95% CL). There was an association between allergic conjunctivitis and chalk use (OR=5.027; 95% CI = 1.063-23.766). Chemicals used in teaching science subjects at schools do not cause significant allergic conjunctivitis to school teachers (p>0.05 at 95% CL). The research study concludes that there is an association between teaching occupation and development of allergic conjunctivitis. It also concludes that knowledge on causes and symptoms of allergic conjunctivitis does not influence its development and that there is no significant difference in prevalence of allergic conjunctivitis between the teachers who teach science and those who do not. Therefore the study recommends that school chalk be replaced with other suitable writing materials. Further studies on clinical research to establish the severity of allergic conjunctivitis among the susceptible teachers at different levels of chalk dust is recommended in order to come up with a threshold for the amount of chalk dust that one should be exposed to. The research study also recommends that a study be carried out on the seasonal variations of allergic conjunctivitis so that people may be sensitized on how to avoid the seasonal trigger factors.
CHAPTER ONE

1.0 INTRODUCTION

1.1 Background information

Hundreds of millions of people throughout the world are working under circumstances that foster ill health and/or are unsafe. It is estimated that yearly, over two million people worldwide die of occupational injuries and work related diseases. About 1.5% of the global burden in terms of disability adjusted life years (DALYs) result from only a selected subset of occupational risks (Eijkemans, 2004). Occupational diseases include allergies (Jeebhay, 2004), silicosis, asbestosis and workers’ pneumoconiosis (GOK, 2007).

An allergy is a hypersensitive state acquired through exposure to a particular allergen, re-exposure bringing to light an altered capacity to react (Saunders, 2004). It is characterised by a harmful reaction to allergens. Types of allergies include asthma, allergic rhinitis, atopic dermatitis, anaphylaxis, urticaria and angioedema, blood transfusion reactions and allergic conjunctivitis (Sringhouse, 1995).

Occupational allergies resulting from immune hypersensitivity to substances encountered in the work environment constitute around 15% of all occupational diseases (Jeebhay, 2004). Occupational allergies are commonly caused by hazardous chemical or biological agents, and the clinical presentation of occupational allergies is not different from allergies caused by common inhalant allergens found in the general environment (Jeebhay, 2004). High molecular weight agents usually cause an immediate hypersensitivity response resulting in rhinitis, conjunctivitis, urticaria and asthma (Kurby,
Allergies of these types are generally more commonly encountered in occupational setting than other allergic diseases such as hypersensitivity pneumonitis (extrinsic allergic alveolitis) and contact dermatitis. Para-occupational exposures of family members through workers’ transport of allergens from the workplace to the home also take place. This occurs in the context of poor workplace hygiene conditions (Jeebhay, 2004).

Teaching, as an occupation, involves imparting knowledge by the teacher to the learners. To enhance this, methods of visually presenting information to a full room of students all at once are used. These may include the use of chalkboard written on using chalk which contains calcium carbonate (Pollick, 2009). As chalk is scraped across the rough surface of the chalkboard, particles of chalk dust stick on the board and the hands of the teacher while others are sent out into the surrounding air. The teachers and students may inhale some of this chalk dust, which usually becomes trapped in the mucus layers of the throat and upper lungs causing respiratory allergies such as coughs or asthmatic attacks. Some of the dust may get into the eyes of the students and teacher. Transfer of chalk dust from the hands to the eyes may also take place if the hands are not washed, causing allergic conjunctivitis (Volans and Wiseman, 2005; Kumar and Kumar, 2003; Pollick, 2009).

Science teachers use chemicals during teaching to explain and demonstrate different reactions in order to improve the understanding of the students. Some of these chemicals are harmful causing diverse problems to those exposed. They include the irritants, fuming
chemicals and those with strong odours which increase the likelihood of developing an allergy (Kumar and Kumar, 2003).

Allergic conjunctivitis is an irritation of conjunctiva (Dana, 2009). It results when allergens get into the eyes of a person who has a genetic predisposition to it (Anderson and Macleod, 1997; Hanley and Belfus, 1987). It affects about 20 % of the world’s population (Dana, 2009; Thomson, 2009). Different parts in Africa have different prevalence with no distribution pattern (Foliaki et al., 2007; Ait-khaled et al., 2007). In Kenya, it constitutes one fifth of all the total diagnoses made in eye clinics (MOH, 2000).

The drugs used to treat allergic conjunctivitis are harmful (Ashok, 2003), and avoidance of the trigger factors has been recommended as the most effective treatment (Kumar and Kumar, 2003). The trigger factors of allergic conjunctivitis in the school environment therefore need to be identified, so that teachers can be safe in order to perform their duties effectively. Bahati Division in Nakuru North District, Nakuru County, Kenya has a population of 942 teachers (DEO, 2009).

1.2 Problem statement

Although the prevalence of allergic conjunctivitis from the Kenyan eye clinics is 20 % (MOH, 2000), the prevalence is likely to be higher because some people use over the counter drugs to alleviate the symptoms (Dermot, 2003). Untreated allergic conjunctivitis can cause injury to the conjunctiva and eye lids (Ono and Abelson, 2005). The allergens in the eye can also drain and contribute to allergic signs and symptoms in the nose
(D’Arienzo, 2005). Drugs used to alleviate the symptoms of allergic conjunctivitis may cause drowsiness, react with other medications to cause life threatening cardiac arrhythmias while others can be sight threatening or may cause acceleration of allergic conjunctivitis (Ashok, 2003), and therefore avoidance of the trigger factors may be the better option as recommended by Kumar and Kumar (2003). It is therefore important to identify the environmental triggers of allergic conjunctivitis, and especially for teachers. However, information is lacking on the factors that influence the development of allergic conjunctivitis in the school environment, placing the teachers at a risk of suffering from uncontrolled allergic conjunctivitis. This research sought to establish the factors that influence the development of allergic conjunctivitis among school teachers in Bahati Division in Nakuru North District.

1.3 Justification

Allergic conjunctivitis is a common disease affecting about 20 % of the world’s population (Dana, 2009). It is therefore important to try and establish whether the occupational environments are responsible for it. Studies have been carried out on allergic conjunctivitis for persons in different occupations (D’Arienzo, 2005; witczak, 2007). However, no such study has been reported in Kenya on allergic conjunctivitis among the members of the teaching occupation. The trigger factors in the school environment have not been identified and therefore the teachers are at a risk of suffering from allergic conjunctivitis. Also, the International Labour Organization (ILO) recommends that the teacher, as a worker, be protected against health hazards arising from the work environment (Tyrer, 1985). The study therefore identified the factors that
influence the development of allergic conjunctivitis among the teachers in Bahati Division.

1.4 Research questions

The study was guided by the following research questions:

i. What is the prevalence of allergic conjunctivitis among the school teachers?

ii. What is the level of knowledge on allergic conjunctivitis among school teachers?

iii. What factors related to exposure to chalk dust influence the development of allergic conjunctivitis among school teachers?

iv. Do chemicals used in teaching of science in schools cause significant allergic conjunctivitis among school teachers?

v. What is the health seeking behaviour of teachers for eye problems?

1.5 Null hypotheses

Three hypotheses were formulated.

i. There is no association between teaching profession and allergic conjunctivitis.

ii. There is no association between knowledge and development of allergic conjunctivitis among school teachers.

iii. Chemicals used in teaching of science subjects at schools do not cause significant allergic conjunctivitis to school teachers.
1.6 Objectives of the study

1.6.1 Broad objective

The main objective of the study was to investigate the factors that influence the development of occupational allergic conjunctivitis among school teachers.

1.6.2 Specific objectives

i. To determine the prevalence of allergic conjunctivitis among school teachers.

ii. To establish the level of knowledge and awareness on allergic conjunctivitis among school teachers.

iii. To determine the influence of exposure to chalk dust on the development of allergic conjunctivitis among school teachers.

iv. To establish whether chemicals used in teaching science cause significant allergic conjunctivitis among school teachers.

v. To establish the health seeking behaviour of school teachers for eye problems.

1.7 Significance

Results of the study would be used by the teachers, learners, planners, policy makers and the entire public to plan interventions to control allergic conjunctivitis. The healthy teacher would be more productive in teaching, use less money to treat the allergic conjunctivitis and reduce work turnover and absenteeism (Ait-Khaled et al., 2007). Also the teacher’s human right to health would be taken care of. The results would also be used by the policy makers to determine whether allergic conjunctivitis should be included in the schedule of occupational diseases in the Work Injury Benefit act of the laws of
Kenya (GOK, 2007). Researchers could also use the results as a foundation for more research to establish other factors that may influence the development of allergic conjunctivitis.

1.8 Limitations
Some respondents were illiterate and could not fill the questionnaires. For such, the questionnaires were used as interview schedules and were translated to the language that the respondents could understand. The study was not able to establish the severity of allergic conjunctivitis with different concentrations and different exposure time of chalk dust. Also the study was not able to determine the seasonal variations of allergic conjunctivitis among the teachers.

1.9 Assumptions
The study assumed that all were able to comprehend the questions in the questionnaires and were honest.

1.10 Scope of the study
The study was done at Bahati Division in Nakuru North District for easy accessibility, administration, supervision and coordination. The study design was cross-sectional and comparative in nature while questionnaires were the data collection tools used in this study. The study limited itself to those persons aged between 18-60 years, as they constitute the active population in the different occupations.
1.11 Theoretical framework

Since allergic conjunctivitis has a lot of effect on quality of life (D’Arienzo, 2005), there is need to control and prevent it. For this to be possible, it is important to focus on the attitudes and beliefs of individuals on allergic conjunctivitis as outlined by the Health Belief Model (Glanz et al., 1997).

The Health Belief Model (HBM) is a psychological model that attempts to explain and predict health behaviours. The HBM is based on the understanding that a person will take a health-related action if that person feels that a negative health condition can be avoided, has a positive expectation that by taking a recommended action they will avoid a negative health condition, and believes that they can successfully take a recommended health action.

The health belief model is spelled out in terms of six constructs representing the perceived threats and net benefits. These are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy.

Perceived susceptibility construct refers to one’s opinion of chances of getting a condition. This involves defining the population(s) at risk and heightening perceived susceptibility if found to be too low. Teachers constitute an occupational group or population who are exposed to factors related to teaching environment. This study would determine whether these factors place this population or group at a risk of developing
allergic conjunctivitis. The study would also reveal whether the teachers are aware of their susceptibility.

Perceived severity construct refers to one’s opinion of how serious a condition is and its consequences. It involves specification of consequences of the risk and the condition. Based on this construct, this study spells out the consequences of allergic conjunctivitis as a disease that can be sight threatening and with many effects on the quality of life.

Perceived benefits construct refers to one’s belief in the efficacy of the advised action to reduce risk or seriousness of impact. It involves defining of action to take and clarification of the positive effects to be expected. This study believes that if the teachers are aware of the factors that influence the development of allergic conjunctivitis, they would accept the avoidance of these factors as a way of preventing allergic conjunctivitis.

Perceived barriers, as a construct, involves identification and reduction of barriers towards putting in place the recommended action. The research study believes that the recommendations put in place would make it easy for the teachers to avoid the trigger factors. These include the substitution of chalk with another writing material, by the authority in charge, making it possible for the teachers to keep off from chalk dust and still continue to earn their living by teaching. Also, if water is provided for the washing of hands, they would be able to wash off the chalk dust and other allergens without going out of their way to look for the water. This would make it easy to comply with the recommendations of avoiding the allergens from coming into contact with their eyes.
Cues to action construct involves providing information and promoting awareness on the condition. This research would create awareness about allergic conjunctivitis among the teachers. Awareness would act as a remainder for the need to prevent and control allergic conjunctivitis. The research study also recommends that teachers should be informed about the symptoms and causes of allergic conjunctivitis. They should be trained or educated on ways of preventing the allergens from getting in contact with the eyes in order to control allergic conjunctivitis. This is in line with the sixth construct (self-efficacy).

1.12 Conceptual framework

This study developed a conceptual framework to show the interactions between dependent and independent variables (Figure 1.1). Selected factors, that is, exposure to chalk dust and science chemicals, level of knowledge on allergic conjunctivitis and the health seeking behaviour of the teachers on eye problems formed the independent variables of the study. The dependent variables comprised of the symptoms of allergic conjunctivitis. Factors associated with these variables were as shown in the conceptual frame work. The extraneous factors in this study were also included.
**Independent variables**
1. Exposure to chalk dust
   - Use of chalk
   - Material of duster used for rubbing the board
   - Workload of a teacher
   - Ventilation of the classrooms
   - Duration of teaching in years
   - Type of chalk used
   - Hygiene
2. Chemicals used in teaching science
   - Use of chemicals
   - Frequency of visiting the science lab
   - Frequency of using the science chemicals
   - Ventilation in the lab
   - Availability of running water in the lab
   - Presence of a lab technician
   - Use of goggles, masks and gloves
3. Knowledge and awareness
   - Causes
   - Symptoms
4. Health seeking behaviour
   - Visit a doctor
   - Buy over counter drugs
   - Leave to clear itself
   - Keep medication in the house

**Dependent variables**
1. Allergic conjunctivitis
   - Redness of the eye
   - Swelling
   - Watery eyes
   - Itchiness
   - Hurting/irritation
   - Discomfort

**Extraneous factors**
- Genetic make-up
- Gender
- Presence of dust and other solid particles
- Weather of the place
- Area of residence
- Fuels used at home
- Age of the person
- Presence of other allergies
- Occupation
- Smoke
- Other eye problems
- Use of insecticides, herbicides or pesticides

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**Figure 1.1: Conceptual framework of the relationship between the variables**
2.1.0 Allergens

Allergens are immunogens that tend to activate specific type of humoral or cell mediated response, having allergic manifestations (Kurby, 1992). The allergic reaction has two phases. When the patient inhales or comes into contact with an allergen, sensitised IgE antibodies trigger mast cell degranulation releasing histamine, cytokines, prostaglandins, thromboxanes, leukotrienes, and eosinophil chemotactic factors. Histamine then attaches to receptor sites causing irritation, inflammation and oedema. The influx of eosinophils in particular, provides additional inflammatory mediators and contributes to local injury (Kurby, 1992; Springhouse, 1995; Anderson and Macleod, 1997; Mitchell, 2002; Kubo et al., 2007).

Persons who are susceptible to allergy need to avoid irritants and chemicals with strong odours and heavy fumes since they increase the likelihood of developing allergy (Kumar and Kumar, 2003). Irritants in the school environment include classroom chalk and chemicals used in teaching of science subjects (Tyrer, 1985; ATSDR, 2007), which are briefly discussed in the following sub-sections.

2.1.1 Classroom chalk

The main component of chalk is calcium carbonate (CaCO₃), a form of processed limestone. Limestone deposits develop as minute calcareous plates created by the decomposition of plankton skeletons and accumulate forming sedimentary layers.
Plankton, a tiny marine organism, concentrates the calcium found naturally in seawater from 0.04 \% to 40 \%, which precipitates when the plankton dies (Stacy et al., 2006).

The procedure for making chalk is explained by Stacy et al. (2006): Limestone is first quarried and crushed after which it is wet-milled with water in a ball mill to remove impurities, leaving behind a fine powder. The particles of chalk are then conveyed to vibrating screens that sift out the finer material, which is then washed and dried. Water is then added to form thick slurry with consistency of clay. The slurry is then placed into and extruded from a die, cut into lengths of approximately 24.43 inches and placed on a sheet that contains places for five such sticks. The sheet is then placed in an oven, where the chalk cures for four days at 188 degrees Fahrenheit. After it has cured, the sticks are cut into pieces of 80 millimetres in length.

There are two types of chalk; the dusty and dustless chalk. The dusty chalk is soft and tends to produce a cloud of dust which take long to settle because it is light and therefore float in the air for a long time. The dustless chalk also produce dust but the dust is heavy because of the compressing of the chalk during the making. This dust therefore settles faster than that of the dusty chalk (Pollick, 2009). Those who use the dusty chalk therefore get exposed to the chalk dust longer before it settles and clear from the air. It would therefore be important to establish whether those who use dusty chalk have a higher prevalence of allergic conjunctivitis than those who use the dustless chalk.
2.1.2 Chemicals used in teaching science in schools

Most chemicals exhibit some degree of both acute and chronic toxicity. The symptoms displayed and the systemic effect will however differ. Chronic toxicity refers to the systemic damage that occurs after repeated exposure of low concentrations over a long period of time. Materials thought not to be hazardous in the recent past are often found to be hazardous at a later time (Magnussen, 1997).

Some chemicals found in the school laboratories have already been confirmed to be hazardous. The gases in the school laboratories can be classified based on their nature of toxic action. Ammonia, sulphur dioxide, chlorine and other halogen vapours are irritants. Irritants have the ability to cause injury and induce inflammation to the mucous membranes upon contact. They therefore cause irritation when they get into contact with the eyes and the lungs if inhaled (Poison control, 1995). They have strong odours and heavy fumes and increase the likelihood of developing allergy (Kumar and Kumar, 2003).

Nitrogen, hydrogen, methane, helium and propane are simple asphyxiants. If present in high concentrations, they displace the oxygen in the surrounding atmosphere and the victims suffer from lack of oxygen. Chemical asphyxiants interfere with the body’s ability to utilise oxygen. They may interfere with oxygen delivery (like carbon monoxide) or inhibit the utilisation of oxygen by the cells. Other chemical asphyxiants include hydrogen cyanide, nitrites and hydrogen sulphide (Magnussen, 1997; Poison control, 1995).
Aliphatic hydrocarbons, chlorinated hydrocarbons, acetone, ethyl ether and benzene are central nervous system depressants while carbon disulphide, mercury, chloroform, allyl alcohol and bromobenzene are neurotoxic agents. Hepatotoxic agents include carbon tetrachloride, chloroform, allyl alcohol and bromobenzene. Carbon tetrachloride and chloroform are also nephrotoxic agents. Naphthalene is a blood damaging agent while benzene and trinitrotoluene damage bone marrow. Benzene and carbon tetrachloride are also carcinogenic (Magnussen, 1997; Poison control, 1995).

Barium nitrate is poisonous and irritates the skin, the eyes, and the respiratory tract. It can also cause systemic poisoning. A dust mask should be worn at all times when handling it. Oxalate toxin is enough to cause intense sensations of burning in the mouth and throat, swelling and choking. If large doses are consumed, it can cause convulsions, coma and death. Dust respirator should be used when handling it. Calcium oxalate irritates the skin, eyes and mucous membranes (ATSDR, 2007).

Copper salts are toxic and should be handled with care. One should always wear gloves and goggles when handling them. Potassium chlorate is toxic. Strontium carbonate irritates the skin and the eyes on contact. Inhalation causes irritation to the lungs and mucous membrane. Strontium nitrate irritate the skin and eyes on contact. Breathing strontium nitrate can irritate the nose and throat. Repeated exposure may damage the lungs, heart, liver and kidneys, and affect the nervous system. Exposure to very high levels can cause it to accumulate in the bones and may affect their function (ATSDR, 2007).
Xylene affects the brain. High levels can cause headaches, lack of muscle coordination, dizziness, confusion, and changes ones sense of balance. It also causes irritation to the skin, eyes, nose, and the throat. It can cause unconsciousness and even death at very high levels (ATSDR, 2007).

Although alcohol and digital thermometers are in use in some schools, mercury thermometers are still widely used in school laboratories. These thermometers break as the students and teachers use them and the mercury in them pour out. Some of the mercury may get into contact with the bodies of the teachers and the students and may cause heavy metal poisoning. Attachment of mercury atom to the protein can seriously alter its properties. Proteins play an important part in cells as enzyme which catalyse biological processes and as constituents of cell membranes. Thus binding or attraction of mercury to sulphur in proteins can inhibit the activity of an enzyme and also interfere with the movement of materials across a cell membrane (Hill and Holman, 1995).

2.2 Hypotheses about allergies
Several hypotheses have been advanced to explain why some individuals are allergic while others are not. The hygiene hypothesis is a widely known theory and states that reduced exposure to immune challenge such as infection and disease, early in life causes the IgE-based defence mechanism to react to other substances, such as environmental pollens (Dermot, 2003; Maggi, 1998). This hypothesis considers the immune systems balance of Th2 and Th1 cells. The differentiation of less specialised Th0 cells into either Th2 or Th1 influences whether individuals will develop an allergic response. In the
development of an allergic sensitivity, the production of Th2 is stimulated, while that of Th1 is suppressed. This shifts the balance of these two mediators in favour of Th2 cells. This hypothesis holds that the western lifestyle of increased personal hygiene brings about this shift toward Th2 (Maggi, 1998). Studies show that children with greater exposure to immune-challenging situations develop less atopy than children kept in sterile environments (Von et al., 2000). While there is much evidence to support this hypothesis, it remains controversial, and conflicting research has challenged the theory. This hypothesis alone cannot completely explain the initial causes of allergy (Ring et al., 2001).

The other hypothesis emphasizes on environment. An individual environment can increase or decrease the incidence of allergy or his exposure to allergens. These factors include the number of children in a household, with fewer children increasing susceptibility to allergy, the presence of pets in the home, smoking or exposure to second hand smoke (Ring et al., 2001; Marshall et al., 2002). The third hypothesis uses diet and lifestyle. Consumption of exotic foods, fatty acids and smoking has been correlated with allergy. Also, a sedentary and indoor lifestyle increases a child’s exposure to indoor allergens (Wakai et al., 2001).

Genetic influence is the other hypothesis used to explain incidences of allergy. Atopy is more likely to run in families. Many of allergic individuals have children who are predisposed to atopy (Ring et al., 2001).
2.3 Allergic conjunctivitis

Allergic conjunctivitis is an inflammation of the conjunctiva (the thin membrane covering the eye) as a result of a reaction of the body’s immune system to an allergen (Bielory and Friedlaender, 2008). Allergic conjunctivitis is common in those persons who have other signs of allergic disease such as hay fever, asthma and eczema (Ring et al., 2001).

Allergic conjunctivitis is a type I hypersensitivity reaction. The Th2 cells produce many of the interleukin, (IL-4 and IL-3), and promote the growth of mast cells and eosinophils. When stimulated by an antigen, Th2 cells begin producing IgE, which binds to and cross-links in the surface of mast cells. This causes the cells to degranulate and release their allergic mediators such as histamine which binds to H1 receptors on nerve endings and causes the ocular symptom of itching, redness, chemosis, lid swelling and tearing. Swelling of the lids peaks within 15-30 minutes of exposure to the allergen. Histamine also binds to H1 receptors of the conjunctival vasculature and causes vasodilatation which appears superficial and pink rather than a deep red. TH2 cytokines such as IL-5 recruit eosinophils and IL-4, IL6 and IL3 which promote increased sensitivity. In severe cases, extreme discomfort may be experienced and ocular surface may sustain damage (Ono and Abelson, 2005; Whitcup, 2006).

There are two acute disorders of allergic conjunctivitis. These are seasonal allergic conjunctivitis (SAC) and perennial allergic conjunctivitis (PAC). These two represent the majority of all ocular allergy diagnosis. Both show the symptoms of allergic
conjunctivitis, which include itching, tearing, lid and conjunctiva oedema, redness and photophobia. Most cases of seasonal conjunctivitis are due to pollen and occur in the hay fever season, grass pollens and various other types of pollen (Figure 2.1). Perennial conjunctivitis is commonly due to an allergy to house dust mite (Ono and Abelson, 2005).

Source: (Du Toit, 2005)
**Figure 2.1 Seasonal allergic conjunctivitis**

Giant papillary conjunctivitis (GPC) is a very rare condition that is mainly caused by an allergic reaction to debris. It is characterised by the presence of a giant papillae which are typically greater than 0.3 mm (Figure 2.2).
The GPC represents an immunological reaction to the debris which causes mechanical irritation to the conjunctiva (Majmudar, 2010). It accounts for 0.5% - 1.0% of eye diseases in most countries. Repeated contact with the conjunctival surface caused by the use of contact lenses is associated with GPC. Surgery may also cause this type of allergic conjunctivitis due to mechanical irritation by the exposed sutures. Contact dermatoconjunctivitis is caused by the rest of the allergens that conjunctiva may come into contact with (Ono and Abelson, 2005; Majmudar, 2010).

Vernal keratoconjunctivitis (VKC) and atopic keratoconjunctivitis (AKC) are chronic allergic diseases where eosinophils, conjunctival fibroblasts, epithelial cells, Th2 lymphocytes aggravate the biochemistry and histology of conjunctiva. The VKC maybe subdivided into palpebral and limbal forms. The classic conjunctival sign in palpebral VKC is the presence of giant papillae which commonly occur on the superior tarsal conjunctiva. Giant papillae assume a flattop appearance, which often is described as
cobblestone papillae (Figure 2.3). In severe cases, large papillae may cause mechanical ptosis (Majmudar, 2010; Du Toit, 2005).

![Figure 2.3 Superior cobblestone papillae](image)

Source (Du Toit, 2005)

**Figure 2.3 Superior cobblestone papillae**

The limbal VKC is a disease of childhood and is prevalent in males living in warm climates. Anecdotally, this is commonly seen in black patients in Southern Africa. Papillae tend to occur at the limbus and have thick gelatinous appearance. They are commonly associated with multiple white spots (Homer-Trantas dots) (Figure 2.4).
While corneal vascularization is rare, the cornea may be affected in a variety of ways. Punctuate epithelial keratopathy may be due to the toxic effect of inflammatory mediators released from the conjunctiva and may be a precursor of characteristic shield ulcer. Chronic mechanical irritation of the giant tarsal papillae may also promote the development of the shield ulcer. Chronic eye rubbing may result in vernal pseudogerontoxon, which is a degenerative lesion in the peripheral (Du Toit, 2005; Ono and Abelson, 2005; Majmudar, 2010).

The AKC is frequently observed in males between the ages of 30 and 50. A family history of allergies, asthma, urticaria and/or hay fever is often present. The conjunctiva can be hyperaemic and oedematous, and tarsal conjunctival papillae are common. Gelatinous nodules can be present around the limbus with or without trantas dots. Lid margins may show meibomian gland dysfunction and keratinisation. Corneal involvement ranges from punctuate epithelial keratopathy early in the course of the
disease, to neovascularization, stromal scarring, and possibly ulceration. Keratoconus may also stem from chronic rubbing of the eyes. Anterior or posterior subcapsular cataract may form (Du Toit, 2005; Ono and Abelson, 2005; Majmudar, 2010).

### 2.4 Distribution of allergic conjunctivitis

Although allergic conjunctivitis affect about 20% of the world’s population (Dana, 2009), the prevalence differ from place to place with no distribution pattern (Foliaki et al., 2007; Ait-Khaled et al., 2007). In Kenya, it constitutes one fifth of all the total diagnoses made in eye clinics (MOH, 2000). Foliaki et al. (2007) and Bateman and Jithoo (2007) suggest that the high prevalence in poor countries may be due to the fact that it may not have been given priority as a disease. However, this contradicts the fact that allergies are on the increase in most of the industrialised countries with about 50 million Americans suffering from allergies (Scottsdale, 2009). Jeebhay (2004) explains that the workplace allergens may be responsible, as they are transported by the worker to their homes, thus affecting the rest of the family.

### 2.5 Trigger factors of allergic conjunctivitis

Research has shown that allergic conjunctivitis occur in those persons who are genetically predisposed (Ring et al., 2001) when they get exposed to those factors that cause allergic conjunctivitis. These factors include pollen, grass, topical medications, air pollutants, smoke, wind, dust, acids and alkalis (Springhouse, 2005). Indoor pollution may result from burnt material for fuels (BMF) which include plant or animal material such as wood and charcoal and account for more than one-half of domestic energy in
most developing countries and for as much as 95% in lower income countries (Smith et al., 2004). The adverse health effects of indoor air pollution are often exacerbated by lack of ventilation in homes using BMF and by the poor design of stoves that do not have flues or hoods to take smoke out of the living area. The combustion efficiency of BMF is also very low, thus it yields relatively high levels of products of incomplete combustion, which are more damaging to health. There is now evidence linking an increased risk of eye disease with air pollution levels (Pope et al., 2002).

The polluting effect, efficiency and cost of domestic fuel use are often construed as an ‘energy ladder’ (WHO, 2006). Dried animal dung, scavenged twigs and grass, which are cheap, inefficient and pollute the most, are at the bottom of the ladder. Crop residues, wood and charcoal are at a higher level BMF, whilst kerosene, coal and bottled or piped gas are the most efficient (non-BMF) combustible energy sources. Electricity is at the top of the energy ladder.

The weather of a place also influences the development of allergic conjunctivitis. High humidity and temperature inversion are some of the conditions which have been associated with allergic conjunctivitis (Dermot, 2003). Different areas have different weather and other environmental factors and this result in different distribution of allergic conjunctivitis in different areas (Foliaki et al., 2007).

D’Arienzo (2005) says that age is another factor that is associated with the development of allergic conjunctivitis. The age groups which coincide with the most productive period
of persons’ life are more prone to allergic conjunctivitis than others. Gender also influences the development of allergic conjunctivitis with more females suffering from allergic conjunctivitis than the males (Easty and Wyse, 2003).

Other eye problems are associated with allergic conjunctivitis. These include the shortsightedness which makes the eye to have an abnormal ocular surface which is not able to hold fluid over the ocular surface making it impossible for the eye to wash away the allergens (Scottsdale, 2009). A short sighted person is therefore more likely to suffer from allergic conjunctivitis than a normal person. Allergic conjunctivitis is also associated with other forms of allergy. Many patients with allergic rhinitis experience symptoms of allergic conjunctivitis (Bielory, 2000) while 15 % - 40 % of atopic eczema patients develop atopic keratoconjunctivitis (Braude and Chandler, 1984).

The eye is one of the first organs to encounter environmental and occupational allergens resulting in Occupational allergic conjunctivitis. Different occupations will therefore contribute differently to the development of allergic conjunctivitis depending on the kind of allergens in the work environments (Wittczak et al., 2007). Insecticides, herbicides and pesticides have strong odours and are irritants which can influence the development of allergic conjunctivitis among those who are exposed to them (Kumar and Kumar, 2003).

2.6 Diagnosis of allergic conjunctivitis

The symptoms of allergic conjunctivitis include watery, itchy, red, sore, swollen, stinging or burning and the feeling of the presence of foreign particles or ‘fullness’ in the eye.
Itching is the hallmark of allergic conjunctivitis and without it a person may not be suffering from allergic conjunctivitis even if all the other symptoms are present. Itching may be mild or severe (Ono and Abelson, 2005).

People with SAC usually note the onset of symptoms during the wet and warm season when the pollens of maize, grass and others are produced (More, 2009; Ono and Abelson, 2005; Morrow and Abbott, 1998). A history of recurrent itching or a personal or family history of hay fever, allergic rhinitis, asthma or atopic dermatitis is also suggestive of ocular allergy (Morrow and Abbott, 1998).

The type of ocular discharge, such as serious (watery), mucoid, mucopurulent or grossly purulent, can be helpful in determining the underlying cause of conjunctival inflammation. A mucoid (stringy or ropy) discharge is highly characteristic of allergy or dry eyes. A mucopurulent discharge often associated with morning crusting and difficulty in opening the eyelids, strongly suggests a bacterial infection (Morrow and Abbott, 1998).

Allergic conjunctivitis usually presents with bilateral symptoms because it is caused by environmental allergens. Infections caused by viruses and bacteria are transmitted by eye-hand contact. Often, these infections initially present in one eye, with the second eye becoming involved a few days later (Morrow and Abbott, 1998).
Most cases of conjunctivitis are treated empirically and are usually successful. Detailed tests involving the conjunctival scrapes are only done if there is no response to the drugs prescribed. However this is rarely done because of the cost and the general lack of laboratory staff experienced in handling ocular specimens (More, 2009).

2.7 Treatment of allergic conjunctivitis

Non specific measures to ameliorate symptoms include cold compresses (which may constrict capillaries) and eye washes with tear substitutes. Treatment consists of mast cell stabilizers, dual mechanism anti-allergen agents or topical antihistamines. Corticosteroids can also be used but cause cataracts and increases intraocular pressure (Ono and Abelson, 2005).

Oral antihistamines can dry the ocular surface, decreasing the barrier to allergens and the ability of the tear film to flush away allergens (Ousler et al., 2004). They also cause drowsiness and may react with other medications to cause life threatening cardiac arrhythmias (Kumar and Kumar, 2003). The first generation antihistamines rely on their ability to stimulate the adrenergic receptors on the conjunctival blood vessels thus creating vasoconstriction. This approach reduces chemosis and hyperemia and provides short-term relief of itching. In the long-term, however, these preparations can lead to significant techyphylaxis, chronic follicular conjunctivitis and eczematoid blepharoconjunctivitis (Abelson and Welch, 2000; Ashok, 2003). Oral antihistamines include the over the counter loratadine (Claritin ® /Alavert ®, generic forms), and prescription cetirizine (Zyrtec ®), fexofenadine (allegra ® and generic forms) and
desloratadine (clarinex ®). First generation antihistamines include Benadryl ® (More, 2009).

The topical therapy has proven to be more effective than oral antihistamines since it allows for drug delivery directly to the eye (Abelson and Welch, 2000). Topical allergic medications are classified by their specific mode of action. These include mast cell stabilizers, which prevent degranulation of mast cells thus inhibiting the release of histamine and other allergic mediators (Miyazaki, 2004). Mast cell stabilizers do not alleviate the effects of free-floating histamine or any of the inflammatory mediators. A patient must therefore start dosing prior to any allergen antigen complex associations to prevent symptoms (Kato et al., 2001). Antihistamines selectively block the histamine receptors. This in turn, reduces itching and hyperaemia. However these do not prevent the allergic cascade (Kato et al., 2001).

Some medications may contain both mast cell stabilizers and antihistamine. These block histamine reactions and reduce the early phase of allergic. Topical corticosteroids block, reduce or inhibit the production of inflammatory mediators (Kato et al., 2001). Cyclosporine blocks helper T-lymphocytes proliferation and IL-2 production. It also inhibits histamine release (Akpek and Tatlipinar, 2005).

Medicated eye drops are available in over the counter and prescription forms. Over the counter eye drops for allergic conjunctivitis include the decongestant (Visine ®, Naphcon ®, generic forms of naphzoline), and decongestant/anti-histamine combinations (visine-A
Registered, Naphcon-A®, generic forms of naphzoline /pheniramine). Decongestant eye drops (with or without antihistamines) should only be used for short periods of time as overuse can lead to conjunctivitis medicamentosa (characterised as rebound eye redness/congestion and dependence on the eye drops). These eye drops should not be used by people with glaucoma, and should be used with caution by people with heart or blood pressure problems (More, 2009).

2.8 Effects of allergic conjunctivitis on quality of life

Allergic conjunctivitis influences many quality of life parameters. First it causes discomfort to the eyes due to itchiness and irritation (Ono and Abelson, 2005; Ait-Khaled et al., 2007). In severe cases, the scratching and inflammation may result in ocular damage which can give rise to secondary infection of the eye (Ono and Abelson, 2005). The allergens in the eye can also drain and contribute to allergic signs and symptoms in the nose (D’Arienzo, 2005).

The drugs used to treat allergic conjunctivitis are harmful. Theses include the oral antihistamines which causes drowsiness to the patient. They may also react with other medications causing life threatening cardiac arrhythmias (Kumar and Kumar, 2003), or may dry the eye reducing its ability to flush away bacteria (Ousler et al., 2004) resulting in secondary infections. Steroids used to treat allergic conjunctivitis may interfere with the body immunity as they block, reduce or inhibit the production of inflammatory mediators (Kato et al., 2001; Kurby, 1992).
Formulation discomfort of the drugs used to treat the allergic conjunctivitis is another factor that the patients have to deal with. Discomfort may include a sensation of burning and stinging (Ono and Abelson, 2005). This is especially for those formulations which do not have a prolonged duration of action since they require a high frequency of instillation (D’Arienzo, 2005).

Allergic conjunctivitis is associated with depression and anxiety in some patients. The symptoms such as running eyes can interfere with the patient’s confidence in social places and limit the choice of outdoor activities. It can also affect one’s ability to wear eye make-ups making the patient feel unattractive. This affects the patient emotionally. Both itching and running eyes can also affect visual tasks (D’Arienzo, 2005).

Another factor is the target age of the population which coincides with the average age of the work force and the most productive period of an individual’s life. Economy is affected due to expenditures on prescriptions, productivity losses related to absenteeism and decreased job effectiveness due to discomfort from the symptoms of the ocular allergy (D’Arienzo, 2005).

The patients have to reschedule their activities to create time to consult a doctor for the eye problems especially in undeveloped countries where the waiting time at the health facilities is long due to few facilities that have to serve many persons over a long distance (Morris and Ferguson, 2007). Also the swelling and tearing of the eyes make the patients to feel unattractive affecting their social activities. Rubbing the eyes from the itchy
feeling can also result in periorbital excoriations and bruising making the eyes to appear even worse (Du Toit, 2005).

**2.9 Effects of allergic conjunctivitis to the teaching profession**

Allergic conjunctivitis is associated with itchy eyes which may make the teacher to concentrate on the rubbing of the eyes interfering with his/her teaching (Ono and Abelson, 2005; Ait-Khaled *et al.*, 2007). The allergen in the eye may also drain into the nose causing sneezing, scratching and discomfort (D’Arienzo, 2005). These symptoms can interfere with the teaching as the teacher has to spend time clearing the nose. Allergic conjunctivitis is also associated with depression and anxiety and a depressed teacher cannot be effective in his/her teaching (D’Arienzo, 2005).

Teaching involves imparting knowledge to learners which means that the learners have to focus on the teacher and the chalkboard (Pollick, 2009). The teachers are therefore very sensitive about their looks. Allergic conjunctivitis can affect the teacher’s ability to wear make ups and this may make them feel like they are not smart enough eroding their confidence in front of the learners (D’Arienzo, 2005). The swelling and tearing of the eyes may interfere with the sight of the teacher (Du Toit, 2005).

The medications used to treat the allergic conjunctivitis can cause drowsiness (Ashok, 2003) making it difficult for the teacher to attend to his duties. In the extreme cases, some of the drugs can react with other medications to cause cardiac arrhythmias which in some instances can result in death (Ashok, 2003) reducing the work force in the teaching
profession. Allergic conjunctivitis can also result in absenteeism as the teachers go to seek medical attention. This is especially in those areas which have very few health facilities and patients have to travel for long distances to access them. Usually the waiting time is also long (Morris and Ferguson, 2007; D’Arienzo, 2005), interfering with the teaching time of the sick teacher.

2.10 Prevention and control of allergies

With the increasing incidence of occupational allergies globally, there is need for a greater focus on preventive activities. Avoidance of the trigger factors of an allergy is the most effective method of controlling the allergy (Kumar and kumar, 2003). This can be made possible by introduction of strict regulatory exposure standards, workplace control measures and surveillance programmes. Manufacturer responsibility for product stewardship through detailed product labelling of allergen content is important in order to ensure overall public health and safety (Jeebhay, 2004).

The workplace sources of allergens can be controlled using the hierarchy or preferred order. This hierarchy, suggest that the source should be eliminated if possible. This is the most effective control measure (Tyrer, 1985). Substitution is considered next where the source of allergen can be substituted with one that has no health effects. Isolation is the next considered where barriers or screens are installed for separating the worker or general public from a source of allergen. Administrative control can also be used which involves introduction of work practices that reduces the risk. These may include limiting the amount of time a worker is exposed to a particular allergen. Personal protective
equipments are considered when the other control methods fail. These may include the use of gloves, barriers, creams and facemasks, to prevent contact with the allergen (Tyrer, 1985; Quinlan and Bohle, 1998).

Since the likelihood of developing symptoms to an allergen also depend on genetic predisposition, fitting the worker to his job by assessing the fitness of a worker to a particular job can be used to control the occupational allergies (Tyrer, 1985).

2.11 Occupational safety for teachers

Occupation is any engagement for which a person gets pay or reward. Teaching is therefore an occupation for the teachers. Safety implies the absence of conditions which may result in ill health (Rukunga, 2005).

Protection of the workers against sickness, disease and injury arising out of employment is among the objectives of the International Labour Organization (ILO). The ILO therefore requires that each member country should promote continuous improvement of occupational safety and health to prevent occupational diseases (C187, 2006). It is the duty of the occupational health staff to recognise and subsequently identify specific hazards or contaminants in the work environment. After the recognition and measurement of the hazard, preventive and control measures should be put in place (Rukunga, 2005). Identification of unrecognised hazards may require research or study. Clinical observation and study may reveal a causal relationship between patterns of sickness or mortality in groups of workers and their occupational exposure (Encyclopaedia
Britannica, 2003). The study of allergic conjunctivitis among the teachers may therefore reveal the factors that influence the development of allergic conjunctivitis making it possible for the condition to be prevented or controlled among the teachers.
CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study area

The study confined itself to Bahati Division for easy access, co-ordination, administration and supervision. Bahati Division has an area of 132 sq. Km (appendix I). It has a population of 105,000 persons (DC, 2009). It has 3 locations and 9 sub locations. These sub locations are Bahati, Chania, Mutukanio, Kabatini, Wendo, Thayu, Kiamaina, Rurii and Workers. There are 28 and 48 secondary and primary schools respectively with a total of 942 school teachers. There are 458 male and 484 female teachers (DEO, 2009).

Bahati division has one hospital (district hospital), one health centre (Kabatini health centre) and three dispensaries among the public health facilities. The rest are private clinics (DPHO, 2010). There is no eye clinic in the whole of Nakuru North District and most of the eye patients are referred to the Rift Valley provincial hospital in the neighbouring Nakuru district, except for minor eye infections which are treated at the facility levels. There are chemists in most of the centres in Bahati division, making over the counter drugs accessible to those who can afford.

3.2 Research design

The research design was cross sectional and comparative in nature. The prevalence of allergic conjunctivitis among school teachers was compared with that of the non teachers to ascertain whether those exposed to chalk and school science chemicals experience more allergic conjunctivitis than those unexposed. Prevalence of allergic conjunctivitis
among those teachers who are knowledgeable on the causes and symptoms of allergic conjunctivitis was compared with that of those teachers who do not know the causes and symptoms to establish whether knowledge and awareness influence the development of allergic conjunctivitis. The health seeking behaviour of the teachers was also studied.

Comparative studies have been used especially in epidemiology, to identify the aetiology of a specific disease or a group of diseases, and factors that increase a person’s risk for it (Ward et al., 1991)

### 3.3 Variables

Variables in this research were divided into three. These were dependent, independent and extraneous variables. Independent variables were exposure to chalk dust and chemicals used to teach science in schools, level of knowledge on allergic conjunctivitis, and the health seeking behaviour of the teachers. The dependent variables comprised the symptoms of allergic conjunctivitis while the extraneous variables were those factors that are believed to cause allergic conjunctivitis. In this research the independent variables were measurement type of independent variables because they had already occurred unlike the experimental type of independent variable, where the researcher has the control over them such as their amounts (Mugenda and Mugenda, 1999).

Factors related to exposure to chalk dust included chalk use, the material of duster used for rubbing the board, workload of a teacher, ventilation of the classrooms, duration of teaching in years, type of chalk used and hygiene of the teacher. Factors related to
exposure to chemicals used in teaching of science included use of these chemicals, frequency of visiting the science laboratory, frequency of using these chemicals, ventilation in the laboratory, availability of running water in the laboratory, presence of a laboratory technician and use of goggles, masks and gloves. Level of knowledge and awareness on allergic conjunctivitis was studied by establishing knowledge on the causes and symptoms of allergic conjunctivitis. One was considered knowledgeable if he/she was able to list the known causes and symptoms of allergic conjunctivitis. Health seeking behaviour of the teachers for eye problems was studied by establishing whether a teacher visits a doctor when he suffers from any eye problem, allows the problem to clear by itself, buys the over the counter drugs on the onset of the eye problem or stores the eye medication in the house ready for use for any eye problem.

The symptoms related to allergic conjunctivitis included itching, irritation or hurting, watery eyes, discomfort and swelling of the eyelids. One was considered to suffer from allergic conjunctivitis if he/she had itchy eyes and other symptoms of allergic conjunctivitis. This was so because some people are not keen on their eyes and therefore may not have noticed all of the symptoms since the study depended on self reporting. Self reporting was preferred because some people may use eye medication alleviating the symptoms thereby making it hard to observe.

The extraneous factors in this study included genetic make up, sex of a person, presence of dust and other solid particles, weather of the place, area of residence, fuels used at
home, age of a person, occupation, tobacco smoke, other eye problems and presence of other allergies in a person.

### 3.4 Target population

The target population was all the school teachers in the teaching profession because the interventions recommended from the results of this study would be applicable to all of them.

### 3.5 Study population

The study population was all the school teacher and non teacher residents of Bahati Division. The population of Bahati Division is 105,000 (DC, 2009). There are 324 secondary and 618 primary school teachers.

### 3.6 Sampling design

The sampling design was random and purposeful sampling. Four sub locations in Bahati Division were sampled randomly. To achieve this, names of the nine sub locations were written on small pieces of papers and each of the paper was then folded and placed in a box. Four pieces of the papers were picked from the box one at a time. The sub locations written on the selected pieces of papers were considered for the study. The researcher visited the DEO’s office, Nakuru North, to establish the schools in the selected sub locations and their teachers’ establishments as per the records. Only those schools whose record was in the DEO’s office were considered for study. A few of new private schools did not have their records in the DEO’s office.
During the visits to the selected schools, the head teacher was requested to participate in the study. This was a purposeful sampling. This was important because the head teachers were considered to teach either very few lessons or none at all because they had other administrative responsibilities. The other teachers were assigned numbers on a list. These numbers were then written on small pieces of papers and each paper folded and placed in a box. The papers were then picked one at a time until the required number of teachers per school was achieved. The number of teachers per school was determined proportionately using the following equation.

\[ n = \frac{246x}{N} \]

Where:

\( n \) = Number of teachers to be selected in the school
\( x \) = Established number of teachers in the school
\( N \) = Grand total of the teachers in all the schools in the sampled Sub Locations

(824)

246 = The required sample size

The number of the sampled teachers in each school was as in table 3.1.

The households in the selected sub locations and close to the schools were picked at random and visited until enough members had been enumerated. The school was purposefully selected as the point of reference for convenient sampling of the households. All those members in the selected households aged between 18 to 60 years were enumerated. The number of household members near each school was equated to that of the teachers selected in that school (table 3.2).
Table 3.1 Sampling of teachers

<table>
<thead>
<tr>
<th>Sample Sublocation</th>
<th>Schools in the Sublocation</th>
<th>Established no. of teachers</th>
<th>No. of sampled teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahati</td>
<td>Primary Schools</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Muringa</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>O.L. of Fatima</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>O.L. of Mercy</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>St. John</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>St. Lwanga</td>
<td>32</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Bahati Central</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Bahati Hill View</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Muthaiti</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Nukuru Gd Shepherd</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>St. Anthony</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Bahati Girls Catholic</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Davis Academy</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Bahati Upperhill</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Secondary Schools</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jomo Kenyatta</td>
<td>49</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Bahati Girls</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>JM Kariuki</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>St. John</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Menengai View</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Bahati Highway</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Muthaiti</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Bahati Victorious</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Bahati Upperhill</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Bleschohouse</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Bahati Boys</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Chania</td>
<td>Primary Schools</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bahati PCEA</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Kendurumu</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>St. Francis</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Secondary Schools</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bahati PCEA</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>Sample Sublocation</td>
<td>Schools in the Sublocation</td>
<td>Established no. of teachers</td>
<td>No. of sampled teachers</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td><strong>Kiamaina</strong></td>
<td><strong>Primary Schools</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Baraka</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Kagoto</td>
<td>33</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Kiamaina</td>
<td>46</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Menengai Hill</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Nakuru Workers</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Rurii</td>
<td>27</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Benag</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Dakimu</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Gd. Samaritan</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>G Samaritan, Solai Rd</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Joswin</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Kiorogo</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Marks Bahati</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>St. George Sch</td>
<td>23</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Neighbourhood</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Secondary Schools</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kiamaina</td>
<td>23</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Moi Ndeffo</td>
<td>23</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Menengai Hill</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>New Elimu</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Cllr Peter</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Bell House</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>St. Evans</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Primary Schools</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Engoshura</td>
<td>27</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Muriundu</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td><strong>Secondary Schools</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>St. Anthony</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td><strong>Kabatini</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td><strong>824</strong></td>
<td><strong>246</strong></td>
</tr>
</tbody>
</table>
Table 3.2 Sampling of the household members

<table>
<thead>
<tr>
<th>Sub Location</th>
<th>No. of teachers sampled</th>
<th>No. of household sampled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahati</td>
<td>58</td>
<td>58</td>
</tr>
<tr>
<td>Chania</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Kiamaina</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Kabatini</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>246</td>
<td>246</td>
</tr>
</tbody>
</table>

3.7 Sample size

Mwangi (2000) cites several authors to argue that a sample of 30 is the lowest acceptable if some form of statistical analysis is to be carried out in the data obtained. Sudman (1976) on the other hand suggests a minimum of 100 subjects in each major sub-group and 20 to 50 in each minor sub-group. This agrees with recommendations from other researchers for example, Peil (1995) and Kathuri and Pals (1993). Mugenda and Mugenda (1999) recommend the use of Fisher et al. (1999) formula,

\[ n = \frac{Z^2pq}{d^2} \]

However, a general rule of thumb is to use as large sample as possible in order to enhance representativeness to the population (Kerlinger, 1983, Gall et al., 1996). Due to financial and time constraints, the Fisher et al. (1999) formula was adopted for this study.

\[ n = \frac{Z^2pq}{d^2} \]

Where \( N \geq 10,000 \)
\( n = \text{the desired sample size} \)

\( z = 1.96 \) at 95\% confidence level (C.L)

\( p = 0.2 \) (since the prevalence of allergic conjunctivitis in the whole world is 20\% (Dana, 2009)

\( d = \text{significance level} \)

\[
\frac{1.96^2 \times 0.2 \times 0.8}{0.05^2} \approx 246 \text{ subjects}
\]

The sample size was therefore 246 school teachers from selected schools and 246 persons from the general population.

### 3.8 Inclusion criteria

All sampled teachers in the selected schools, who consented to be included in the study, were enumerated. Also, those in the selected households who were neither students nor school teachers and consented to be included in the study were enumerated. The subjects considered were those between 18-60 years of age, because they represent the active population in the different occupations.

### 3.9 Exclusion criteria

The study did not enumerate the students and school teachers in the households visited. This is because the students were exposed to the same substances as the school teachers at school while teachers had already been selected at their schools. Those below 18 and above 60 years of age were not legible because the government does not employ teachers below the age of 18 and the retirement of teachers is 60 years. Individuals who cannot
give sound judgment like the mentally challenged were not enumerated. Also, those who
did not consent were not legible.

3.10 Construction of research instruments

Closed questionnaires were constructed to collect information from the school teachers
and non teachers. Closed questionnaires ensured that the respondents gave only the
required information for the study. The responses were also easy to analyze. Some items
had yes/no items followed by some open ended questions which gave the respondents
opportunity to provide their own answers (Peil, 1995). The questionnaires are as shown
in appendixes II and III.

3.11 Pilot study

Pilot study was carried out in Wendo Sub location because Wendo sub location was not
selected for the study. Limuko primary school and Goshen secondary school were
selected randomly. Ten teachers from each of the two schools were selected purposefully
depending on who was available when the researcher went to these schools. The teachers
were first explained to the importance of the study, confidentiality assured and their
consent sought before participating in the pilot study.

The researcher then visited the households close these schools and requested the
assistance of the household members present in filling of the questionnaires. The
researcher first explained to them the importance of the study and sought their verbal
consent before they participated in the pilot study.
3.12 Reliability of research instruments
The reliability of the study was established from the pilot study as the responses given by the respondents on the questions were consistent. The items that showed lack of consistency were reconstructed accordingly.

3.13 Validity of research instruments
The validity of the instruments was established during pilot study when it was noted that the instruments were able to collect the required information on the various variables discussed earlier.

3.14 Data quality control
Piloting was carried out to ensure that the instruments were appropriate to collect the required information. After piloting the questionnaires were corrected in order to collect the required information. The researcher also worked with a clinical officer who was involved in the diagnoses of allergic conjunctivitis. The data collected was cleaned before analysis took place.

3.15 Administration of research instruments
The questionnaires for teachers were delivered personally by the researcher to ensure that they reach the respondents (Peil, 1995). If any of the selected teachers was absent from school, the researcher inquired of when he/she was likely to be present and revisited the school. All through the filling of the questionnaires, the researcher was present for clarification and to ensure that each teacher filled independently. If a selected teacher
declined to fill the questionnaire, replacement sampling was carried out by picking another folded piece of paper from the remaining papers with the names of the teachers. However this was only in one school where a few teachers declined and were replaced.

In each school, the head teacher filled a questionnaire which was similar to those of the other teachers. The selection of the head teacher was purposeful (Mugenda and Mugenda, 1999).

The questionnaires for the household members were also delivered personally to the respective respondents during the visit to the households. For the literate members, they were handed the questionnaires to fill for themselves. However, the questionnaires were used as interview schedules for those that were illiterate. Interpretation into understandable languages (such as Kiswahili and kikuyu) was done by the researcher for any of the household member who had problem with the language used in the questionnaires. All through the filling of the questionnaire, the researcher was there to explain anything that may have required clarification. It was also important to ensure independence in the filling of those questionnaires by the household members.

Questionnaires were administered to the selected subjects in order to establish the prevalence of self-reported symptoms of allergic conjunctivitis among the school teachers and non-teaching population. Self-reported symptoms were used since the subjects may use medications, which alleviates the symptoms (Kurby, 1992), therefore making it difficult to observe.
3.16 Ethical considerations

Clearance for the study was sought from all the relevant authorities including the Ministry of higher Education, Science and Technology. Prior to the visits to the schools, a courtesy call was made to the DEO, Nakuru North, who gave an introductory letter to the researcher. The researcher also sought permission from the head teacher of each of the visited schools before sampling the teachers and administering the questionnaires. If the head teacher was absent, the deputy teacher was consulted and their permission sought although the researcher had to revisit such a school in order to request the head teacher to participate in the study. The researcher also made a courtesy call to the DC, Nakuru North district where permission was sought to visit and enumerate the household members in Bahati Division.

Confidentiality of information and anonymity in data recording was assured in the first part of the questionnaires and also verbally before administering the questionnaires. The importance of the study was explained to the subjects and finally their verbal consent sought. For those who declined, others were randomly sampled to replace them. The researcher also made recommendations for ways of controlling allergic conjunctivitis which would benefit the subjects.

3.17 Data analysis

Prior to data analysis, the questionnaires were checked for clarity, completeness and consistency in the responses given. According to Knoll (1996) hand sorting and organisation of data require careful planning. The data collected from the questionnaires
was therefore organized, coded and entered into the computer for analysis. The SPSS (Version 12.0 for Windows) package was used to analyse data. The computer produced tables of descriptive and inferential statistics. Descriptive statistics included frequencies and percentages while inferential statistics included chi-square and Odds ratio tested at 95% confidence level. Chi-square test was used to determine the association between allergic conjunctivitis and teaching occupation by comparing the prevalence of allergic conjunctivitis of teachers and non teachers as the different factors known to cause allergic conjunctivitis were held constant. Chi-square test was also used to determine the association between allergic conjunctivitis and knowledge and allergic conjunctivitis and exposure to chemicals used in teaching of science subjects. Odds ratio, frequencies and proportions were used to compare presence of allergic conjunctivitis in the different groups.

Indicators of presence of allergic conjunctivitis were established using the discussed symptoms in the literature review. Those reporting to experience itchy eyes and other symptoms of allergic conjunctivitis (as explained in the literature review) were considered to have the condition.
CHAPTER FOUR

4.0 RESULTS

4.1 Socio-demographic characteristics of the respondents

The study sample had 246 teachers and 246 non teachers. There were 166 primary school teachers and 80 secondary school teachers. The table 4.1 summarizes the socio-demographic characteristics of the respondents.

Table 4.1 Socio-demographic characteristics of the respondents

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>School teachers</th>
<th>Non teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>128</td>
<td>52</td>
</tr>
<tr>
<td>Female</td>
<td>118</td>
<td>48</td>
</tr>
<tr>
<td>Age in years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>24</td>
<td>9.8</td>
</tr>
<tr>
<td>25-34</td>
<td>64</td>
<td>26.0</td>
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<tr>
<td>35-44</td>
<td>107</td>
<td>43.5</td>
</tr>
<tr>
<td>45-54</td>
<td>49</td>
<td>19.9</td>
</tr>
<tr>
<td>55-60</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>College</td>
<td>236</td>
<td>95.9</td>
</tr>
<tr>
<td>Secondary</td>
<td>10</td>
<td>4.1</td>
</tr>
<tr>
<td>Primary level and below</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>193</td>
<td>79.5</td>
</tr>
<tr>
<td>Single</td>
<td>50</td>
<td>20.5</td>
</tr>
</tbody>
</table>
From Table 4.1, there were 128 (52.0 %) male teachers and 136 (55.3 %) male non-teachers. The females were 118 (48.0 %) and 110 (44.7 %) respectively. Majority of the teachers (89.4 %) were in the age bracket of 25-54 years. There were very few teachers in the age brackets of 18-24 (9.8 %) and 55-60 (0.8 %) years. Majority of the teachers (95.9 %) had college education and only 10 (4.1 %) with secondary education. Most of the non teacher respondents (104) had secondary education. Only 30.1 % (74) of non teachers had college education while 24.8 % (61) had primary education. There were 78.5 % (193) married teachers and 20.3 % (50) single teachers. The married and single non teachers were 69.9 % (172) and 28.0 % (69) respectively.

4.2 Prevalence of allergic conjunctivitis

A person who had itchy eyes and other symptoms of allergic conjunctivitis as indicated in the conceptual frame work was considered to suffer from allergic conjunctivitis. One hundred and twenty six (51.2 %) of teachers suffered from allergic conjunctivitis while only 25.6 % (63) of non teachers suffered. Around 42.9 % (54) of those teachers with allergic conjunctivitis were males while 57.6 % (72) were females (Table 4.2).

<table>
<thead>
<tr>
<th>Presence of allergic conjunctivitis</th>
<th>teachers</th>
<th>%</th>
<th>Others</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>126</td>
<td>51.2</td>
<td>63</td>
<td>25.6</td>
</tr>
<tr>
<td>No</td>
<td>120</td>
<td>48.8</td>
<td>183</td>
<td>74.4</td>
</tr>
<tr>
<td>Total</td>
<td>246</td>
<td>100.0</td>
<td>246</td>
<td>100.0</td>
</tr>
</tbody>
</table>
These results showed that more teachers than non-teachers suffered from allergic conjunctivitis. The results also showed that 63.1% (53) genetically predisposed teachers suffered from allergic conjunctivitis while only 43.7% (31) of the genetically predisposed non-teachers suffered from allergic conjunctivitis. One was said to be genetically predisposed if either of the parents or a sibling was reported to have itchy eyes and other symptoms of allergic conjunctivitis (Ring et al., 2001). There was an association between teaching occupation and allergic conjunctivitis (p<0.05 at 95% CL) for the genetically predisposed respondents.

Among the respondents who resided in very dusty areas, 52.9% (99) of teachers and 25.0% (57) of non-teachers suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic conjunctivitis (p<0.05 at 95% CL) for those who resided in very dusty areas. The results also showed that 50.4% (120) of teachers and 24.9% (60) of non-teachers in the very warm residential areas suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic conjunctivitis (p<0.05 at 95% CL) among the residents of very warm areas. There was no association between teaching occupation and allergic conjunctivitis (p>0.05 at 95% CL) for the residents from the very cold areas although more teachers (83.3%) suffered from allergic conjunctivitis than non-teachers (40.0%).

When use of different fuels was considered, it was found that 49.3% (33) of teachers and 26.5% (35) of non-teachers who used firewood as fuel suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic
conjunctivitis (p<0.05 at 95 % CL) for the respondents who used firewood as fuel. The results also showed that 49.2 % (60) of teachers and 24.8 % (26) of non teachers who used charcoal as fuel suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic conjunctivitis (p<0.05 at 95 % CL) for the respondents who used charcoal as fuel. More teachers (44.4 %) than non teachers (14.3 %) suffered from allergic conjunctivitis, although there was no association between teaching occupation and allergic conjunctivitis (p>0.05 at 95 % CL) for the respondents who used kerosene as fuel.

There was no association between teaching occupation and allergic conjunctivitis (p>0.05 at 95 % CL) for the respondents who used gas as fuel. However, more teachers (66.7 %) than non teachers (0.0 %) suffered from allergic conjunctivitis. The test of association between teaching and allergic conjunctivitis was not carried out for the respondents who used electricity as fuel because there were no non teachers who used electricity as fuel. Among the teachers who used electricity as fuel, 45.5 % (5) suffered from allergic conjunctivitis.

Association between teaching occupation and allergic conjunctivitis was tested for the respondents in the different age groups. The results showed that 50.0 % (12) of teachers and 13.8 % (90) of non teachers in the 18-24 years age group suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic conjunctivitis (p<0.05 at 95 % CL) for the respondents in this age group. Among the respondents aged between 25-34 years, 51.6 % (33) teachers and 19.1 % (18) non
teachers suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic conjunctivitis ($p<0.05$ at 95 % CL) for the respondents in this age group.

There was no association between teaching occupation and allergic conjunctivitis ($p>0.05$ at 95 % CL) for the respondents aged between 35-44 years. However, the prevalence of allergic conjunctivitis for the teachers was higher (47.2 %) than that of the non teachers (43.9 %). Also, teachers aged between 45-54 years had a higher prevalence of allergic conjunctivitis (59.2 %) than the non teachers in the same age group (35.3%). There was an association between teaching occupation and allergic conjunctivitis ($p<0.05$ at 95 % CL) for the respondents in this age group. The results also showed that there was no association between teaching occupation and allergic conjunctivitis ($p>0.05$ at 95 % CL) for the respondents aged between 55-60 years. However, the teachers had a higher prevalence of allergic conjunctivitis (100.0 %) than the non teachers (50.0 %).

More teachers (104) suffered from other forms of allergy than the non teacher respondents (34). Of these respondents, 68.3 % (71) teachers and 50.0 % (17) non teachers suffered from allergic conjunctivitis. There was no association between teaching occupation and allergic conjunctivitis ($p>0.05$ at 95 % CL) for those who suffered from other forms of allergies.

Only 8.5 % (21) teachers and 10.6 % (26) non teachers smoked tobacco. Of these, 38.1 % (8) teachers and 23.1 % (6) non teachers suffered from allergic conjunctivitis. There was
no association between teaching occupation and allergic conjunctivitis (p>0.05 at 95 % CL) among the smokers. When those exposed to secondary tobacco smoke were considered, the results showed that 52.2 % (83) teachers and 33.3 % (36) non teachers suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic conjunctivitis (p<0.05 at 95 % CL) for those exposed to secondary tobacco smoke. One was considered to be exposed to secondary tobacco smoke if he said he/she gets exposed to smoke from tobacco smokers on daily basis.

Other eye problems were also considered. The results showed that 65.0 % (13) shortsighted teachers and 45.5 % (10) short sighted non teachers suffered from allergic conjunctivitis. There was no association between teaching occupation and allergic conjunctivitis (p>0.05 at 95 % CL) among the shortsighted respondents. About 50.0 % (1) longsighted teachers suffered from allergic conjunctivitis while there were no long sighted non teacher respondents. The association between teaching occupation and allergic conjunctivitis was therefore not tested for the long sighted respondents. Among the respondents who suffered from photophobia eye problem, 90.9 % (10) teachers and 40.0 % (4) non teachers suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic conjunctivitis (p<0.05 at 95 % CL) among those who suffered from photophobia.

More male teachers (42.5 %) than male non teachers (25.0 %) suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic conjunctivitis (p<0.05 at 95 % CL) among the male respondents. Among the female
respondents, 61.0% (72) teachers and 25.5% (28) non teachers suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic conjunctivitis (p<0.05 at 95% CL) for the female respondents.

The results showed that 69.9% (172) teachers and 60.6% (149) non teachers used insecticides, herbicides or pesticides. Of those, 51.7% (89) teachers and 27.5% (41) non teachers suffered from allergic conjunctivitis. There was an association between teaching occupation and allergic conjunctivitis (p<0.05 at 95% CL) among this group of respondents.

From these results, it can be noted that there was an association between teaching occupation and allergic conjunctivitis (p<0.05) when all the factors were held constant except for shortsightedness, smoking, presence of other allergies, 55-60 years and 35-44 years age groups, use of kerosene and gas as fuel and cold residential areas. Table 4.3 summarizes these results.
Table 4.3 Association between teaching occupation and allergic conjunctivitis

<table>
<thead>
<tr>
<th>Factor defining a group of respondents</th>
<th>Allergic conjunctivitis Teachers %</th>
<th>Non teachers %</th>
<th>χ²</th>
<th>df</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetically predisposed</td>
<td>Yes</td>
<td>63.1 (53)</td>
<td>43.7 (31)</td>
<td>5.854</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>36.9 (31)</td>
<td>56.3 (40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dusty residential area</td>
<td>Yes</td>
<td>52.9 (99)</td>
<td>25.0 (57)</td>
<td>34.189</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>47.1 (88)</td>
<td>75.0 (171)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warm residential area</td>
<td>Yes</td>
<td>50.4 (120)</td>
<td>24.9 (60)</td>
<td>33.257</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>49.6 (118)</td>
<td>75.1 (181)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cold residential area</td>
<td>Yes</td>
<td>83.3 (5)</td>
<td>40.0 (2)</td>
<td>2.213</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>16.7 (1)</td>
<td>60.0 (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuels used at home</td>
<td>Firewood</td>
<td>49.3 (33)</td>
<td>26.5 (35)</td>
<td>10.215</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>50.7 (34)</td>
<td>73.5 (97)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Charcoal</td>
<td>49.2 (60)</td>
<td>24.8 (26)</td>
<td>14.299</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>50.8 (62)</td>
<td>75.2 (79)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kerosene</td>
<td>44.4 (4)</td>
<td>14.3 (1)</td>
<td>1.667</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>55.6 (5)</td>
<td>85.7 (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gas</td>
<td>66.7 (24)</td>
<td>0 (0)</td>
<td>3.619</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>33.3 (12)</td>
<td>100 (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electricity</td>
<td>45.5 (5)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>54.5 (6)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age of the person in years</td>
<td>18-24</td>
<td>50.0 (12)</td>
<td>13.8 (90)</td>
<td>12.709</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>50.0 (12)</td>
<td>86.2 (56)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25-34</td>
<td>51.6 (33)</td>
<td>19.1 (18)</td>
<td>18.301</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>48.4 (31)</td>
<td>80.9 (76)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35-44</td>
<td>47.2 (50)</td>
<td>43.9 (18)</td>
<td>0.127</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>52.8 (56)</td>
<td>56.1 (23)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>45-54</td>
<td>59.2 (29)</td>
<td>35.3 (12)</td>
<td>4.583</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>40.8 (20)</td>
<td>64.7 (22)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>55-60</td>
<td>100.0 (2)</td>
<td>50.0 (5)</td>
<td>1.714</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0 (0)</td>
<td>50.0 (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of other allergies in a person</td>
<td>Yes</td>
<td>68.3 (71)</td>
<td>50.0 (17)</td>
<td>3.702</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>31.7 (33)</td>
<td>50.0 (17)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.3 Association between teaching occupation and allergic conjunctivitis (continued)

<table>
<thead>
<tr>
<th>Tobacco smoke</th>
<th>Yes</th>
<th>No</th>
<th>1</th>
<th>0.263</th>
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</thead>
<tbody>
<tr>
<td>Smoking tobacco</td>
<td>38.1 (8)</td>
<td>23.1 (6)</td>
<td>1.253</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>61.9 (13)</td>
<td>76.9 (20)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure to secondary tobacco smoke</td>
<td>52.2 (83)</td>
<td>33.3 (36)</td>
<td>9.268</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>47.8 (76)</td>
<td>66.7 (72)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other eye problems</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortsightedness</td>
<td>65.0 (13)</td>
<td>45.5 (10)</td>
<td>1.616</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>35.0 (7)</td>
<td>54.5 (12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long sightedness</td>
<td>50.0 (1)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>50.0 (1)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Photophobia</td>
<td>90.9 (10)</td>
<td>40.0 (4)</td>
<td>6.109</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>9.1   (1)</td>
<td>60.0 (6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>42.5 (54)</td>
<td>25.0 (34)</td>
<td>9.054</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>57.5 (73)</td>
<td>75.0 (102)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>61.0 (72)</td>
<td>25.5 (28)</td>
<td>29.240</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>39.0 (46)</td>
<td>74.5 (82)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use of insecticides, herbicides and pesticides</th>
<th>Yes</th>
<th>No</th>
<th>1</th>
<th>0.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>51.7 (89)</td>
<td>27.5 (41)</td>
<td>19.447</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>48.3 (83)</td>
<td>72.5 (108)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.3 Knowledge and awareness on allergic conjunctivitis among school teachers

Knowledge and awareness of teachers on allergic conjunctivitis was determined by trying to establish whether the teachers knew the causes and symptoms of allergic conjunctivitis. One was considered knowledgeable if he/she was able to list the correct causes and symptoms of allergic conjunctivitis in the questionnaires used for data collection (appendix II). The results showed that only 4.1 % (10) of teachers knew the symptoms of allergic conjunctivitis and that 70.0 % (7) of those who knew suffered from
allergic conjunctivitis while 50.4 % (117) of those who did not know suffered. The results also showed that majority of teachers (97.1 %) do not know the causes of allergic conjunctivitis. Among those who knew the causes, 42.9 % (3) suffered from allergic conjunctivitis while 51.5 % (121) of those who did not know suffered from allergic conjunctivitis. The results did not show an association between allergic conjunctivitis and knowledge (p>0.05 at 95 % CL) as shown in Table 4.4.

### Table 4.4 Knowledge and awareness of teachers on allergic conjunctivitis

<table>
<thead>
<tr>
<th>Knowledge of teachers on causes and symptoms</th>
<th>Allergic %</th>
<th>Not allergic %</th>
<th>Statistic test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causes of allergic conjunctivitis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>42.9 (3)</td>
<td>57.1 (4)</td>
<td>χ² = 0.203, df = 1, p = 0.653</td>
</tr>
<tr>
<td>No</td>
<td>51.5 (121)</td>
<td>48.5 (114)</td>
<td></td>
</tr>
<tr>
<td>Symptoms of allergic conjunctivitis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>70.0 (7)</td>
<td>30.0 (3)</td>
<td>χ² = 1.469, df = 1, p = 0.225</td>
</tr>
<tr>
<td>No</td>
<td>50.4 (117)</td>
<td>49.6 (115)</td>
<td></td>
</tr>
</tbody>
</table>

#### 4.4 Influence of chalk dust on development of allergic conjunctivitis

There was a higher prevalence of allergic conjunctivitis among those who use chalk (52.8 %) than those who do not use (18.2 %). The Odds Ratio was used to establish association between chalk use and development of allergic conjunctivitis. The results showed that use of chalk was associated with allergic conjunctivitis (OR=5.027; 95 % CI = 1.063-23.766) (Table 4.5). Among the teachers with 1-3 lessons per day, 60.0 % (3) suffered from allergic conjunctivitis while 52.6 % (121) of those with 4 lessons and above suffered from allergic conjunctivitis. There was no association between workload
and development of allergic conjunctivitis (OR= 0.740; 95 % CI= 0.121-4.512) (Table 4.5).

Most of the dusters (76.8 %) in the schools were made up of soft materials. Ninety seven teachers (51.3 %) who used dusters with soft materials suffered from allergic conjunctivitis while 50.9 % (29) of those who used dusters with hard material suffered from allergic conjunctivitis. There was no association between material of duster and development of allergic conjunctivitis (OR= 0.982; 95 % CI= 0.543-1.776) (Table 4.5).

Majority of teachers (89.0 %) taught in classes with good ventilation. Of these, 50.5 % (110) suffered from allergic conjunctivitis while 55.6 % (15) of those with poorly ventilated classrooms suffered from allergic conjunctivitis. There was no association between ventilation of the classrooms and development of allergic conjunctivitis (OR= 1.227; 95 % CI= 0.549-2.743) (Table 4.5).

Majority of teachers (78.6 %) had taught for 5 or more years. Among them, 51.3 % (98) suffered from allergic conjunctivitis while 50.0 % (26) of those who had taught for less than five years suffered from allergic conjunctivitis. There was no association between length of teaching in years and development of allergic conjunctivitis (OR= 0.949; 95 % CI= 0.514-1.752) (Table 4.5).

Most of the teachers (90.6 %) used dustless chalk. Of these, 53.1 % (113) suffered from allergic conjunctivitis while 54.5 % (12) of those who used dusty chalk suffered from
allergic conjunctivitis. There was no association between type of chalk used and development of allergic conjunctivitis (OR= 0.942; 95% CI= 0.390-2.273) (Table 4.5).

There were very few teachers (27.8%) with access to water for washing hands. Only 45.6% (31) of those teachers with access to water suffered from allergic conjunctivitis while 53.7% (95) of those teachers without water suffered from allergic conjunctivitis. The results showed that those teachers who had access to water for washing of the hands had a lower prevalence of allergic conjunctivitis than those who did not have access to the water. There was no association between accessibility of water for washing hands and the development of allergic conjunctivitis (OR= 0.723; 95% CI= 0.413-1.268) (Table 4.5).
<table>
<thead>
<tr>
<th>Factor</th>
<th>Presence of allergic conjunctivitis</th>
<th>Absence of allergic conjunctivitis</th>
<th>Odds Ratio</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chalk use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use chalk</td>
<td>52.8 (124)</td>
<td>47.2 (111)</td>
<td>5.027</td>
<td>1.063-23.766</td>
</tr>
<tr>
<td>Don’t use chalk</td>
<td>18.2 (2)</td>
<td>81.8 (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Workload</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3 lessons per day</td>
<td>60.0 (3)</td>
<td>40.0 (2)</td>
<td>0.740</td>
<td>0.121-4.512</td>
</tr>
<tr>
<td>Above 4 lessons per day</td>
<td>52.6 (121)</td>
<td>47.4 (109)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Material used to make the duster</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft</td>
<td>51.3 (97)</td>
<td>48.7 (92)</td>
<td>0.982</td>
<td>0.543-1.776</td>
</tr>
<tr>
<td>Not soft</td>
<td>50.9 (29)</td>
<td>49.1 (28)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ventilation of classrooms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>55.6 (15)</td>
<td>44.4 (12)</td>
<td>1.227</td>
<td>0.549-2.743</td>
</tr>
<tr>
<td>Good</td>
<td>50.5 (110)</td>
<td>49.5 (108)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Duration of teaching in years</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5</td>
<td>50.0 (26)</td>
<td>50.0 (26)</td>
<td>0.949</td>
<td>0.514-1.752</td>
</tr>
<tr>
<td>Above 5 years</td>
<td>51.3 (98)</td>
<td>48.7 (93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type of chalk used</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dustless</td>
<td>53.1 (113)</td>
<td>46.9 (100)</td>
<td>0.942</td>
<td>0.390-2.273</td>
</tr>
<tr>
<td>Dusty</td>
<td>54.5 (12)</td>
<td>45.5 (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Water accessibility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water accessible</td>
<td>45.6 (31)</td>
<td>54.4 (37)</td>
<td>0.723</td>
<td>0.413-1.268</td>
</tr>
<tr>
<td>Water not accessible</td>
<td>53.7 (95)</td>
<td>46.3 (82)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.5 Influence of science chemicals on development of allergic conjunctivitis

There were few teachers (18.7 %) who used chemicals in the teaching of the sciences in the schools. Of those teachers, 54.3 % (25) suffered from allergic conjunctivitis while 50.5 % (101) of those who did not use chemicals in teaching science (200) suffered from allergic conjunctivitis (Table 4.6). There was no association between use of chemicals in teaching of science subjects and allergic conjunctivitis (p>0.05, 95 % CL).

When the frequency of use of chemicals to teach science was considered, it was found that 59.1 % (13) of those who used them once a week suffered from allergic conjunctivitis while 50.0 % (12) of those who used them twice or more times a week suffered from allergic conjunctivitis (Table 4.6). There was no association between frequency of use of these chemicals and allergic conjunctivitis (p>0.05, 95 % CL).

The result showed that 52.8 % (19) of those who had running water in the laboratory suffered from allergic conjunctivitis while 63.6 % (7) of those who did not have running water in the laboratory suffered from allergic conjunctivitis (Table 4.6). There was no association between availability of running water in the laboratory and allergic conjunctivitis (p>0.05, 95 % CL).

When presence of a full time laboratory technician was considered, the results showed that 56.8 % (21) of those science teachers who had a full time laboratory technician suffered from allergic conjunctivitis while 50.0 % (5) of those without a full time laboratory technician suffered from allergic conjunctivitis (Table 4.6). There was no
association between presence of a full time laboratory technician and allergic conjunctivitis (p>0.05, 95 % CL). The association between use of gloves, masks and goggles and allergic conjunctivitis was not tested because the data indicated that all those teachers who participated in the study did not use them consistently.

Table 4.6 Influence of chemicals used in teaching science on development of allergic conjunctivitis

<table>
<thead>
<tr>
<th>Factors associated with chemicals used in teaching science in schools</th>
<th>Allergic %</th>
<th>Not allergic %</th>
<th>Statistic test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of chemicals</td>
<td>Yes</td>
<td>54.3 (25)</td>
<td>45.7 (21)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>50.5 (101)</td>
<td>49.5 (99)</td>
</tr>
<tr>
<td>Frequency of use of chemicals</td>
<td>Once a wk</td>
<td>59.1 (13)</td>
<td>40.9 (9)</td>
</tr>
<tr>
<td></td>
<td>2 or more</td>
<td>50.0 (12)</td>
<td>50.0 (12)</td>
</tr>
<tr>
<td>Availability of running water in the lab</td>
<td>Yes</td>
<td>52.8 (19)</td>
<td>47.2 (17)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>63.6 (7)</td>
<td>36.4 (4)</td>
</tr>
<tr>
<td>Presence of full time lab technician</td>
<td>Yes</td>
<td>56.8 (21)</td>
<td>43.2 (16)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>50.0 (5)</td>
<td>50.0 (5)</td>
</tr>
</tbody>
</table>

4.6 Health seeking behaviour regarding eye problems among school teachers

Only 37.4 % (92) of teachers visit the doctor when they develop any eye problem while 19.5 % (48) allow the eye problem to clear itself. Only 24.8 % (61) of teachers buy over the counter eye medications without the doctor’s prescription. Of the 15.9 % teachers who keep medicine at home for use incase of eye problems, 66.7 % (26) keep medication prescribed by a doctor while 33.3 % keep eye medication without the doctor’s prescription (Table4.7).
Table 4.7 Health seeking behaviour regarding eye problems among teachers

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit the doctor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>92</td>
<td>37.4</td>
</tr>
<tr>
<td>No</td>
<td>48</td>
<td>19.5</td>
</tr>
<tr>
<td>Missing</td>
<td>106</td>
<td>43.1</td>
</tr>
<tr>
<td>Use of over the counter drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>61</td>
<td>24.8</td>
</tr>
<tr>
<td>no</td>
<td>182</td>
<td>74.0</td>
</tr>
<tr>
<td>missing</td>
<td>3</td>
<td>1.2</td>
</tr>
<tr>
<td>Storage of drugs in the house</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>39</td>
<td>15.9</td>
</tr>
<tr>
<td>no</td>
<td>207</td>
<td>84.1</td>
</tr>
</tbody>
</table>
CHAPTER FIVE

5.0 DISCUSSION OF RESULTS

5.1 Socio-demographic characteristics of the respondents

Majority of teachers had college level education because it is a requirement of the Ministry of Education that a teacher has to be registered with the Teachers’ Service Commission (TSC) so as to qualify to teach in either public or private school (Birgen, 2002; Lengoiboni, 2008). The Teachers’ Service Commission registers only those who have trained to be teachers. There were few non teachers with college level education because most of those with college education hold other formal employments in urban areas (Wahome, 2007).

5.2 Prevalence of allergic conjunctivitis

The prevalence of allergic conjunctivitis of both the teachers (51.2 %) and non teachers (25.6 %) was higher than the world’s (Dana, 2009) and the general Kenyan prevalence (MOH, 2000) of about 20 %. This may be expected because some of those who suffer from allergic conjunctivitis may not consult a medical professional and therefore may not be included in the Ministry of Health’s report (Scottsdale, 2009; Dermot, 2003). This also agrees with Foliaki et al. (2007) who reported that the prevalence of allergic conjunctivitis differs from place to place. This may be due to the different environmental factors in the areas. Bahati Division has most of the parts with sandy soil which does not retain water for long and therefore easily forms dust which can be carried up by the wind getting into the eyes of the people. Some parts of Bahati also experience temperature inversion which Dermot (2003) associates with the development of allergic...
conjunctivitis. In addition, the area has a lot of motorbikes and other vehicles plying it. This may also increase the pollution of the air by the petroleum products increasing the chances of developing allergy (Heinrich and Wichmann, 2004).

5.3 Association between teaching occupation and allergic conjunctivitis

The association between teaching occupation and allergic conjunctivitis was tested using the chi square test of association (95 % C.L) while the factors associated with development of allergic conjunctivitis were held constant. However, the expected values of some of the cells for the cold residential area, use of kerosene and gas as fuel and the 55-60 years age group had expected count less than 5. The values for Fisher’s exact test were therefore used to test whether there was an association between teaching occupation and allergic conjunctivitis for the respondents defined by these factors.

The hypotheses testing for the association between allergic conjunctivitis and teaching profession showed an association (p<0.05) when all the factors that influence development of allergic conjunctivitis were held constant, except shortsightedness, age brackets of 55-60 and 35-44 years, use of kerosene and gas as fuel, smoking, presence of other allergies and cold residential areas. Shortsightedness is associated with allergic conjunctivitis because the abnormal ocular surface deteriorates the capacity of the fluid reservoir over the ocular surface allowing the allergens to remain there. Also, myopic eyes have a longer axial eye length and wider palpebral fissures allowing allergens to remain in contact with the conjunctiva (Scottsdale, 2009). This may make even the less potent allergens to cause allergic reactions after they accumulate and remain in contact
with the eye for long. It is therefore expected that the non teachers who are shortsighted will still experience as much of allergic conjunctivitis even if they may not be exposed to potent allergens like the teachers.

The age bracket 55-60 years had many (40 %) of the non teachers suffering from shortsightedness. This agrees with Shay and Wright (2007) who say that old age is associated with shortsightedness. Shortsightedness is associated with allergic conjunctivitis as explained above.

Although there was no association between teaching and allergic conjunctivitis for the smokers, the results still showed that a higher percentage of teacher smokers (38.1 %) suffered from allergic conjunctivitis than the non teacher smokers (23.1 %). The total number of smokers for both teachers and non teachers was also low.

The teachers and non teachers who suffered from other forms of allergy had a high prevalence of allergic conjunctivitis (68.3 % and 50.0 % respectively). This agrees with Ring et al. (2001) who says that allergic conjunctivitis is common in those persons who have other signs of allergic diseases. Also, the results showed that sneezing was the most common form of allergy for both the teachers (61.5 %) and non teacher respondents (51.5 %). This may have resulted from the allergens from the eye draining into the nose and thereby contributing to these signs and symptoms (D’Arienzo, 2005). There was therefore no association between teaching occupation and allergic conjunctivitis among the respondents with other forms of allergy because both the teachers and non teachers
already have had the allergic conjunctivitis which may have contributed to the sneezing as another form of allergy.

Higher percentage of teachers (44.4%) using kerosene as fuel had allergic conjunctivitis than the non teachers (14.3%). The number of those who used kerosene for both the teachers and non teachers was very low (9 and 7 respectively). Also, very few non teacher respondents used gas as a fuel (2) and none (0) of these suffered from allergic conjunctivitis.

The age bracket 35-44 years coincide with the active age group and allergies are associated with the active age group (D’Arienzo, 2005). Both teachers and non teachers therefore had a high prevalence of allergic conjunctivitis although a higher percentage (47.2%) of the teachers suffered compared to non teachers (43.9%). There was also a big difference in the number of teachers and the non teachers in that age group (107 and 41 respectively).

The cold areas of Bahati division experience temperature inversion which is associated with development of allergic conjunctivitis (Dermot, 2003). Both the teachers and non teachers in the area therefore suffered from allergic conjunctivitis. However the teachers still had a higher prevalence of allergic conjunctivitis (83.3%) than the non teachers (40.0%).
5.4 Knowledge and awareness of teachers on allergic conjunctivitis

There was no association between knowledge and development of allergic conjunctivitis. This may be due to the fact that the teachers were required to deal with those substances that influence the development of allergic conjunctivitis as the work demanded regardless of what they knew or believed. These include use of chalk in spite of some of them (82.0 %) stating that they thought it was hazardous. The teachers could not also change the environment that they found their schools in. In some schools, there was no water and teachers had to carry drinking water all the way from their houses which were far. They would therefore not afford water to wash their hands all the time even if they may suspect that the hands transfer the allergens to the eyes. However, the number of teachers who knew the causes and symptoms of allergic conjunctivitis was very low (2.9 % and 4.1 % respectively). This may be due to lack of sensitization, reading and networking. This agrees with Scottsdale (2009) who suggests that majority of people do not know about allergies. They usually treat eye problems with the common eye medications bought as over the counter drugs and they never bother to know the causes of these eye problems.

5.5 Influence of chalk dust on development of allergic conjunctivitis

There was an association between chalk use and allergic conjunctivitis (OR= 5.027, 95 % CI =1.063-23.766). The study results show that those who said that they do not use chalk did not teach any lesson. This suggests that they were not likely to enter those classes where teaching was taking place frequently and therefore may not get exposed to the chalk dust. This is an indication that chalk dust causes allergic conjunctivitis. Other
factors associated with amount and duration of exposure to chalk dust did not show an association with development of allergic conjunctivitis.

Low work load meant that the teacher was exposed to chalk dust for a shorter time than that teacher with a higher workload. Those with higher workload were therefore expected to have a higher prevalence of allergic conjunctivitis (Plats-Mills, 2005). Since the study results do not show an association between development of allergic conjunctivitis and workload, it is an indication that the length of exposure to chalk dust does not influence the development of allergic conjunctivitis. Also, it may be due to presence of chalk dust in the air which may have accumulated as the teachers in the previous lessons rubbed the board such that the teacher get exposed to a lot of dust though for a short time and therefore still experience its effect. However, this study was not able to establish the change in severity of allergic conjunctivitis with increase in time of exposure to the allergen as suggested by Hauschildt (2002), and Trocme and Aldave (1994).

The material of the duster used to rub the board determines the concentration of the chalk dust that is thrown into the air. Hard material results in a lot of dust being thrown into the air (Fernley, 2008). The results showed that the type of material of the duster used to rub the chalk board did not influence the development of allergic conjunctivitis. This may be an indication that both small and large amounts of chalk dust elicit allergic reaction to the eyes of those susceptible teachers. Different amounts of allergens are believed to elicit different levels of severity of allergic reactions (Elberling et al., 2007; Hauschildt, 2002).
However the study was not able to determine the severity of the allergic reaction elicited by different amounts.

Ventilation of the classrooms also had something to do with the concentration of the chalk dust in the air in the classrooms. It was expected that the poorly ventilated rooms were likely to have high concentration of the chalk dust accumulating because of lack of escape routes. More allergic reaction was therefore expected among those with poor ventilated rooms (Elberling et al., 2007). The study results did not show an association between ventilation and development of allergic conjunctivitis. This may have been because in both cases, the amount of chalk dust in the air was enough to elicit the allergic reaction. This study was not able to establish the threshold in amount of the chalk dust that is able to elicit allergic conjunctivitis (Wittczak et al., 2007).

Kurby (1992) suggests that re-exposure of an individual repeatedly with a controlled amount of allergen can be used to control the allergic reaction to that allergen. Duration of teaching in years indicated the repeated exposure to the same chalk dust over several years for those who had taught for many years. It was therefore expected that those teachers who had taught for a longer time would have a low prevalence of allergic conjunctivitis. However, the study results did not show any association between duration of teaching and development of allergic conjunctivitis. This may have been due to the fact that the amount of chalk dust that the teachers were exposed to through out their years of teaching was not controlled.
The type of chalk used determines the weight of the chalk dust produced. Dusty chalk produce light dust which take long to settle and therefore remain floating in the air for a long time increasing the chance of it getting into the eyes of the teachers. Dustless type of chalk produces heavy dust which settles fast, reducing the duration of exposure to the eyes of the teachers (Pollick, 2009). It was therefore expected that those teachers who used dusty chalk would suffer from more allergic conjunctivitis than those who used the dustless type of chalk. However, the study results did not show an association between allergic conjunctivitis and the type of chalk used, indicating that the time taken for both types of chalk dust to settle was still long enough to expose the eyes of the teachers. The study was not able to determine the exact amount of time that each type of chalk dust took to settle and clear completely from the air in the room.

There were very few teachers who had access to water for washing hands (27.8 %). This contradicts with the requirement by part X of the Occupational Safety and Health Act 15 of 2007 (GOK, 2007) which makes a provision for the basic welfare facilities at a place of work. These include supply of drinking water and washing facilities. Accessibility of water for washing hands showed a reduced prevalence of allergic conjunctivitis (45.6 % vs. 54.4 %) although there was no association between accessibility of water and the development of allergic conjunctivitis. This may have been because the floating chalk dust in the classrooms may enter directly into the eyes without being transferred by the hands. Washing the hands however may have reduced the chance of transporting the chalk dust directly into the eyes using hands.
5.6 Influence of science chemicals on development of allergic conjunctivitis

There was no association between allergic conjunctivitis and chemicals used in teaching of science in schools. This may indicate that these chemicals do not cause significant allergic conjunctivitis to school teachers and are therefore not responsible for the high prevalence of allergic conjunctivitis among the school teachers. It could also be an indication that the science teachers are already aware that these chemicals are harmful as indicated in the secondary school syllabus which require the teachers to teach the students about their dangers and the safety precautions that they need to take (Megha and Patel, 2003). This knowledge may make the teachers to be quite careful as they handle these chemicals ensuring that they do not get into their eyes. Also some of the manufacturers have labeled the contents of their chemicals stating the dangers and this makes the teachers to be careful when handling these chemicals (Magnussem, 1997).

The frequency of use of chemicals in teaching science did not influence the development of allergic conjunctivitis. This could be due to the fact that the teachers may have been careful in handling the chemicals every time they used them. There was no association between availability of running water in the laboratory and development of allergic conjunctivitis. This may have been due to the fact that the science teachers are aware of the dangers posed by the chemicals and therefore some may go out of their way to access water for washing hands even in the absence of running water in the laboratory. Also, some experiments in science involve use of water as a reactant or solvent (Megha and Patel, 2003). Some of the teachers may end up washing the hands using the water available for use during the experiments.
Those who said that they had a full time laboratory technician in their schools also indicated they do not prepare chemicals and solutions to be used for experiments but depend on these laboratory technicians to do it. As such, it was expected that these teachers would have a lower prevalence of allergic conjunctivitis since they were not exposed to the chemicals as much as those who prepare chemicals and solutions for themselves. However, those with a full time laboratory technician still had a high prevalence and the results did not show an association between presence of a full time laboratory technician and development of allergic conjunctivitis. This may be an indication that the chemicals used in teaching of science subjects do not cause significant allergic conjunctivitis to the science teachers.

5.7 Health seeking behaviour regarding eye problems among teachers

Only 37.4 % of teachers consulted a medical professional on eye problems. This agrees with Scottsdale (2009) who says that about two thirds of people with eye problems do not consult medical professionals. About 24.8 % of teachers self medicate using over the counter drugs because they are available (Easty and Wyse, 2003). Some of the teachers keep medication at home (15.9 %) incase of an eye problem especially after a prior relieve with use because they mask the allergy symptoms (Scottsdale, 2009; Dermot, 2003).
CHAPTER SIX

6.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

This study shows that there is an association between teaching occupation and allergic conjunctivitis. When all the factors which are considered to influence development of allergic conjunctivitis were held constant, the teachers showed a higher prevalence of allergic conjunctivitis than the non teachers.

Knowledge and awareness do not influence the development of allergic conjunctivitis among the school teachers. Creating awareness of allergic conjunctivitis therefore need to be combined with other more effective methods of controlling allergic conjunctivitis among the school teachers.

There was an association between chalk use and development of allergic conjunctivitis. The allergen in the chalk dust may be very potent such that small amounts and short duration of exposure do not reduce the development of allergic conjunctivitis.

The study results do not associate development of allergic conjunctivitis with chemicals used in teaching of the science subjects in schools. This exonerates these chemicals from being significant trigger factors of allergic conjunctivitis among the school teachers.
The health seeking behaviour of teachers for eye problems is not any different from that of the general population and therefore both the teachers and the general population need to be sensitized about the need to seek medical help for eye problems.

6.2 Conclusions

The analysis of data was carried out according to the responses on research questions which were in turn based on the objectives of the study. The following conclusions were derived from the study:

i. There is an association between teaching occupation and development of allergic conjunctivitis, with teachers having a prevalence of 52%.

ii. There is no association between knowledge on causes and symptoms and development of allergic conjunctivitis among school teachers. However most of the teachers do not know the causes and symptoms of allergic conjunctivitis.

iii. Use of chalk to write on the chalk board influence the development of allergic conjunctivitis making more teachers to suffer from allergic conjunctivitis than the non teachers.

iv. Chemicals used in teaching science subjects at schools do not cause significant allergic conjunctivitis to school teachers.
v. The health seeking behaviour of teachers on eye problems is not different from that of the general population.

6.3 Recommendations

6.3.1 Recommendations from this work

The findings of this study lead to a number of recommendations. These are:

i. Since the results of the study show an association between chalk use and allergic conjunctivitis, it would be important to control the contact between chalk dust and the eyes of teachers. This study recommends substitution of chalk with other suitable writing materials that may not have significant harm on the eyes of teachers and students.

ii. The teachers and the general population should be sensitized about allergic conjunctivitis so that they can be able to identify it and avoid the trigger factors. Sensitization could be done through news bulletins in education based journals such as teachers’ image magazine by the TSC. They should also be encouraged to consult a medical professional when faced with those allergic symptoms so that they can be placed on appropriate medication to avoid the side effects from wrongly prescribed medications. The health professionals can also make a point of inquiring about the eye problems from every patient who visits them for other ailments.
6.3.2 Recommendations for further research

i. This study recommends a clinical research to establish the severity of allergic conjunctivitis among the susceptible teachers at different levels of chalk dust in order to come up with a threshold for the amount of chalk dust that one should be exposed to.

ii. The study also recommends a research study to determine the relationship between development of allergic conjunctivitis and different seasons so that the people can learn how to keep away from the trigger factors associated with the different seasons.
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APPENDIX I: MAP OF NAKURU NORTH DISTRICT SHOWING THE STUDY AREA

INSET MAP OF KENYA SHOWING NAKURU NORTH DISTRICT
APPENDIX II: QUESTIONNAIRE FOR TEACHERS

This research study aims at establishing the prevalence of allergic conjunctivitis. You have been selected to participate in the study. Please fill the questionnaire below as honestly as possible. The information collected will be used for the research study purpose only and will be treated with maximum confidentiality. Please tick where applicable.

Section A- Social demographic variables

1. Sex:  □ Male  □ female
2. Age in years:  □ 15-24 □ 25-34 □ 35-44 □ 45-54 □ 55-60
3. Marital status:  □ Married  □ single
4. Level of education:  □ primary and below □ secondary □ Certificate □ diploma □ degree
5. a) Area of residence:  □ Bahati division
   □ Others (please specify)……
   How long have you resided in this area?
   □ 0-5 years  □ 5-10 years  □ above 10 years
6. What is the weather of your area of residence?
   □ Warm □ Cool □ Very cold □ Others (Please specify)……
7. Is your area of residence very dusty?  □ Yes □ No
8. Do you use insecticides, pesticides or herbicides?  □ Yes □ No
9. What kind of a house do you live in?
   □ Stone house with cemented floor □ Wooden house with cemented floor
Wooden house without cemented floor □  Mud house □

□ Others (please specify) ............................................

10. What is the main fuel used for cooking at your house?

□ Firewood  □ Charcoal  □ Kerosene  □ Gas  □ Electricity

11. Do you smoke? Yes □  No □

12. Do you get exposed to tobacco smoke from the smokers? Yes □  No □

If yes, how often? □ Rarely  □ Daily  □ Others (Please specify)……..

13. Do you get exposed to other types of smoke on daily basis? Yes □  No □

If yes, what type of smoke? (Please specify) ..........................

Section B - Occupational variables

1. What school do you teach? Primary □  Secondary □

2. How long have you been teaching in the current station?

□ 0 – 5 years  □ 6 – 10 years  □ others (please specify) ...........

3. How long have you been teaching as a teacher? □ 0-5 years  □ 6-10 years

□ 11-15 years  □ 16 –20 years  □ 21-25 years  □ Above 25 years

4. Do you use chalk at all? Yes □  No □

If yes, how often? □ Daily  □ Weekly  □ Monthly  □ Others (specify)

5. What is your daily workload? □ 0 lessons  □ 1-3 lessons  □ 4-5 lessons

□ 6 and above

6. What type of chalk do you use? □ Dustless  □ Others (Please specify)…

7. Do you know the composition of the chalk that you use? □ Yes  □ No

If yes, state the components of the chalk .............................
8. Do you consider chalk a health hazard? □ Yes □ No

9. If yes, do you protect yourself? □ Yes □ No

If yes, Explain how you protect yourself…………………………

10. What material makes your duster? □ soft □ Not soft

11. Do you have a sink (including an improvised one) in your office? □ Yes □ No □ not applicable

12. Does your staffroom have a sink (including an improvised one)?

□ Yes □ No

13. Is the water easily accessible for washing hands all the time? □ Yes □ No

14. How is the ventilation of your classes? □ Very well ventilated □ Well ventilated □ poorly ventilated □ Very poorly ventilated

15. What type of structures do you have for classrooms?

□ Permanent with cemented floors □ Permanent without cemented floors □ Temporary with cemented floors □ Temporary without cemented floors

16. How often do the classes get washed?

□ Daily □ Twice a week □ Weekly □ Not applicable

17. How is your school compound? □ Very dusty □ Dusty □ Not dusty

18. Are there other solid particles in the air at your place of work? □ Yes □ No

If yes, please specify………………………………………………

Section C- For Science Teachers

19. Do you teach any science subject? □ Yes □ No

20. Do you use laboratory chemicals during teaching? □ Yes □ No
If yes, how often do you use them?

☐ Once a week   ☐ 2-3 times a week   ☐ 4-5 times a week

☐ others (Please specify)

21. Do you have a science lab?  Yes ☐   No ☐

22. Is there a full time laboratory technician in your school?  Yes ☐   No ☐

If not, who prepares the solutions and other chemicals for practical?

☐ Self   ☐ Others (Please specify) ………….

23. Do you wear goggles, gloves and masks in the school lab?  Yes ☐   No ☐

If yes, how often?  ☐ Every time in the lab   ☐ Once in a while

24. Do you have running water in the lab?  Yes ☐   No ☐

If yes, is it always available?  Yes ☐   No ☐

Section D: Symptoms

1. Do you suffer from any eye problem?  Yes ☐   No ☐

If yes, please specify……………………………………

2. What do you do when you get an eye problem?

☐ Visit a doctor   ☐ Buy drugs from a chemist   ☐ let it clear by itself

☐ Others (please specify)………………   ☐ N/A

3. Do you use eye medication every time when you have an eye problem?

☐ Yes   ☐ No   ☐ N/A

4. Do you usually buy eye medications as an over the counter drug without the doctors prescription?  Yes ☐   No ☐
5. Do you always keep eye medications?  Yes□ No□
   If yes, does the doctor prescribe it?  Yes□ No□

6. Do you suffer from any eye allergy? □Yes □No

7. Do you suffer from any other type of allergy? □Yes □No
   If yes, what type of allergy? □Food allergy □Sneezing □Wheezing
   □Skin allergy □Others (please specify)……………… □N/A

8. Do your both eyes usually feel itchy? Yes□ No□
   If yes, how frequent? □Daily □Weekly □Once in awhile
   □Others (please specify)………………

9. Do your both eyes usually get swollen? Yes□ No□
   If yes, how often? □Daily □Weekly □Once in awhile
   □Others (please specify)………………

10. Do your both eyes usually get red? Yes□ No□
    If yes, how often? □Daily □Weekly □Once in awhile
        □Others (please specify)

11. Do your both eyes usually get watery? Yes□ No□
    If yes, how often? □Daily □Weekly □Once in awhile
        □Others (please specify)………………
12. Do your both eyes usually feel irritated? Yes □ No □
   If yes, how often? □ Daily □ Weekly □ once in awhile
   □ Others (please specify)

13. Do your both eyes usually pain? Yes □ No □
   If yes, how often? □ Daily □ Weekly □ once in awhile
   □ Others (please specify)

14. Do you wear spectacles? Yes □ No □
   If yes, for what eye defect?
   □ Long sightedness □ Short sightedness □ Long sightedness and light effects
   □ Short sightedness and light effects □ Others (please specify)……

15. Do you suffer from asthma? Yes □ No □

16. a. Do the eyes of any of your parents or siblings get itchy? Yes □ No □
b. Do the eyes of any of your parents or siblings get watery? Yes □ No □
c. Do the eyes of any of your parents or siblings get irritated or hurt? Yes □ No □
d. Do the eyes of any of your parents or siblings get red? Yes □ No □
e. Do the eyes of any of your parents or siblings get swollen? Yes □ No □

17. Do you know the symptoms of allergic conjunctivitis? Yes □ No □
   If yes, state them……………………………………

18. Do you know the causes of allergic conjunctivitis? Yes □ No □
   If yes, state them……………………………………
APPENDIX III: QUESTIONNAIRE FOR NON-TEACHERS

This research study aims at establishing the prevalence of allergic conjunctivitis. You have been selected to participate in the study. Please fill the questionnaire below as honestly as possible. The information collected will be used for the research study purpose only and will be treated with maximum confidentiality. Please tick where applicable.

Section A- Social demographic variables

1. Sex:  Male □   female □
2. Age in years:  15-24 □  25-34 □  35-44 □  45-54 □  55-60 □
3. Marital status.  □ Married  □ single
4. Level of education:  □ primary and below  □ secondary  □ Certificate  □ diploma  □ degree
5. a) Area of residence:  □ Bahati division  □ Others (please specify)…….

How long have you resided in this area?

□ 0-5 years □ 5-10 years □ above 10 years □

6. What is the weather of your area of residence?

□ Warm □ Cool □ Very cold □ □ Others (Please specify)…….

7. Is your area of residence very dusty?  □ Yes □ No □

8. Do you use insecticides, pesticides or herbicides  □ Yes □ No □
9. What kind of a house do you live in?

☐ Stone house with cemented floor ☐ Wooden house with cemented floor
☐ Wooden house without cemented floor ☐ Mud house
☐ Others (please specify) .................................................................

10. What is the main fuel used for cooking at your house?

☐ Firewood ☐ Charcoal ☐ Kerosene ☐ Gas ☐ Electricity

11. Do you smoke? ☐ Yes ☐ No

12. Do you get exposed to tobacco smoke from the smokers? Yes ☐ No ☐

If yes, how often? ☐ Rarely ☐ Daily ☐ Others (Please specify)……

13. Do you get exposed to other types of smoke on daily basis? Yes ☐ No ☐

If yes, what type of smoke? (Please specify) .................................

Section B - Occupational Variables

1. What is your occupation?

☐ School teacher ☐ Others (please specify) .................................

2. How is the ventilation at your place of work?

☐ Very good ☐ Good ☐ Bad ☐ Very bad ☐ Not applicable

3. Do you get exposed to a lot of dust during your working? ☐ Yes ☐ No

4. Do your eyes get exposed to other solid particles at your place of work?

☐ Yes ☐ No

If yes, please specify .................................

5. Is water easily accessible for washing hands all the time? ☐ Yes ☐ No
6. What type of structure make the place of work

- Permanent with cemented floors
- Permanent without cemented floors
- Temporary with cemented floors
- Temporary without cemented floors
- Not applicable

7. If you do your work in rooms, how often do they get washed

- Daily
- Twice a week
- Weekly
- Yearly
- Others (Please Specify)…

8. How long have you been in that occupation?

- 0-5 years
- 6-10 years
- More than 10 years

9. How many hours do you spend at your place of work per day?

- 3 hours
- 5 hours
- 8 hours
- Others (please specify) …………..

Section D: Symptoms

1. Do you suffer from any eye problem? □ Yes  □ No

If yes, please specify……………………………………

2. What do you do when you get an eye problem?

- Visit a doctor
- Buy drugs from a chemist
- Let it clear by itself

- Others (please specify)…………………………..

□ N/A
3. Do you use eye medication every time when you have an eye problem?
   □ Yes  □ No  □ N/A

4. Do you usually buy eye medications as an over the counter drug without the
doctor's prescription?  □ Yes  □ No

5. Do you always keep eye medications?  Yes □  No □
   If yes, does the doctor prescribe it?  Yes □  No □

6. Do you suffer from any eye allergy?  □ Yes  □ No

7. Do you suffer from any other type of allergy?  □ Yes  □ No
   If yes, what type of allergy?  □ Food allergy  □ sneezing
   □ wheezing  □ Skin allergy  □ others (please specify) ................
   □ N/A

8. Do your both eyes usually feel itchy?  Yes □  No □
   If yes, how frequent?  □ Daily  □ Weekly  □ once in awhile
   □ Others (please specify) ................

9. Do your both eyes usually get swollen?  Yes □  No □
   If yes, how often?  □ Daily  □ Weekly
   □ once in awhile  □ Others (please specify) .............

10. Do your both eyes usually get red?  Yes □  No □
    If yes, how often?  □ Daily  □ Weekly  □ once in awhile
    □ Others (please specify) .......................
11. Do your both eyes usually get watery? Yes ☐ No ☐

If yes, how often? ☐ Daily ☐ Weekly ☐ once in awhile

☐ Others (please specify)………………

12. Do your both eyes usually feel irritated? Yes ☐ No ☐

If yes, how often? ☐ Daily ☐ Weekly ☐ once in awhile

☐ Others (please specify)…………………………

13. Do your both eyes usually pain? Yes ☐ No ☐

If yes, how often? ☐ Daily ☐ Weekly ☐ once in awhile

☐ Others (please specify)…………………………

14. Do you wear spectacles? Yes ☐ No ☐

If yes, for what eye defect? ☐ Long sightedness ☐ Short sightedness

☐ Long sightedness and light effects ☐ Short sightedness and light effects

☐ Others (please specify)……

15. Do you suffer from asthma? Yes ☐ No ☐

16. a. Do the eyes of any of your parents or siblings get itchy? Yes ☐ No ☐

b. Do the eyes of any of your parents or siblings get watery? Yes ☐ No ☐

c. Do the eyes of any of your parents or siblings get irritated or hurt? Yes ☐ No ☐

d. Do the eyes of any of your parents or siblings get red? Yes ☐ No ☐

e. Do the eyes of any of your parents or siblings get swollen? Yes ☐ No ☐
17. Do you know the symptoms of allergic conjunctivitis? Yes ☐ No ☐

If yes, state them…………………………………..

18. Do you know the causes of allergic conjunctivitis? Yes ☐ No ☐

If yes, state them………………………………..