OCCUPATION FACTORS ASSOCIATED WITH CATARACT DEVELOPMENT

SULEEPORN KHONGSEE

A THESIS SUBMITTED IN PARTIAL FULFILMENT
OF THE REQUIRMENTS FOR
THE DEGREE OF MASTER OF SCIENCE (PUBLIC HEALTH)
MAJOR IN INFECTIOUS DISEASES AND EPIDEMIOLOGY
MAHIDOL UNIVERSITY
2010

Thesis
entitled

OCCUPATIONAL FACTORS ASSOCIATED WITH CATARACT DEVELOPMENT

Suleeporn Khongsee
.....
Mrs. Suleeporn Khongsee
Candidate

Kitiphong H
.....
Lect. Kitiphong Hamcharoen
Ph.D (Biological Science)
Major-advisor

Dusit Suj
.....
Assoc. Prof. Dusit Sujirarat,
M.Sc. (Biostatistic)
Co-advisor

Supachai Pitikultang
.....
Lect. Supachai Pitikultang,
M.D., Dip.Thai Board of Pediatrics
Co-advisor.

M. Pradipasen
.....
Assoc. Prof. Mandhana Pradipasen,
M.D., M.S. (Human Nutrition)
Dr.P.H. (Epidimiology)
Co-advisor

B. Mahaisariya
.....
Prof. Banchong Mahaisariya,
M.D., Dip Thai Board of Orthopedics
Dean
Faculty of Graduate Studies
Mahidol University

Pakpimol Mahamop
.....
Assoc. Prof. Pakpimol Mahamop,
Ph.D. (Tropical Medicine)
Program Director
Master of Science (Public Health)
Major in Infectious Diseases and epidemiology
Faculty of Public Health
Mahidol University

Thesis
entitled

OCCUPATIONAL FACTORS ASSOCIATED WITH CATARACT DEVELOPMENT

Was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of Master of Science (Public Health)
Major in Infectious Diseases and Epidemiology
on
March 4, 2010

Suleeporn Khongsee
.....
Mrs.Suleeporn Khongsee
Candidate

.....
Mr. Boonsong Wanichwecharungrunang,
M.D. Dip Thai Board of Thalmology
Chair

Kitiphong H.
.....
Lect. Kitiphong Hamcharoen
Ph.D (Biological Science)
Member

Dusit Sij
.....
Assoc. Prof. Dusit Sujirarat,
M.Sc. (Biostatistic)
Member

Supachai Pitikultang
.....
Lect. Supachai Pitikultang,
M.D., Dip.Thai Board of Pediatrics
Member.

Mb. Pradipasen
.....
Assoc. Prof. Mandhana Pradipasen,
M.D., M.S. (Human Nutrition)
Dr.P.H. (Epidimiology)
Member

B. Mahaisariya
.....
Prof. Banchong Mahaisariya,
M.D., Dip Thai Board of Orthopedics
Dean
Faculty of graduate Studies
Mahidol University

Phitaya Charupoophol
.....
Assoc. Prof. Phitaya Charupoophol,
M.D., D.T.M. & H.
Dean
Faculty of Public Health
Mahidol University

ACKNOWLEDGEMENTS

The success of this thesis can been attributed to the extensive support and assistance from my major advisor, Dr.Kitiphong Harnchareon and my co-advisor Assoc. Prof. Dusit Sujirarat, Assoc. Prof. Mandhana Pradipasen Mr. Supachai Pitikultang. I deeply thank them for their valuable advice and guidance in this research.

I would like to express my deep gratitude to Assoc. Dr.Kitiphong Harnchareon, Department of Epidemiology, Faculty of Public Health, Mahidol University, for his extremely kindness, valuable guidance, encouragement and helpful advice.

I would like to thank Dr..Boonsong Wanichwecharungrunang, Opthalmologist, Rjavithi Hospital.For his extremely kindness, valuable guidance and who is my chair and external thesis committee.

I would like to thank my co - advisor Assoc. Prof. Dusit Sujirarat, Department Epidemiology, Faculty of Public Health, Mahidol University, encouragement, kindness and supportive valuable guidance for statistic analysis.

I would like to thank Assoc. Prof. Mandhana Pradipasen, Department of Nutrition, Mr. Supachai Pitikultang, Department of Family Health, Faculty of Public Health, Mahidol University, a member of thesis committee for their kind suggestion and helpful guidance.

I would like to express my special thanks to Lect. Mathuros Tipayamongkholgul, for her encouragement helpful advice guidance, concern and support.

I would like to thank all hospital personnel in the studied wards for giving to collaboration and kindness. They were always very nice and friendly.

I also wish to extend my deep appreciation to all participants recruited in this study: my friends for their moral support, encouragement and helping me to complete this thesis. Finally, my deep gratitude is extended to my family for greatest love in my life for supporting my education.

Suleeporn Khongsee

OCCUPATIONAL FACTORS ASSOCIATED WITH CATARAC DEVELOPMENT

SULEEPORN KHONGSEE 4737286 PHPH/M

M.Sc. (PUBLIC HEALTH) MAJOR IN INFECTIOUS DISEASES AND EPIDEMIOLOGY

THESIS ADVISORY COMMITTEE: KITIPHONG HARNCHAREON, Ph.D. (BIOLOGICAL SCIENCE), BOONGSONG WANICHWECHARUNGRUNANG, M.D. (OPTHALMOLOGY), ASSOC. PROF. DUSIT SUJIRARAT, M.Sc. (BIOSTATISTIC), ASSOC. PROF. MANDHANA PRADIPASEN, M.D., M.S. (HUMAN NUTRITION), Dr.P.H. (EPIDIMIOLOGY), SUPACHAI PITIKULTANG, M.D. (PEDIATRICS)

ABSTRACT

This hospital-based case control study was conducted at Nopparat Rajathanee Hospital, Bangkok, Thailand from April 2006 to June 2006. The aim of this study was to determine the occupational factors that are associated with cataract development. A total of 329 patients between 20-59 years of age were included in the study. 162 patients with cataracts were the case group, and 167 without cataracts were the control group. Multiple logistic regression analysis indicated that, after adjusting for other variables in the model, only four variables were significantly associated with cataract development in these cases: age, between 30–44 years and 45–59 years with (OR = 3.9, 95% CI of 1.41-10.6 and OR = 15.5, 95% CI of 4.5–53.1, respectively); gender, male (OR = 3.1, 95% CI of 1.4-6.8); cold temperature exposure (OR = 5.8, 95% CI of 1.7-20.0); and computer use (OR = 0.4, 95% CI of 0.2-0.9). Other variables did not show a significant association with cataract development.

These results strongly suggest that cold temperature exposure is the most important factor associated with cataract development. These results could be applied to programs for the prevention and control of cataract development.

KEY WORDS: CATARACT / OCCUPATIONAL FACTOR / CASE – CONTROL STUDY

60 pages

ปัจจัยด้านอาชีพที่มีความสัมพันธ์กับการเกิดต้อกระจกในคนวัยทำงาน
OCCUPATIONAL FACTORS ASSOCIATED CATARACT DEVELOPMENT

ศุลีภรณ์ คงสี 4737286 PHPH/M

วท.ม. (สาธารณสุขศาสตร์) สาขาวิชาเอกโรคติดเชื้อและวิทยาการระบาด

คณะกรรมการที่ปรึกษาวิทยานิพนธ์: กิติพงษ์ หาญเจริญ, Ph.D. (Biological science),
บุญส่ง วนิชเวชารุ่งเรือง, M.D. (Opthalmology) ดุสิต สุจิรารัตน์, M.Sc. (Biostatistic),
มันทนา ประทีปะเสน, M.D., M.S. (Human Nutrition), Dr.P.H. (Epidimiology),
ศุภชัย ปิติกุลตัง, M.D. (Pediatrics)

บทคัดย่อ

การศึกษาแบบ Case control study เพื่อศึกษาปัจจัยด้านอาชีพที่มี ความสัมพันธ์กับ การเกิดต้อกระจก ทำการศึกษาในผู้ที่มีอายุ 20-59 ปีกลุ่มศึกษาได้แก่ผู้ป่วยต้อกระจก ที่มารับบริการ ที่แผนกตาจำนวน 162 ราย กลุ่มควบคุมได้แก่ผู้ป่วย ซึ่งปราศจากโรคตาที่มา รับบริการแผนกอื่น จำนวน 167 ราย ของโรงพยาบาลนพรัตนราชธานีโดยใช้แบบสอบถาม ในการสัมภาษณ์ ทางโทรศัพท์ ระหว่างเดือนเมษายน – มิถุนายน พ.ศ 2549

ผลการศึกษาโดยการวิเคราะห์ด้วย Multiple logistic regression เพื่อหาความสัมพันธ์ระหว่างปัจจัยเสี่ยงกับการเกิดต้อกระจกโดยควบคุมตัวแปรกวนที่มีอิทธิพลต่อการเกิดโรคพบว่าปัจจัยที่มีความสัมพันธ์กับการเกิดต้อกระจก ได้แก่ อายุ โดยที่กลุ่มอายุ 30-44 ปี และ 45-59 ปีมีความสัมพันธ์กับการเกิดต้อกระจก (OR = 3.9, 95% CI 1.41 – 10.6, OR = 15.5, 95% CI 4.5-53.1), เพศชาย (OR = 3.1, 95% CI 1.4-6.8), อุณหภูมิเย็น (OR = 5.8, 95% CI 1.7-20.0), การใช้คอมพิวเตอร์ (OR = 0.4, 95% CI 0.2 -0.9).

จากผลการศึกษาแสดงปัจจัยด้านอาชีพที่มีความสัมพันธ์กับการเกิต้อกระจกในคนวัยทำงาน ข้อเสนอแนะ ควรดำเนินการป้องกัน ควบคุมและปรับเปลี่ยนในผู้ที่สัมผัสปัจจัยเสี่ยง เพื่อยืดระยะเวลาในการเกิดภาวะต้อกระจก

60 หน้า

CONTENTS

Page

ACKNOWLEDGEMENTS ……. iii

ABSTRACT (ENGLISH) …… iv

ABSTRAC (THAI) …….. v

LIST OF TABLES …….. viii

CHAPTER I INTRODUCTION …….. 1

CHAPTER II LITERATURE REVIEW ……. 8

Definition and history of cataract……. 8

Biochemistry and physiology of the lens……. 9

Carbohydrate metabolism…… 10

Pathophysiology of cataract formation…… 11

Type of cataract…… 16

Symtomps and Sign…… 18

Relevant Research…….. 20

CHAPTER III MATERIALS AND METHODS …….. 25

1. Research design / study method……. 25

2. Study population…… 25

3. Sample Size……..... 25

4. Sample selection……. 26

5. Research tools…….. 27

6. The questionnaire & quality control……..…….. 27

7. Data collection……. 27

8. Ethical implication…….. 27

9. Research variables……... 28

10. Data analysis…….. 28

CHAPTER IV RESULTS …… 29

1. Descriptive characteristics……..……29

CONTENTS (cont.)

Page

2. The association between occupation factors with cataract development by univariate analysis……..…34
3. Multivariate analysis of the association between occupational factors and cataract development……40

CHAPTER V ……44
CHAPTER VI ……47
REFERENCES……49
APPENDIX……..…53
BIOGRAPHY……..60

LIST OF TABLES

Table		Page
1	Demographics characteristics in case and control groups…….....	32
2	Association demographic factors with cataract development…….....	36
3	Association between physical factors and cataract……	38
4	Association between chemical factors and cataract……	39
5	Association between biological factors and cataract……..	40
6	Multivariate analysis of the association between occupational factors and cataract development ……..	42

CHAPTER I
INTRODUCTION

Visual impairment and blindness are important issues. Because of the society which people with blindness and visual impairment will lose the potential of human resources and cannot create output effectively. Also, blinded and visual impaired people are burden to family and nation. Especially those who are still in working age, if they faced with eye problems the impact much be higher. Most of people are working at least 1 in 3 of their life-time, therefore, occupational factors that they exposure, might associate with the impairment and blindness.

Cataract is a clouding of the lens eye. Cataract is regularly related to ageing change. These conditions are very common in older people. Some people who have small cataracts can see well enough around the clouded areas to live normally. But for many people, clouded lens are extensive enough to interfere greatly with daily activities. Extensive cataract can compromise the ability to earn a reading, driving, or independent living. This disease is the leading cause of blindness and visual impairment worldwide. According to WHO estimation there are 45 million people worldwide who get blind. A 135 millions who get visually disabled depended on family support or care on a daily basis. Each year about 1-2 million people worldwide are blind. The prevalence of blindness in developing and least developed counties is much higher than that economically developed countries. WHO estimates that numbers is climbing to 75 million blind and 200 million visually impaired by the year 2020, unless there is urgent coordinated action (1). Cataract accounts for nearly half of all blindness worldwide (2). WHO estimates that, globally, up to 75% of all blindness is avoidable In the United States; cataract surgery is the most frequently performed surgical procedure in the Medicare program, with approximately 1.35 million cataract operations done each year at a cost of approximately $3.4 billion. The Third National Survey of Blindness in Thailand (1994-1995), by the Committee for the Prevention of Blindness and Control of Visual Impairment, indicates that the prevalence of blindness

0.31 % and low vision was 0.80 %. Cataract is the major cause of the prevalence 74 % and 78 %, respectively (3).

Nopparat Rajathanee Hospital is a government hospital where nearly several industry communities, therefore it take care of many people who are working age live in this area. Data from the year 2004 in Nopparat Rajathanee Hospital showed that cataract is the first of top five eye diseases. It is 46 % of outpatient and 75 % of inpatient who had cataract operation. About 20 % of cataract patient had within working age among 15 % are blind and 14 % are visual impairment. In Nopparat Rajathanee Hospital. The cost of surgical treatment for cataract is 4.3 million Baht per year (2004) surgical treatment for cataract is effective. The cost of procedures done each year is high (4). It has been estimated that a delay in cataract onset of only 10 years could reduce the need for cataract surgery by as much as half (5). Although, safe and effective surgery is available as a mean of secondary prevention, but primary prevention has the potential for saving health care delay visual impairment including with independence of the growing number of elderly people in the population (6). Visual impairment and blindness from cataract is an important public health problem throughout the world (7).

Aging is the primary risk factor for cataract, but other factors are involved in determining overall risk, the age of onset, and the severity. Although cataract is not completely preventable but their occurrence can be delayed (8). In the past, studies have linked of possible risk factors for cataract development including indoor smoke, radiation, and chemical factor

Visual impairment and blindness from cataract is an important public health problem of Thailand. In the budget year 2005 of Department of Medical Service report that cataract is the most frequently performed surgical procedure in the medical program, with approximately 100,000 eyes (9).

From data and impact of visual impairment and blindness this research aims to study the associated between occupation risk factors and cataract development.

General Objectives

To investigate occupational factors associated with cataract development.

Specific objectives

To study the association between occupational risk factors and cataract development: demographic factors, physical factors, chemical factors and biological factors.

Hypothesis of the study

1. Demographic factors are associated with cataract development.
2. Physical factors are associated with cataract development
3. Chemical factors are associated with cataract development
4. Biological factors are associated with cataract development

Scope of this study

The study was conducted in Nopparat Rajathanee Hospital patient 20-59 years of age who had been diagnosed as having cataract in single or both eyes, during January 2003 to June 2006.

Assumption

1. All cataract diagnoses were made by ophthalmologists.
2. Ophthalmologists were able to diagnose cataract.
3. Ophthalmic examination with snellen eye chart, direct Ophthalmoscope and slit lamp or Binocular biomicroscope was efficiency.
4. All controls were patients without eye disease from the other department.

Definition

Cataract

A cataract is a clouding of the lens in the eye that affects vision. The lens is a clear part of the eye that helps to focus light, or an image, on the retina. The retina is the light-sensitive tissue at the back of the eye (14).

Age

Age was the age at time of examination.

Education

Education was ascertained by question that the highest education level and categorized in to three group: primary education, high school – diploma and bachelor or higher.

Occupation

Occupation was ascertained with the question and categorized in to six groups for this analysis: employment (labor), housework, trade or business private, government or stated enterprise, contact (office) and the other group.

Histories of illness

Histories of illness were ascertained by the question of diabetes, hypertension, rheumatoid arthritis and cardiovascular disease.

Family history about cataract

Family history about cataract was ascertained by the question with the response yes or no.

BMI

Body Mass Index is defined as the measurement indicating obesity level. Height was measure in centimeters while the participant stood without shoes, and weight was measured in kilograms while the participant stood without shoes and in light clothing. BMI was calculated as weight in kilograms over height in meter squared. It is expressed as follow:

$$BMI = \frac{Wt(kg)}{Ht^2(meter)^2}$$

To interpret BMI (WHO, 2000) (10).

Under weight	< 18.5	kg/m^2
Normal	18.5 - 22.9	kg/m^2
Over weight	≥ 23.0 - < 25.0	kg/m^2
Obesity	≥ 25.0	kg/m^2

Smoking status

Smokers are subjects who smoke cigarettes, cigars and non-filter cigarettes.

Alcohol consumption

Alcohol is defined as ethyl alcohol (ethanol) that produced by fermenting. Alcoholic beverages produce by fermentation and distillation include beer, wine and distilled liquors such as whisky, brandy, mixed liquor of Thai and local liquor, which might be made by licensed industries, or local made by local people (12).

Refractive error

Refractive errors are disorders, not diseases. It means that the shape of your eye does not bend light correctly, resulting in a blurred image. Light has to be refracted or bent by the cornea and the lens to the retina in order for us to see. The common refractive disorders are described Hyperopia is farsightedness, Myopia is nearsightedness (13).

Physical factors was Non-living factors that affect organisms

Temperature

Temperature is a measure of the average energy of motion. Temperature is a physical property that underlies the common notions of hot and cold. Ascertained by the question and categorized in to two groups: ≥ 30 °C was heat temperature, ≤ 25 °C was cold temperature.

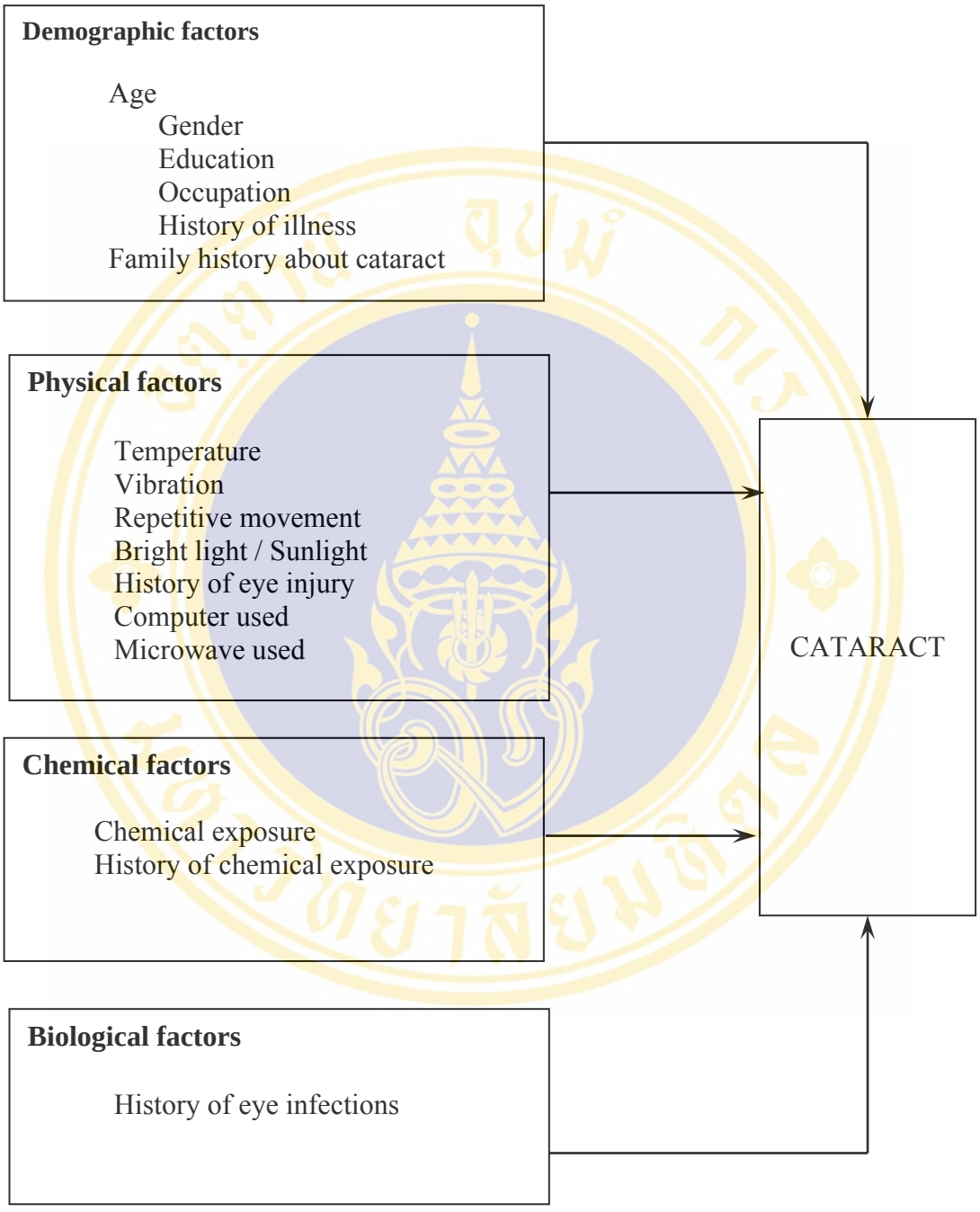
Vibration

Vibration refers to mechanical oscillations about an equilibrium point. The oscillations may be periodic such as the motion of a pendulum or random such as the movement of a tire on a gravel road.

Usefulness of the study

1. The modifiable risk factors are potentially amenable to change through public health measure for primary prevention to delay the onset of cataract development.
2. People at high risk of developing cataract should be advised to be alert for change in their vision associated with development of cataract.
3. Health care providers should be informed about the high-risk group so that they can refer them for timely treatment of cataract before the onset of severe functional impairment.
4. Primary prevention of the systemic diseases or medication would also serve as primary prevention for cataract.

Conceptual framework



CHAPTER II

LITERATURE REVIEW

Definition and history of cataract

A cataract is a clouding of the lens in the eye that affects vision. The term “cataract” is derived from the Latin word *cataracta*, which is in turn derived from the Greek word *Kataractes*, which mean waterfall (breakdown, downrushing). Ancient practitioners probably gave this name to this condition in the belief that the liquid content of the eye was cascading down.

Defined strictly on the basis of the pathomophological process involved, cataract is an opacification or loss of transparency in the crystalline lens of the eye. From a public health perspective, however, attention also needs to be paid to be consequences such as opacification in term of visual acuity.

In a large number of instances, the opacity, by virtue of its size or position, does not affect vision. In many cases, the opacity is not progressive and mere identification of such opacity during mass eye examination surveys of clinical examination does not necessarily portend progression to blindness in the future. These considerations sometime confound the data on cataract diagnosed during eye examinations in blindness surveys, in respect both of the actual prevalence of cataract and of the annual incidence of new cases requiring surgery. An accurate estimation of both rates is essential for determining the magnitude of existing problem, as well as for predicting how it is likely to develop in the medium and long term. Such a prediction would make it easier to plan interventions against cataract as a part of national programmes for the prevention of blindness (14).

Biochemistry and physiology of the lens

The human lens has a high protein concentration constituting 33% percent of its wet weight. Eighty percent of the proteins are water-soluble and consist mainly of crystallins. They have been traditionally divided into three categories: the a-, b- and g-crystallins(2). The a-crystallins are large macromolecular aggregates (600 – 4000 kDa) composed of different polypeptides of about 20 kDa in size bonded together with hydrophobic and hydrogen bonds. They function as chaperones of several other proteins (16).

The b-crystallins constitute 55% of the watersoluble lens protein and are related to the g-crystallins. They are about 20 kDa in size, but in solution they associate into dimers of about 40 kDa, tetramers of about 80 kDa, and higher-order aggregates ranging from 150 to 200 kDa. The g-crystallins are the smallest, 18–20 kDa. Because they are expressed mostly in the early phases of lens development, they are found primarily in the embryonal nucleus where it is thought they are adapted for density molecular packing rather than more hydrated regions of lower protein concentration (17).

The role of crystallins is not thought to be only structural; they seem to be also active signal players in lens development. Mutations in the crystallin genes have been linked to several congenital cataracts in animal models such as mutations in the b2 crystallin found in the Philly mouse as well as in several human inherited cataracts (18).

The water insoluble proteins constitute primarily the cytoskeletal and membrane structural proteins/53. The former are urea insoluble and the latter are soluble in 8 M urea. Approximately 50% of the plasma membrane protein is a 28kDa polypeptide known as major intrinsic polypeptide (MIP) that is not expressed in the lens epithelial cells, but is first found in differentiating lens fibers. With aging this protein breaks down to a 22kDa size. By the age of 20–30 years, the two protein species are in equal abundance. Inside the nucleus the 22kDa protein predominates. Within the structure of the plasma membrane, MIP is primarily concentrated in the gap junctions (19).

As the lens ages there is an increase in the water insoluble portion of the proteins and large size aggregates form that have the ability to scatter light. Some

investigators believe that this is a major cause of senescent cataractogenesis. This hypothesis remains controversial, since it is also known that with aging even in the clear lens there is an increase in the water insoluble portion. Perhaps in cataractogenesis there is an accelerated rhythm and/or there are other collaborating factors. In addition, aging brings an increase in the oxidation, disulfide and non-disulfide cross-linking of proteins. These processes further contribute to formation of larger size aggregates that scatter light. The non-disulfide cross-linking of proteins results in products that have intrinsic fluorescence and are less soluble in 8 M urea. This insoluble fraction contains a yellow-brown protein that is found in higher concentration in nuclear senescent cataracts.

With aging not just the proportion of the water-soluble versus insoluble fraction change, but there is a decrease in the total protein content as the lens epithelium/ capsule becomes ‘‘leaky’’ to the crystalline. In the aqueous humor there is an increase in a- and g-crystalline with cortical cataracts; where in nuclear sclerotic cataract there is an increase in a-crystalline and a decrease in g-crystalline.

Carbohydrate metabolism

The lens must obtain its energy in the absence of vascular supply and low oxygen tension. Glucose is the major energy source and is supplied to the lens by simple and facilitated diffusion from the aqueous humor. Inside the lens, the glucose molecule is phosphorylated to glucose-6-PO4 (G6P) by hexokinase. This is the first and rate-limiting step in glycolysis. About 85% of the G6P formed is utilized in anaerobic glycolysis yielding two molecules of net ATP. The Hexose monophosphate shunt utilizes about 5%, which is important in the generation of NADPH reducing agent, important molecules in the anti-oxidant machinery of the lens cell. About 5% of the glucose is utilized by the high efficiency aerobic Krebs cycle yielding about 25% of the total ATP in the lens. Transparency is not dependent on aerobic metabolism, since the lens can remain transparent in vitro for several hours even in the total absence of oxygen. In contrast, limiting glucose levels will lead to severe impairment of its function. Another important metabolic enzyme in the lens is aldose reductase,

involved in the sorbitol pathway. Some people think that this enzyme is important in the generation of ‘‘sugar’’ cataracts.

Pathophysiology of cataract formation

Physiology of lens water and cation balance

Since the orderly packing of macromolecules inside the lens is critical for its transparency, control of hydration level is an important aspect of lens physiology. The normal human lens is about 65% water with about 5% of it being extracellular. Lower intracellular sodium and higher intracellular potassium concentrations than in the aqueous at 20 mM and 120 mM are maintained through an epithelial based Na/K ATPase pump, which is important for the lens hydration level. Inhibition of the Na/K ATPase pump with ouabain leads to increased water content and loss of transparency. In senile nuclear sclerosis there is no major perturbation of lens water, but in cortical opacities water content is significantly elevated.

Another important intracellular ion is calcium. Calcium in lens is usually maintained at a very low concentration in respect to _2.5 mM in plasma. Lens fibers are no exception. Measurements have placed intracellular calcium levels in-between 100nm and few hundreds mM, and with only about 0.1–1% being free/unbound. This steep gradient is maintained through a Ca/ATPase pump and by Na/Ca exchanger. Levels of calcium are very important for the cell since several proteases are calcium activated (calpains) and since calcium is used in second messenger systems and protein phosphorylation/dephosphorylation. Thus deregulation of calcium levels can lead to formation of cataracts through depressed glucose metabolism, formation of high molecular aggregates and proteolysis. Calcium also plays a role in signal transduction that controls cell proliferation and thus it may be used experimentally in controlling posterior capsular opacification after cataract surgeries.

Metabolic cataracts

When there are high levels of glucose, such as are found in the hyperglycemic state, the products of glycolysis inhibit hexokinase and the aldose

reductase is able to utilize more glucose producing sorbitol. The next enzyme in that pathway, polyol dehydrogenase has low affinity for sorbitol, so enough sorbitol needs to accumulate before it will be metabolized to fructose, which can then enter the glycolytic pathway. Both sorbitol and fructose are impermeable to lens capsule/epithelium and are osmotically active, drawing in water. Initially, the energy-dependent pumps of the lens can accommodate but eventually they are overwhelmed and clouding of the lens ensues. Studies with animals have shown that species with high aldose reductase are very sensitive to formation of sugar cataracts, whereas diminished levels of aldose reductase lead to resistance. Use of topical or systemic preparations of aldose reductase in humans did not have as promising results. Galactose is another sugar utilized by aldose reductase to yield galactilol. Galactilol is not utilized by polyol-dehydrogenase and thus is rapidly accumulating in the lens, producing osmotic effects. Patients with inborn errors of galactose metabolism have high levels of intracellular galactilol and form cataracts. Several authors that point to a number of inconsistencies in the experimental data have criticized the role and significance of aldose reductase in the development of sugar cataracts.

Elevated intracellular glucose can also produce lens damage by non-enzymatic glycation of proteins. Glycation involves the covalent interaction between the glucose aldehyde group and usually the amino group of a free lysine moiety of a protein. The initial reversible reaction results in a Schiff base, which then undergoes an Amadori rearrangement to form a more stable ketoamine structure, usually called the Amadori product or the early glycation product, the most well known example being hemoglobin A1c. The Amadori products can, under non-oxidative conditions, break down to 3-deoxyglucosone, can react with many amino groups to give rise to brown and cross-linked products termed advanced glycation end products. This reaction is usually called the Maillard reaction or advanced glycation. In the diabetic lens there is evidence of increased glycation of lens crystallins, MIP and other cellular enzymes. Glycation of proteins can lead to change in their structure-function directly and/or can expose thiol groups leading to oxidation and cross-linking. It can also expose hydrophobic groups making the proteins less soluble. All these contribute to formation of high molecular weight aggregates. Glycation also leads to susceptibility to photooxidation by UVA light.

Oxidative stress in cataractogenesis

Free radicals are constantly formed in the cell by normal metabolic activities and external agents. These free radicals may attack plasma membrane lipids leading to formation of a fatty acid radical. This in turn can combine with molecular oxygen leading to lipid peroxy radical and initiate a chain reaction leading to lipid peroxide (LOOH) and formation of malondialdehyde, a potent cross-linker. In addition, free radicals can attack DNA and intracellular proteins, leading to more incapacitation of cell function. The lens cell has several mechanisms to protect itself, including non-enzymatic molecules, such as ascorbate and Vitamin E, as well as enzymes like super-oxide dismutase, catalase and glutathione. The reactions involved in free radical formation and the cellular scavenger and repair systems are shown in box. Oxidative damage results in disulfide cross-linking of proteins leading to high molecular weight aggregates and thus limiting lens transparency. Much evidence has been accumulated supporting the etiological role of oxidative damage in cataractogenesis in humans and in animal models.

Direct effect/stress by absorption of light energy from lens molecules leads to photo-oxidative stress. The cornea absorbs most of the UVC (180–280 nm) spectrum of light. The human lens absorbs Ultraviolet B (UVB 290–320 nm) and ultraviolet A (UVA 320– 400 nm) rays and transmits in the visible spectrum, with the exception of very young lens (< 10 yrs of age), which transmits part of UV at 330 nm and diseases such as porphyria in which increased levels of porphyrin absorb part of the visible light.

Although exposure to UV light has not been found to be significant for the genesis of nuclear cataracts, cortical and posterior subcapsular cataracts have been correlated with increased UVB exposure. Chronic UVB or UVA exposure of experimental animals consistently demonstrates the appearance of lightscattering cortical opacities. The most efficient wavelength seems to be the 300 nm. It is thought that is due to generation of photosensitizers from tryptophan, which maximally absorbs at this range.

A photochemical reaction is caused when a molecule absorption light energy. A direct photochemical reaction takes place when the absorbing chromophore is chemically changed during the reaction. Photosensitized reaction occurs when the

absorbing chromophore does not change chemically but rather initiates a chemical change in another molecule. Photosensitizers become most effective when they give long-lived triplet state of chromophores in high quantum yield light absorption. There are two mechanisms of photooxidation mechanisms by which a triplet state of the photosensitizer reacts further. The lens contains several endogenous lens chromophores like N-formylkynurenine (NFK), kynurenic acid (KUA) that are generated by the oxidation of lens protein tryptophan, as well as riboflavin that can all have relatively good photosensitizing efficiency, although less than drugs used in phototherapy. Nuclear DNA of epithelial cells is damaged by absorbance of UVB irradiation and is more difficult to repair compared to damage by H2O2. UVA irradiation has been shown to damage DNA, the Na/K ATPase pump and catalase of epithelial cells. High levels of glutathione, which absorbs at 302 nm, can act as a direct scavenger of UVB irradiation damage and as a donor of H+ to glutathione peroxidase for participation in general repair mechanisms of oxidative damage. The lens crystallins are also affected by UVB and UVA irradiation that results in their cross-linking and high molecular weight aggregates. Membrane function is compromised by UV light not only by direct lipid peroxidation products but also from impaired synthesis of membrane structural/functional proteins.

Rays from the visible spectrum can also interact with cellular constituents and produce photo-oxidative damage. This can be further exacerbated in treatment for neonatal jaundice therapy and brightlight therapy for seasonal affective disorder seasonal. The presences of exogenous photosensitizers during procedures such as hematoporphyrin derivative photochemotherapy and psoralen-ultraviolet-A therapy have the potential to enter the lens and increase lens photodamage.

Effects of photo-oxidation on human lens color

The young human lens is primarily colorless to pale yellow. As it ages it becomes progressively more yellow to brown. Two main groups of chromophores are found, the first is a low molecular weight, water-soluble compound, 3-hydroxykynurenine glucoside (3-HKG) that absorbs light between 300 and 400 nm, is present during embryogenesis, and is thought to be derived from tryptophan. The second group, a

yellow chromophore, is bound to lens proteins, s absorption extending up to 500 nm and increases with aging.

The 3-hydroxykynurenine glucoside (3-HKG) reduces blue light scatter and filters out blue light from the retina thus improving visual acuity. In the infant, it is primarily located in the lens nucleus but with aging highest concentrations is found in the cortex of the lens. 3-HKG has not been shown to have photosensitizing properties.

The yellow chromophores are minimally detected early in life and increase progressively with aging. There are two subgroups recognized: one with excitation at 340 nm and emission at 440 nm and another excitation maximum at 430 nm and emission maximum at 520 nm. These two fluorophores, especially the latter one, have longer light excited state lifetimes and thus can act as photosensitizers.

More age-related yellow/brown chromophores can form in the human lens by interaction between of 3-hydroxykynurenine (3-HK) to lens proteins by a photochemical process. In addition advanced glycation (Maillard reaction) may be involved in the formation of yellow compounds in the lens with age.

Transparency, phase-separation and cataracts

With the exception of early developmental stages, the lens remains perfectly transparent in the wavelength range of 400 nm–1000 nm for the majority of human lifetime. This remarkable feat is a multifactorial achievement, including absence of blood and lymph vessels, and nerves. Other factors that contribute to lens transparency include: A) the orderly packaging of lens fibers in a para-crystalline hexagonal lattice, joined firmly by specialized intercellular connections that minimizes inter-cellular connective tissue, B) the absence of cell nuclei besides the paraxial equatorial region, C) the finely granular and evenly dense cytoplasm lacking intra-cellular organelles, D) specialized lens proteins (crystallins), of appropriate molecular weight and concentration as well as relative dehydration, specialized metabolism and ionic concentration, resulting in spatial fluctuations in cytoplasmic refractive index that are small relative to the wavelength of visible light, minimizing light scatter. Localized alterations in the density of packing of lens proteins, such as after protein aggregation and/ or configurational changes, can lead to change in lens transparency. This is best exemplified by the reversible cold cataract phenomenon, in which lenses

from young animals become cloudy upon temperature lowering and reversal upon rewarming. Benedek et al. propose that this is due to a phase separation phenomenon of water-protein regions. This results in a two-phase system where protein-aggregate-lakes and water-lakes with relatively different refractive indices will be adjacent to each other. This transition happens at a particular temperature called Tc. This is relatively much lower than body temperature at about 15_C. It is believed that several of the cataractogenic processes raise the Tc to levels close or above human body temperature, thus having a ‘‘cold phenomenon’’ at body temperature (20).

Type of cataract

Cataract can be classified by age of onset (e.g. congenital, juvinile, or “senile” cataract) or by the location of the opacity within the lens (e.g. cortical or nuclear). In addition, cataract may be designated as being the result of, or secondary to, other ocular disease, systemic disorders, and genetic or environmental influences.

The type of cataract and consequence blindness that gives rise to public health problems is generally related to ageing (“senile” cataract). However congenital cataract and cataracts resulting from trauma, among other things, pose special problem in management with regard to both prevention and treatment. While prevention is part of primary eye care, management of such of cataracts is generally the responsibility of institutions that can provide the necessary sophisticated instrumentation often required for treatment and follow up, and will not be described here.

Cataracts can also be classified in relation to their stage of maturity, i.e. as incipient, immature, mature or hypermature. An incipient cataract is a lens opacity that interferes with vision, if at all to a very small extent and produces only a slight localized or generalized reduction of a red reflex. An immature cataract is a further stage of lens opacification that may reduce vision to little better than the perception of hand movement at close range and in which there is a marked generalized reduction of a red reflex. A mature cataract is defined as a totally opaque lens that reduces the visual acuity to the perception of hand movements at a close range, or less, and in which there is a total absence of the red reflex. Swelling of the lens may occur when a

cataract has reached an advanced stage (intumescent cataract). Finally, the term *hypermature cataract* is applied to a cataractous lens that has shrunk, often with a wrinkling of the capsule. Vision is generally restricted to the perception of hand movement at close range, or less, and the red reflex is absent.

The above classification is important point of view, not only in eye examination surveys but also because of the deleterious effect that delay in surgery can have in the mature (Morgagnian) and hypermature stage. This has important implication for the planning of timely cataract intervention services and in assigning priorities for surgical intervention, if irreversible blinding complications are to be averted.

The pathway to blindness in cataract is generally direct and is the result of the impediment that the lens opacity poses to the entry of light beyond the pupil. However, where the lens become swollen (intumescent cataract) or hypermature, provoking an inflammatory or cellular (phacolytic) reaction, secondary glaucoma may supervene; if not urgently and appropriately managed, this can lead to irreversible loss of vision. Secondary glaucoma may also ensue from displacement of long- standing cataractous lenses in the very elderly, either spontaneously or often as a consequence of minor trauma.

Such dislocation may, however, be caused intentionally, as in the procedure called “couching”. This ancient technique is still practiced in some developing countries, often by itinerant traditional practitioners in remote rural areas not served by cataract surgical services. The procedure is very likely to produce severe complications which, more often than not, render the eye blind within a very short period of time (14).

Symptoms and Sign

Symptoms

Opacity of the lens may be present without causing any symptoms, and may be discovered only on routine ocular examination.

A gradual and painless deterioration of vision in an older person is generally suggestive of cataract. However, Other conditions, such as chronic glaucoma, macular change in diabetes mellitus, and senile macular degeneration, need to be excluded.

One of the earliest visual disturbances with cataract is glare or intolerance of bright light, such as direct sunlight or the headlights of an oncoming motor vehicle. The among of glare or dazzle will vary with be location and size of the opacity, those of occurring in the pupillary area causing symptoms out of proportion to their size. In the early stage, the visual acuity may be normal on routine testing. As the lens opacity progresses, the quality of vision begins to suffer, with an associated fall in acuity of both distance and near vision.

However, where nuclear sclerosis predominates, an improvement in near vision may become apparent as a result of developing myopia of ventricular origin. Thus an individual who has hitherto required glasses for near work may find that it is possible to dispense with them. However, at the same time, the visual acuity for distance becomes impaired. Before long, the individual's activities are restricted as a result of further progression of the opacity, and surgical removal of the lens is necessary.

Other visual disturbances include misty vision, dulling of color sense and occasionally monocular double vision. The consequences of lens-included uveitis and secondary glaucoma have been referred to earlier; these are heralded by severe pain and redness in the eye. This often occurs in patients who have earlier had vision restored in one eye but have ignored a long-standing cataract in the other eye (1).

Signs

Evidence of lowered visual acuity together with a dull or absent red reflex is suggestive of the diagnosis of cataract. However, cloudiness of the cornea or

vitreous body from any causes needs to be excluded. When the cataract is more developed, a gray or white pupil is observed. In mature cataract, vision may be reduced to the perception of hand movements at close range or event light perception. It is important to test for light projection in such eye to exclude possible underlying disease of, or damage to, the retina or optic nerve.

The pupil in eye with cataract is normally briskly reactive to light. This is an important clinical sign, which denotes healthy retinal and optic nerve function and is predictive of a successful outcome following surgery (14).

Relevant Research

BMI

Leske et al. (21) had studied the lens opacities case-control study. Risk factors for cataract. The 1380 participant were ophthalmology out patient, aged 40-79 years in 1991, found that BMI no associated with cataract.

Schamberg et al. (22) had studied relation of body fat distribution and height with cataract in men. Study of 22071 apparently healthy male US physicians who did not cataract at baseline were aged 40-84 years in 1982. This was a prospective follow-up study, assessed at the ninth years of follow-up. The study revealed that BMI was associated with incident cataract.

Gynn et al. (23) had studied Body Mass Index an in dependent predictor of cataract (1982). In 5 years of follow-up prospective cohort study. Participants are 17764 US male physicians participating in the Physicians, Health Study, aged 40 to 84 years, who were free of cataract, myocardial infarction, stroke, and cancer at baseline. Found that incident cataract occurred during follow-up in 370 participants. In proportional hazards model that adjust for potential confounding variables, body mass index had a strong, graded relationship with risk of cataract. Higher body mass index was especially strongly related to risk of cataract.

Foster et al. (24) had studied risk factors for nuclear, cortical and posterior subcapsular cataracts in the Chinese population of Singapore: the Tanjong pagar Survey. A population based cross sectional study was carried out on ethnic Chinese

men and women aged 40-81 years. After controlling for age, sex and other factors, lower body mass index was associated with cortical cataract (1.8;95% CI: 1.1-2.9; lowest versus highest quintile) and any cataract (2.3; 95%CI: 1.3-4.0).

Nimalan et al. (25) had studied risk factors for age related cataract in a rural population of southern India: the Aravind Comprehensive Eye Study. A cross sectional population based study of 5150 people aged 40 years and above from 50clusters from three districts in southern India. Cataract was associated with lean body mass index (OR: 1.37, 95%CI: 1.17 to 1.59).

Jacques et al. (26) had studied weight status, abdominal adiposity, diabetes, and early age-related lens opacities. Eye examinations were conducted in 466 Boston-area women age 53-73 years that were without previously diagnosing cataract and were part of the Nurses' Health Study cohort. Women with a BMI $\geq$ 30 had a higher prevalence of PSC opacities than did women with a BMI < 25 (OR: 2.5: 95%CI 1.2 to 5.2)

Several epidemiological studies examined the association between BMI and the risk of cataract, but these studies provide no consistent pattern of relation between BMI and cataract.

Education

The association between educational achievement and cataract has been one of the most consistently reported observations in epidemiologic studies of cataract.

Age-Related Eye Disease Group (27) had studied risk factors associated with aged- related nuclear and cortical cataract. Of the 4477 age 60 to 80 years are include in the study by case-control study in 2000. They found that cortical cataract were less common in persons with higher educational status.

Leske, Chylack Jr, Wu (21) had studied the lens opacities case-control study. Risk factors for cataract. The 1380 participants were ophthalmology outpatients, aged 40 to 79 years. They found low education increased risk for cataract (OR= 1.46)

Foster et al. (24) had studied risk factors for nuclear, cortical and posterior subcapsular cataracts in the Chinese population of Singapore: the Tanjong pagar Survey. A population based cross sectional study was carried out on ethnic Chinese

men and women aged 40-81 years. Lower education was associated with nuclear cataract (OR 2.3; 95%CI 1.0 to 5.2)

Delcourt et al. (28) had studied risk factors for cortical cataract, nuclear, and posterior sub capsular cataracts: the POLA study, Pathologies Oculaires Liees a L' Age.The POLA Study is a population-based study of cataract being carried out among 2,584 residents of Sete, southern France, aged 60-95 years. Recruitment took place between June 1995 and July 1997. This paper presents result obtained from cross-sectional analysis of the first phase of the study. In polytomous logistic regression analyses was found decreased risk of cataract with higher education (OR=0.59).

Occupation

Leske, Chylack LT Jr, Wu SY (21) had studied the lens opacities case-control study. Risk factors for cataract. The 1380 participants were ophthalmology outpatients, aged 40 to 79 years. They found nonprofessional occupation increased risk for cataract (OR= 1.96)

Age-Related Eye Disease Group (14) had studied risk factors associated with aged- related nuclear and cortical cataract. Of the 4477 age 60 to 80 years are include in the study by case-control study in 2000. They found that higher level of sunlight exposure associated with cataract (OR=1.33)

Foster et al. (24) had studied risk factors for nuclear, cortical and posterior subcapsular cataracts in the Chinese population of Singapore: the Tanjong pagar Survey. A population based cross sectional study was carried out on ethnic Chinese men and women aged 40-81 years. A non-professional occupation was associated with nuclear cataract (OR=2.3 95%CI: 1.0-5.2)

Smoking status

Foster et al. (24) had studied risk factors for nuclear, cortical and posterior subcapsular cataracts in the Chinese population of Singapore: the Tanjong pagar Survey. A population based cross sectional study was carried out on ethnic Chinese men and women aged 40-81 years. Current cigarette smoking was associated with nuclear cataract (OR 1.7; 95%CI 1.0 to 2.9; more than cigarette per day versus none).

Age-Related Eye Disease Group (27) had studied risk factors associated with aged- related nuclear and cortical cataract. Of the 4477 age 60 to 80 years are include in the study by case-control study in 2000. They found the presence of nuclear cataract is significantly associated with increasing current smoking (OR=1.96).

Leske, Chylack Jr, Wu (21) had studied the lens opacities case-control study. Risk factors for cataract. The 1380 participants were ophthalmology outpatients, aged 40 to 79 years. They found current smoking increased risk for cataract (OR= 1.68).

Sanjay. Zodpey and Suresh n. Ughade (29) had studied tobacco smoking and risk of age-related cataract in men. The present study was carried out at Government Medical College Hospital, Nagpur, India. The study was designed as a group-matched, case-control study. They used confounding age as a matching variable. Based on the findings of a pilot study on 100 case and 100 control aged 35 to 85 years. The significant risk association between tobacco smoking and aged-related cataract (OR=2.90, 95%CI 1.92 to 4.39).

Klein et al. (30) had studied cigarette smoking and lens opacities: the Beaver Dam Eye Study. To evaluated the relationship between cigarette smoking behavior and lens opacities in cross-sectional data on 4,926 adults in Beaver Dam. The OR associated with 10 packyears of cigarette smoking was 1.06 (CI=0.98-1.14) for women and1.05 (CI=1.00,1.11) for men after controlling for age.

Delcourt et al. (28) had studied risk factors for cortical cataract, nuclear, and posterior subcapsular cataracts: the POLA study, Pathologies Oculaires Liees a L' Age.The POLA Study is a population-based study of cataract being carried out among 2,584 residents of Sete, southern France, aged 60-95 years. Recruitment took place between June 1995 and July 1997. This paper presents result obtained from cross-sectional analysis of the first phase of the study. In polytomous logistic regression analyses, an increased risk of cataract was found for smoking (OR=2.34 for current smokers and OR=3.75 for former smoker).

Cristen et al. (31) had studied a prospective study of cigarette smoking and risk of cataract in men to examine the association between cigarette smoking and the incident of cataract. The design was a prospective cohort study using data from the Physicians' Health Study. This analysis includes the 17,824 physicians aged 40-84

years who did not cataract report cataract at baseline and did provide complete risk factor information that began in 1982 follow-up 60 month. An incident cataract was defined as a self-report confirmed by medical record review. During follow-up, 557 incident cataracts among 371 participants were confirmed. Compare with never smokers, current smokers of 20 or more cigarettes per day had a statistically significant increase in the risk of cataract (RR=2.16; 95%CI, 1.46-3.20 P less than .001)

Alcohol consumption

Manson et al (32) had studied a prospective study of alcohol consumption and risk of cataract. They used the prospective database of the Physicians' Health Study to examine the association between alcohol consumption and incidence of cataract. A total of 17,824 physicians satisfied these criteria. An incidence cataract was defined as a self-report confirm by medical record review. During 88,565 person-years of follow-up, 371 participants had a confirmed incident cataract. Compared to physicians consuming alcohol less than once per month, daily consumers of alcohol had an age-adjusted relative risk (RR) of cataract of 1.31 (95% CI=0.95-1.81)

Medical history

Delcourt et al. (28) had studied risk factors for cortical cataract, nuclear, and posterior sub capsular cataracts: the POLA study, Pathologies Oculaires Liees a L' Age.The POLA Study is a population-based study of cataract being carried out among 2,584 residents of Sete, southern France, aged 60-95 years. Recruitment took place between June 1995 and July 1997. This paper presents result obtained from cross-sectional analysis of the first phase of the study. In polytomous logistic regression analyses, an increased risk of cataract was found for known diabetes of 10 or more years, duration (OR=2.27), asthma or chronic bronchitis (OR=2.04), cancer (OR=1.92), and cardiovascular disease (OR=1.96)

Leske et al. (33) had studied risk factor for incident nuclear opacities. To evaluate risk factors for the 4- year incidence of nuclear opacities, 2600participants of the Barbados Eye Studies, without any nuclear opacities at baseline. Participants completed a standardized protocol at baseline and follow-up, including ophthalmic

and other measurements, an interview, slit-lamp lens grading, fundus photography, and an ophthalmologic examination. The 4-years incidence of nuclear opacities was 9.2% (241 of 2609). History of diabetes was significantly risk (RR=1.6; 95%CI)

Refractive error

Leske, Chylack LT Jr, Wu SY (21) had studied the lens opacities case-control study. Risk factors for cataract. The 1380 participants were ophthalmology outpatients, aged 40 to 79 years. They found use of eyeglasses by age 20 years, which is an indicator of myopia (OR= 1.44).

Leske et al. (33) had studied risk factor for incident nuclear opacities. To evaluate risk factors for the 4- year incidence of nuclear opacities, 2600participants of the Barbados Eye Studies, without any nuclear opacities at baseline. Participants completed a standardized protocol at baseline and follow-up, including ophthalmic and other measurements, an interview, slit-lamp lens grading, fundus photography, and an ophthalmologic examination. The 4-years incidence of nuclear opacities was 9.2% (241 of 2609). Myopia was significantly risk (RR=2.8; 95%CI)

It can be seen from the literature review that factors influencing cataract were both related and non-related. It is therefore important to study with factors were related to cataract. The following illustration is the concept framework of this research.

Ultraviolet light

Bocchoe et al. (14) had a case-control study was undertaken to investigate the role of exposure to ultraviolet light in the B range (UV-B) and other potential risk factors for the development of PSC cataracts. All patients with PSC opacities who underwent cataract surgery in a 12-month period were chosen. One hundred sixty-eight cases and 168 controls were interviewed regarding sunlight exposure was associated with increased risk of PSC cataracts.

CHAPTER III
MATERIALS AND METHODS

1. Research design / study method

This study was conducted in Noparat Rajathanee Hospital. Cataract is the most prevalent form of blindness. Case-Control methods have been chosen to test the study hypothesis. A ratio of cases per controls is 1:1.

2. Study population

The study samples included 2 groups from patients at Noparat Rajathanee Hospital. The first group was cases that diagnosed with cataract in single or both eyes the second group was controls would be selected patients from the other department, who without eye diseases.

3. Sample Size

Sample size calculation was based on the following information: The exposure of interest in control was non professional occupation. The odd ratio among those who had no history of exposure was 1.96.The sample size was calculated using Lemeshow's formula ().The information obtained from the literature review was use to calculate the number of sample size

Parameter:

P_0 (Proportion of exposure in control group) = 0.25

OR (Expected odd ratio) = 1.96

$Z_{\alpha/2}$ (Standard value of Z score at type I error = 0.05) = 1.96

$Z_{\beta/2}$ (Standard value of Z score at type II error = 0.20) = 0.84

The sample ratio between case and control = 1:1

The information obtained from the literature review was used to calculate the number of both groups which was the same.

$$n = \frac{\left[Z_{\alpha/2}\sqrt{2P(1-P)} + Z_{\beta}\sqrt{P_1(1-P_1)+P_0(1-P_0)}\right]^2}{(P_1-P_0)^2}$$

$$P_1 = \frac{OR * P_0}{OR * P_0 + (1-P_0)}$$

$$P = \frac{P_1 + P_0}{2}$$

$$n = \frac{\left[1.96\sqrt{2(0.322)+(1-0.322)} + 0.84\sqrt{0.395(1-0.395)+0.25(1-0.25)}\right]^2}{(0.395-0.25)^2}$$

n = 161

From the calculation, the sample size should not be less than 161 per group. The total sample 322 that is required for the study. The ratio of case and control was 1:1. From the patient, minimum of 161 cases and 161 controls will be selected. However, effort would be made to gather as many cases and controls as possible.

4. Sample selection

This study selected cases and controls from patients at Noparat Rajathanee Hospital

Cases: Patients aged between 20 to 59 years old, diagnosed with cataract in single or both eye. Excluded from case subject would be those who have been diagnosed with conjunctivitis, trachoma, ocular trauma, corneal foreign bodies, ecchymosis of the lids, hyphaema, onchocerciasis, potential congenital causes, glaucoma and diabetic retinopathy and childhood blindness.

Control: The control was selected from patients in the other departments whose had come without eye diseases.

5. Research tools

The questionnaire was used in this study. It was developed from literature review and modified to suit the study. It included with close - end questions and open - end questions. It consists of four parts

Part 1: Demographic factors: age, gender, height and weight, BMI, education, occupational, time work, smoking status, alcohol consumption, history of illness and family history about cataract.

Part 2: Physical factors: temperature, vibration, repetitive movement, bright light / sunlight, history of eye injury from work, computer used and microwave used.

Part 3: Chemical factors: chemical exposure such as dust, fume, burning smoke, droplet, gas, steam and solvent.

Part 4: Biological factor: history of eye infection.

6. The questionnaire & quality control

Content validity of the questionnaire was examined. It was revised for clearer content and suitability according to the experts, recommendations, and it was subsequently tested with the group of 15 cases and 15 controls at Nopparat Rajathanee Hospital

7. Data collection

1. One interviewer was responsible for data collection and by telephone interview, during April 2006 and June 2006

2. Data of medical history: body weight, oral medication and underlying disease from the medical record (OPD Card)

8. Ethical implication

The proposal was reviewed and approved by Mahidol University Ethical Committee. Permission was, also, obtained from the Director of Nopparat Rajathanee

Hospital. The details of the study protocol are explained to all participants, and informed consents were obtained prior to data collection.

9. Research variables (Variables to be study)

9.1 Dependent variable: Cataract

9.2 Independent variables:

Demographic factors: age, gender, education, occupation, history of illness, family history about cataract

Physical factors: temperature, vibration, repetitive movement, bright light / sunlight, history of eye injury, computer used, microwave used

Chemical factors: Chemical exposure, History of chemical exposure

Biological factors: history of eye infections

The following variables were examined in the questionnaire. Among these variables, information about factors: demographic, physical, chemical and biological.

10. Data analysis

Application program computer analyzed the data and presented in following:

1. Descriptive statistics was used to describe frequency, percentage, mean and SD

2. Analysis statistics was used for univariate analysis using chi square test, odds ratio, and 95% CI of OR

3. Multivariate analysis using Multiple Logistic Regression was performed to simultaneously control the confounders and to assess possible risk.

CHAPTER IV
RESULTS

This case–control study was conducted to determine the association between occupational factors and cataract development. The study samples included 2 groups from patients at Noparat Rajathanee Hospital. The first sample group was cases that diagnosed with pure cataract in single or both eyes during January 2003 to June 2006. The second group was controls would be selected patients from the other department who without eye diseases. The both group were 20– 59 years of age. The data was collected by interviewing 162 cases and 167 of controls. The studied results were presented as follows. (Table1)

1. Descriptive characteristics

Age

The case and control were unmatched by age. Majority of the subject in case was age group between 45-59 years (68.5%) and control was age group between 30-44 (53.9%). The average age were 46.7(SD = 8.7) and 33.6(SD = 8.9) in cases and controls group respectively. This difference was statistical significant (*p-value* < 0.001).

Sex

The majority of cases were female (52.5% and controls of the case and 63.5% of the controls). This difference was statistical significant (*p-value* = 0.043).

BMI

The BMI in cases and controls were 18.5 – 22.9. The majority of cases were 75(47.2%) and controls were 84 (50.9%). BMI group <18.5 was the smallest group with 6.9 % of cases and 12.7 % of controls. The average BMI were 23.4 (SD = 3.9)

and 22.7(SD = 4.0) in cases and controls group. This difference was not statistical significant (*p-value* = 0.147).

Education Level

Education level in cases and controls were difference. The majority of cases were primary education 50.6% and controls were high school – diploma 53.3%. The smallest group of cases was bachelor or higher 13.0% and controls were Primary education 15.0%. This difference was statistical significant (*p-value* < 0.001).

Occupation

Occupation in cases and controls were difference. The majority of cases were employment (labor) 40.1% and controls were office staff 36.5%. The smallest group of cases was the other group with 12.3% and controls were Trade / business private 5.4%. This difference was statistical significant (*p-value* < 0.001).

Time worked (years)

The majority time worked of case and control were 1 – 10 years (37.7% of the case and 66.5% of the control).The smallest group of the case and control were more than or equal 31 years (6.2%, 0.6%). The average time worked were 17.2 (SD = 10.6) and 9.0(SD = 6.7) in case and control group respectively. This difference was statistical significant (*p-value* <0.001).

Refractive error

The majority of Refractive error in case was no refractive error (61.1%) and control was refractive error (50.3%).This difference was statistical significant (*p-value* = 0.037).

History of illness

The majority of history in cases and controls were same that no disease. The majority of diabetes mellitus in cases and controls 63.6%, 94.6%, hypertension 66.7%, 91.6% and cardiovascular disease 79.6%, 94.0%. This difference was statistical significant (*p-value* <0.001). The majority of rheumatoid arthritis in cases

92.0% and controls 94.0%. This difference was not statistical significant (*p-value* = 0.469).

Family history about cataract

Family history about cataract in cases and control were statistical significant (*p-value* <0.001). The majority in cases and control were negative Family history about cataract (59.9%, 82.6%).

Smoke

Smoke in cases and control were statistical significant (*p-value* = 0.012). The majority in cases and control were no smoke (75.3%, 86.2%).

Alcohol Consumption

Alcohol Consumption in cases and control were not statistical significant (*p-value* = 0.240). The majority in cases and control were no Alcohol Consumption (74.7%, 68.9%).

Table 1 Demographics characteristics in case and control groups

Characteristic	Case (n=162)		Control (n=167)		*p*-value
	Number	Percent	Number	Percent	
Age					
15-29	9	5.6	56	33.5	<0.001
30-44	42	25.9	90	53.9	
45-59	111	68.5	21	12.6	
Mean (SD)	46.7(8.7)		33.6(8.9)		
Sex					
male	77	47.5	61	36.5	0.043
female	85	52.5	106	63.5	
BMI					
< 18.5	11	6.9	21	12.7	0.147
18.5 - 22.9	75	47.2	84	50.9	
23.0 - 24.9	34	21.4	24	14.5	
≥ 25	39	24.5	36	21.8	
Mean(SD)	23.4(3.9)		22.7(4.0)		
Education Level					
Primary education	82	50.6	25	15.0	<0.001
High School - Diploma	59	36.4	89	53.3	
Bachelor or higher	21	13.0	53	31.7	
Occupation					
Employment (labor).	65	40.1	58	34.7	<0.001
Housework.	30	18.5	14	8.4	
Trade / business private.	25	15.4	9	5.4	
Government / state enterprise.	20	12.3	13	7.8	
Staff (Office)	15	9.3	61	36.5	
Other	7	4.4	12	7.2	
time worked (years)					
1-10	61	37.7	111	66.5	<0.001
11-20	38	23.5	45	26.9	
21-30	53	32.7	10	6.0	
>=31	10	6.2	1	0.6	
Mean (SD)	17.2(10.6)		9.0(6.7)		

Table 1 Demographics characteristics in case and control groups (cont.)

Characteristic	Case (n=162)		Control (n=167)		*p*-value
	Number	Percent	Number	Percent	
Refractive error					
yes	63	38.9	84	50.3	0.037
no	99	61.1	83	49.7	
Diabetes					
yes	59	36.4	9	5.4	<0.001
no	103	63.6	158	94.6	
Hypertension					
yes	54	33.3	14	8.4	<0.001
no	108	66.7	153	91.6	
Rheumatoid arthritis					
yes	13	8.0	10	6.0	0.469
no	149	92.0	157	94.0	
Cardiovascular disease					
yes	33	20.4	10	6.0	<0.001
no	129	79.6	157	94.0	
Family history about cataract					
yes	65	40.1	29	17.4	<0.001
no	97	59.9	138	82.6	
Smoke					
yes	40	24.7	23	13.8	0.012
no	122	75.3	144	86.2	
Alcohol					
yes	41	25.3	52	31.1	0.240
no	121	74.7	115	68.9	

2. The association between occupation factors with early cataract development by univariate analysis.

Demographics factor

This analyzed was adjusted for age. There were variables associated with cataract development in each group of factor. This study found that gender, education level, time worked, smoke, refractive error, cardiovascular disease and family history had a statistic significant association with cataract development. The details were as follow. (Table2.)

Gender

Male had a higher risk of early cataract development than male (OR=1.80, 95%CI 1.06 – 3.19)

Education level

Primary education level had a higher risk than bachelor or higher education level (OR=4.27, 95%CI 1.97 – 9.27) compared with bachelor or higher level.

Refractive error

Positive refractive error had a risk of cataract development than negative refractive error (OR=1.10, 95%CI 0.21 – 0.66)

Cardiovascular Disease

Cardiovascular Disease was associated with cataract development (OR=2.99, 95%CI 1.24 – 7.19).

Physical factors

There were variables associated with cataract development in each group of factor. This study found that cold temperature, movement repetitions, computer used and microwave used had a statistic significant association with cataract development. Only cold temperature had a risk (OR = 7.78, 95%CI 2.85 – 21.2).

Computer used, microwave used and movement repetition were inverse association with early cataract development (OR = 0.23, 95%CI 0.13 – 0.42, OR = 0.38, 95%CI 0.21- 0.71). Other variables such as, bright light/sunlight, vibration, heat temperature and history of eye injury did not show significant association with early cataract development. (Table 3)

Chemical factors

Dust and mists were significant association with cataract development, there were protective risk Dust had a risk (OR = 4.30, 95%CI 0.21 – 0.62), mists had a risk (OR = 0.47, 95%CI 0.24 – 0.92) compared with unexposed those variables. Other variables such as fume, burning smoke, gas, vapor and solvent did not show significant association with cataract development. . (Table 4)

Biology factor

This study found history of eye infection from work not significant association with cataract development. . (Table 5)

Table 2 Association between demographic factors and cataract development

Characteristic	Case (n=162)		Control (n=167)		OR*	95%CI	*p*-value
	Number	Percent	Number	Percent			
Gender							
female	85	52.5	106	63.5	1.00		
male	77	47.5	61	36.5	1.8	1.06-3.19	0.030
BMI							
<18.5	11	6.9	21	12.7	1.00		
18.5-22.9	75	47.2	84	50.9	1.12	0.40-3.12	0.832
23.0-24.9	34	21.4	24	14.5	1.41	0.45-4.44	0.554
≥25	39	24.5	36	21.8	0.80	0.26-2.43	0.689
Mean(SD)	23.4(3.9)		22.7(4.0)				
Education Level							
Primary education	82	50.6	25	15.0	4.27	1.97-9.27	<0.001
High School - Diploma	59	36.4	89	53.3	1.93	0.95-3.90	0.068
Bachelor or higher	21	13.0	53	31.7	1.00		
Occupation							
Employment (labor).	65	40.1	58	34.7	1.24	0.36-4.21	0.735
Housework.	30	18.5	14	8.4	1.42	0.36-5.64	0.620
Trade / business private.	25	15.4	9	5.4	2.25	0.52-9.74	0.278
Government / state enterprise.	20	12.3	13	7.8	1.15	0.28-4.76	0.850
Staff (Office)	15	9.3	61	36.5	0.43	0.11-1.58	0.202
Other	7	4.4	12	7.2	1.00		
time worked (years)							
1-10	61	37.7	111	66.5	1		
11-20	38	23.5	45	26.9	0.62	0.32-1.20	0.156
21-30	53	32.7	10	6.0	1.75	0.70-4.34	0.230
>=31	10	6.2	1	0.6	2.08	0.24-18.08	0.508
Mean (SD)	17.2(10.6)		9.0(6.7)				

** Adjust for age*

Table 2 Association between demographic factors and cataract development (cont.)

Characteristic	Case (n=162)		Control (n=167)		OR*	95%CI	*p*-value
	Number	Percent	Number	Percent			
Smoke							
no	122	75.3	144	86.2	1		
yes	40	24.7	23	13.8	2.49	1.25-4.94	0.009
Alcohol							
no	121	74.7	115	68.9	1		
yes	41	25.3	52	31.1	1.10	0.61-1.99	0.747
Refractive error							
no	99	61.1	83	49.7	1.00		
yes	63	38.9	84	50.3	0.37	0.21-0.66	0.001
Diabetes							
no	103	63.6	158	94.6	1.00		
yes	59	36.4	9	5.4	5.03	2.18-11.58	<0.001
Hypertension							
no	108	66.7	153	91.6	1.00		
yes	54	33.3	14	8.4	1.59	0.74-3.41	0.234
Rheumatoid arthritis							
no	149	92.0	157	94.0	1.00		
yes	13	8.0	10	6.0	0.69	0.24-1.98	0.486
Cardiovascular disease							
no	129	79.6	157	94.0	1.0		
yes	33	20.4	10	6.0	2.99	1.24-7.19	0.015
Family history about cataract							
no	97	59.9	132	79.0	1.00		
yes	65	40.1	29	17.4	2.13	1.16-3.92	0.015

* *Adjust for age*

Table 3 Association between physical factors and cataract development

Characteristic	Case (n=162)		Control (n=167)		OR*	95%CI	*p*-value
	Number	Percent	Number	Percent			
Heat temperature							
no	5	3.1	21	12.6	1.00		
yes	157	96.9	146	87.4	2.29	0.76 -6.90	0.143
Cold temperature							
no	6	3.7	44	26.3	1.00		
yes	156.00	96.30	123.00	73.70	7.78	2.85 -21.22	<0.001
Bright light / sunlight.							
no	94	58.0	108	64.7	1.00		
yes	68	42.0	59	35.3	1.15	0.66-1.98	0.628
Vibration.							
no	149	92.0	149	89.2	1.00		
yes	13	8.0	18	10.8	0.87	0.36-2.13	0.762
Movement repetitions.							
no	143	88.3	115	68.9	1.00		
yes	19	11.7	52	31.1	0.33	0.17 - 0.67	0.002
History of eye injury							
no	154	95.1	160	95.8	1.00		
yes	12	7.4	13	7.8	2.31	0.89- 5.97	0.084
Computer used							
not used	133	82.1	7	4.2	1.00		
used	29	17.9	61	36.5	0.23	0.13 - 0.42	<0.001
Microwave used							
not used	129	79.6	104	62.3	1.00		
used	33	20.4	63	37.7	0.38	0.21 - 0.71	0.002

** Adjust for age*

Table 4 Association between chemical factors and cataract development.

Characteristic	Case (n=162)		Control (n=167)		OR*	95%CI	*p*-value
	Number	Percent	Number	Percent			
Dust.							
unexposed	107	66.0	52	31.1	1.00		
exposed	55	34.0	115	68.9	0.36	0.21 -0.62	<0.001
Fume							
unexposed	161	99.4	165	98.8	1.00		
exposed	1	0.6	2	1.2	0.51	0.02 - 10.52	0.663
Burning smoke.							
unexposed	121	74.7	117	70.1	1.00		
exposed	41	25.3	50	29.9	0.86	0.47 - 1.57	0.625
Mists							
unexposed	141	87.0	118	70.7	1.00		
exposed	21	13.0	49	29.3	0.47	0.24 - 0.92	0.027
Gas.							
unexposed	154	95.1	152	91.0	1.00		
exposed	8	4.9	15	9.0	0.67	0.23 - 1.96	0.469
Vapor.							
unexposed	148	91.4	150	89.8	1.00		
exposed	14	8.6	17	10.2	1.31	0.55 - 3.12	0.537
Solvent.							
unexposed	160	98.8	162	97.0	1.00		
exposed	2	1.2	5	3.0	0.55	0.09 - 3.45	0.526

* *Adjust for age*

Table 5 Association between biological factors and cataract.

Characteristic	Case (n=162)		Control (n=167)		OR*	95%CI	*p*-value
	Number	Percent	Number	Percent			
History of eye infection from worked							
no	143	88.27	157	94.01			
yes	19	11.73	10	5.99	0.50	0.19-1.33	0.167

* *Adjust for age*

3. Multivariate analysis of the association between occupational factors and cataract development.

After performing the crude analysis, the factors considered to be significantly associated with early cataract development there were cold temperature, movement repetitions, computer used, microwave used, dust and mists.

This association might be influenced by confounding factors. In order to get rid of potential confounders, unconditional multiple logistic regression was provided by controlling for the effect of age, gender, education level, occupation, time worked, cold temperature, heat temperature, movement repetitions, vibration, bright light / sunlight, computer used, microwave used, History of eye injury, dust and mists.

After controlling for confounding factors there were 4 risk factors, namely age, sex, computer used and cold temperature, significantly associated with cataract development was shown as follow. (Table6)

Age

Age group were showed a positive trend with increasing association level of age group 30 -44, 45 -49 59 (OR=3.87, 95%CI 1.41 – 10.62, OR = 15.50, 95%CI 4.52 – 53.10)

Sex

The association between genders with cataract development was analyzed by univariate analysis and multivariate analysis found had a risk factor. In multivariate found that had a risk (OR= 3.14, 95%CI 1.43 – 6.84), female was a baseline.

Cold Temperature

The association between cold temperatures with cataract development was analyzed by univariate analysis and multivariate analysis found had a risk factor. In multivariate found that had a risk (OR= 5.85, 95%CI 1.70 – 20.05).

Computer used

The association between computer used with cataract development was analyzed by univariate analysis and multivariate analysis found that a protective factor. In multivariate analysis (OR= 0.29, 95%CI 0.16 – 0.91).

Table 6 Multivariate analysis of the association between occupational factors and cataract development

Characteristic	Crude OR*	95%CI	Adjust OR**	95%CI	*p*-value
Age					
15-29	1.00		1.00		
30-44	2.90	1.31 - 6.42	3.87	1.41 - 10.62	0.009
45-59	32.89	14.14-76.52	15.50	4.53 - 53.10	<0.001
Gender					
female	1.00		1.00		
male	1.80	1.06-3.19	3.13	1.43-6.84	.004
Education Level					
Primary education	4.27	1.97-9.27	2.85	0.84 - 9.67	0.092
High School - Diploma	1.93	0.95-3.90	2.60	0.95 - 7.14	0.064
Bachelor or higher	1.00		1.00		
Occupation					
Employment (labor).	1.24	0.36-4.21	0.65	0.12 - 3.50	0.617
Housework.	1.42	0.36-5.64	1.02	0.17 - 6.16	0.980
Trade / business private.	2.25	0.52-9.74	1.96	0.30 - 12.94	0.486
Government / state enterprise.	1.15	0.28-4.76	1.58	0.24 - 10.32	0.633
Contact (Office)	0.43	0.11-1.58	0.70	0.13 -3.77	0.676
Other	1.00		1.00		
Time worked (years)					
1-10	1.00		1.00		
11-20	0.62	0.32-1.20	0.65	0.27 - 1.55	0.327
21-30	1.75	0.70-4.34	1.69	0.52 - 5.46	0.380
>=31	2.08	0.24-18.08	2.21	0.19 - 26.37	0.530
Mean (SD)					

** Adjust for age*

*** Adjust for age, gender, education level, occupation, time worked, cold temperature, heat temperature, movement repetitions, vibration, bright light / sunlight, computer used, microwave used, History of eye injury, dust and mists.*

Table 6 Multivariate analysis of the association between occupational factors and cataract development. (cont.)

Characteristic	Crude OR*	95%CI	Adjust OR**	95%CI	*p*-value
Heat temperature					
no	1.00		1.00		
yes	2.29	0.76 -6.90	1.84	0.40 - 8.52	0.436
Cold temperature					
no	1.00		1.00		
yes	7.78	2.85 - 21.22	5.85	1.71 - 20.05	0.005
Vibration.					
no	1.00		1.00		
yes	0.87	0.36-2.13	0.69	0.31 - 1.57	0.380
History of eye injury					
no	1.00		1.00		
yes	2.31	0.89- 5.97	1.62	0.51 - 5.12	0.412
Computer used					
not used	1.00		1.00		
used	0.23	0.13 - 0.42	0.38	0.16 - 0.90	0.029
Microwave used					
not used	1.00		1.00		
used	0.38	0.21 - 0.71	0.7	0.31 - 1.57	0.38
Bright light / sunlight.					
no	1.00		1.00		
yes	1.15	0.66-1.98	1.07	0.50 - 2.28	0.860
Movement repetitions.					
no	1.00		1.00		
yes	0.33	0.17 - 0.67	0.49	0.22 - 1.13	0.095
Dust.					
unexposed	1.00		1.00		
exposed	0.36	0.21 -0.62	0.42	0.20 - 0.92	0.030
Mists					
unexposed	1.00		1.00		
exposed	0.47	0.24 - 0.92	0.49	0.22 - 1.13	0.095

** Adjust for age*

*** Adjust for age, gender, education level, occupation, time worked, cold temperature, heat temperature, movement repetitions, vibration, bright light / sunlight, computer used, microwave used, History of eye injury, dust and mists.*

CHAPTER V
DISCUSSION

This case–control study was conducted to determine the association between occupation factors and cataract development. The data were collected by using questionnaires to interview. The study samples included 2 groups from patients at Nopparat Rajathanee Hospital. The first sample group was cases that diagnosed with pure cataract in single or both eyes, the second group was controls would be selected patients from the other department who without eye disease during January 2003 to June 2006. The both group were 20– 59 years of age 162 cases and 167 of controls.

The majority of cases and controls were female. Age in cases was age group between 45-59 years and controls was 30 -44. The BMI in cases and controls were 18.5 – 22.9. Education level and occupation in cases and controls were difference. The majority of education level in cases were primary education and controls were high school – diploma. The majority occupation of cases was employment (labor) and controls were office staff had time work 1 – 10 years. The most of subjects were not smoking and not alcohol consumption. The majority of them had no history of illness diabetes, hypertension, rheumatoid arthritis, cardiovascular disease and family history about cataract. Refractive error in the case was no and control was not difference.

From the multivariate analysis for the association between occupation factors and cataract development by controlling potential confounder, it was shown 4 factors considered to be significantly associated with cataract development; age, gender, computer used and cold temperature.

Discussion the study result

Age

Age was clearly a major risk factor in development of early cataract in this study, This study found Age group were showed a positive trend with increasing association level of age group 30 -44, 45 -49 59 (OR=3.87, 95%CI 1.41 – 10.62, OR = 15.50, 95%CI 4.52 – 53.10).

In this study no control age in each case and control groups. Has the potential to cataract development. So should have control. In the age group most in case of a group with the minimum of control. Size of potential disease would differ from the findings. Even in the same direction.

This studied result consistent with several past studies. Anselm Hennis et al had studied found older age, female gender (RR=1.3), and education of Li T et al (37) found older age was relate with cataract. Because ageing had the single-most important cause of cataract, the lens is made mostly of water and protein. Specific proteins within the lens are responsible for maintaining its clarity. Over many years, the structures of these lens proteins are altered, ultimately leading to a gradual clouding of the lens.

Gender

The result showed that the association between genders and cataract development had a risk factor (OR= 3.14, 95%CI 1.43 – 6.84), female was a baseline. Number of males in case and control were less than female but the study result found that males at risk than females. Perhaps the duties of work and life style most of men due to exposure risk factors than females.

The study result was contrast with several studies. A number of epidemiological studies using cross-sectional data have shown an increased prevalence of cataract in women compared with men. Although some have shown an increased prevalence of cataract generally (35).The cause of the gender differences in cataract occurrence is not clear but could be related to the hormonal differences between women and men. Postmenopausal estrogen deficiency may be a factor. Recent

epidemiologic data provide some evidence that estrogen and hormone replacement therapy (HRT) may play a protective role in reducing the incidence of age-related cataract and cataract surgery (36).

Computer used

The association between computer used and cataract development was protective factor (OR= 0.38, 95%CI 0.16 – 0.90). Not found any study about computer association with cataract. Many people who use computers were educate and know how to protect themselves. This is consistent with factors namely education level of this study. Some of them regularly complain of difficulties with their vision. There are several different things that can lead to eyestrain symptoms. When the muscle inside of the eye that controls focusing is overworked, symptoms can occur. These symptoms will not start immediately, but only after several hours of work. Janardan V Bhatt et al (37) studied found Total six types of eye symptoms were prevailed among the computer users. They are computer eye strain/fatigue, dry eye, blurred vision, eye irritation, pain in eye/headache, neck ache, backache and other musculoskeletal problems.

Cold temperature

The result showed that the association between genders and cataract development had a risk factor (OR= 5.85, 95%CI 1.70 – 20.05).). Not found any study about computer association with cataract. Expect to be association with changes in lens proteins. May be the sample size in each group are very different in exposure, unexposure. However, considered this variable was Interesting to study specific variables.

CHAPTER VI
CONCLUSION AND RECOMMENDATION

Conclusion

A hospital based case control study was conducted from the period of April 2006 and June 2006 at Nopparat Rajathanee Hospital, Bangkok. To study the association between occupational risk factors and cataract development: demographic factors, physical factors, chemical factors and biological factors.

One hundred and sixty two patients with cataract were a case group and 167 patients without cataract were a control group. The case was select from patients with cataract in eye department. The control was selected from patients in the other departments whose had come without eye diseases. The both group was aged between 20 to 59 years old. All subjects were interviewed by the researcher and research assistance.

The variables included in the study were four parts; Demographic factors, Physical factors, Chemical factors, Biological factor.

In univariate analysis, the factors found to be significantly associated with cataract development as follow:

Demographic factors: gender, education level, time worked, smoke, refractive error, cardiovascular disease and family history

Physical factors; cold temperature, movement repetitions, computer used and microwave used.

Chemical factors; Dust and mists

After adjusting for the possible confounder, 4 factors were significantly associated with cataract development namely age, sex, computer used and cold temperature. The variables namely age, sex and cold temperature had risk; Age group 30 -44, 45 -49 59 (OR=3.87, 95%CI 1.41 – 10.62, OR = 15.50, 95%CI 4.52 – 53.10), sex was male (OR= 3.14, 95%CI 1.43 – 6.84) and cold temperature (OR= 5.85,

95%CI 1.70 – 20.05). The variable computer used was a protective risk (OR= 0.29, 95%CI 0.16 – 0.91).

Recommendation for the Result application

1. The result from this study suggests the baseline data and factors contributing to cataract development.

2. To delay the onset of cataract development in working age this result can be utilized in program of prevention and control in population at risk.

3. Population at risk should be screen for early detect for timely treatment of cataract before the onset of severe functional impairment.

Recommendation for Further Study

1. The association between occupations factors with early cataract development need to be investigated in a large sample size and specific each factor.

2. The result in this study represent only patient at Nopparat Rajathanee Hospital. The result should confirm with the data of cataract patient in other hospitals in difference areas of country.

3. Some factors, such as occupation, bright light (UV Radiation), history of eye injury, were not found the association with early cataract development in this study; this situation may due to small sample size.

REFERENCES

1. World health organization fifty-sixth world health assembly A56/26Provisional agenda item 14.17 Elimination of avoidable blindness. 2003.
2. Thylefors B, Negrel AD, Pararajasegaram R, Dadzie KY. Global data on blindness. Bull World Health Organ 1995;73(1):115-21.
3. เทียนชัย พรหมภูเบศร์ และสมชัย วงศ์เวช สวัสดิ์. รายงานผลสำรวจสภาวะตาบอด และโรคที่เป็นสาเหตุสำคัญ ในประเทศไทยครั้งที่ 3. 2537.
4. Steinberg EP, Javitt JC, Sharkey PD, Zuckerman A, Legro MW, Anderson GF, et al. The content and cost of cataract surgery. Arch Ophthalmol 1993;111(8):1041.
5. Coughlin SS, Benichou J, Weed DL. Attributable risk estimation in case-control studies. Epidemiol Rev 1994;16(1):51-64.
6. McCarty CA, Nanjan MB, Taylor HR. Attributable risk estimates for cataract to prioritize medical and public health action. Invest Ophthalmol Vis Sci 2000;41(12):3720-5.
7. N143 WFS. Blindness and visual disability. Part II of VII: major causes of worldwide. 1997.
8. CDC. MMWR weekly 1983/32(9);11:119-120.
9. ชาตรี บานชื่น. แนวทางการดำเนินงานของกรมการแพทย์ ปี 2548. 2548.
10. Choo V. WHO reassesses appropriate body-mass index for Asian populations. Lancet 2002;360(9328):235.
11. Kelly SP, Thornton J, Edwards R, Sahu A, Harrison R. Smoking and cataract: Review of causal association. J Cataract Refract Surg 2005;31(12):2395-2404.
12. McElduff P, Dobson AJ. How much alcohol and how often? Population based case-control study of alcohol consumption and risk of a major coronary event. Bmj 1997;314(7088):1159-64.

13. Fielden M, Krishnadev N. Essentials of Clinical Skills Handbook"Essentials, 4th Ed. 2004.
14. WHO. management of cataract in primary health care services. 1996.
15. Piatigorsky J. Lens crystallins and their genes: diversity and tissue-specific expression. Faseb J 1989;3(8):1933-40.
16. Hook DW, Harding JJ. Protection of enzymes by alpha-crystallin acting as a molecular chaperone. Int J Biol Macromol 1998;22(3-4):295-306.
17. Slingsby C, Clout NJ. Structure of the crystallins. Eye 1999;13:395-402.
18. Bloemendal H, Benedetti EL, Dunia I. Transgenic mice: models for the study of cataractogenesis. A minireview. Ophthalmic Res 1996;28 Suppl 1:1-7.
19. Horwitz J, Robertson NP, Wong MM, Zigler JS, Kinoshita JH. Some properties of lens plasma membrane polypeptides isolated from normal human lenses. Exp Eye Res 1979;28(3):359-65.
20. Vavvas D, Azar NF, Azar DT. Mechanisms of disease: cataracts. Ophthalmol Clin North Am 2002;15(1):49-60.
21. Leske MC, Chylack LT, Jr., Wu SY. The Lens Opacities Case-Control Study. Risk factors for cataract. Arch Ophthalmol 1991;109(2):244-51.
22. Schaumberg DA, Glynn RJ, Christen WG, Hankinson SE, Hennekens CH. Relations of body fat distribution and height with cataract in men. Am J Clin Nutr 2000;72(6):1495-502.
23. Glynn RJ, Christen WG, Manson JE, Bernheimer J, Hennekens CH. Body mass index. An independent predictor of cataract. Arch Ophthalmol 1995;113(9):1131-7.
24. Foster PJ, Wong TY, Machin D, Johnson GJ, Seah SK. Risk factors for nuclear, cortical and posterior subcapsular cataracts in the Chinese population of Singapore: the Tanjong Pagar Survey. Br J Ophthalmol 2003;87(9):1112-20.
25. Nirmalan PK, Robin AL, Katz J, Tielsch JM, Thulasiraj RD, Krishnadas R, et al. Risk factors for age related cataract in a rural population of southern India: the Aravind Comprehensive Eye Study. Br J Ophthalmol 2004;88(8):989-94.
26. Jacques PF, Moeller SM, Hankinson SE, Chylack LT, Jr., Rogers G, Tung W, et al. Weight status, abdominal adiposity, diabetes, and early age-related lens opacities. Am J Clin Nutr 2003;78(3):400-5.

27. Risk factors associated with age-related nuclear and cortical cataract: a case-control study in the Age-Related Eye Disease Study, AREDS Report No. 5. Ophthalmology 2001;108(8):1400-8.
28. Delcourt C, Cristol JP, Tessier F, Leger CL, Michel F, Papoz L. Risk factors for cortical, nuclear, and posterior subcapsular cataracts: the POLA study. Pathologies Oculaires Liees a l'Age. Am J Epidemiol 2000;151(5):497-504.
29. Zodpey SP, Uphade SN. Tobacco smoking and risk of age-related cataract in men. Regional Health Forum WHO South-East asia Region;3.
30. Klein BE, Klein R, Linton KL, Franke T. Cigarette smoking and lens opacities: the Beaver Dam Eye Study. Am J Prev Med 1993;9(1):27-30.
31. Christen WG, Manson JE, Seddon JM, Glynn RJ, Buring JE, Rosner B, et al. A prospective study of cigarette smoking and risk of cataract in men. Jama 1992;268(8):989-93.
32. Manson JE, Christen WG, Seddon JM, Glynn RJ, Hennekens CH. A prospective study of alcohol consumption and risk of cataract. Am J Prev Med 1994;10(3):156-61.
33. Leske MC, Wu SY, Nemesure B, Hennis A. Risk factors for incident nuclear opacities. Ophthalmology 2002;109(7):1303-8.
34. Lemeshow S,Hosmer DW, Klar J, L wanga SK. Adequacy of sample size in health studies. World Health Organization. 1990.
35. Hyojin Kim M,et al .The Prevalence and Demographic Characteristics of Anterior Polar Cataract in a Hospital-Based Study in Korea. Am J Ophthalmol 1999;128:446-65.
36. Christine Younan PM, Robert G. Cumming, et al. Hormone Replacement Therapy, Reproductive Factors, and the Incidence of Cataract and Cataract Surgery: The Blue Mountains Eye Study. Am J Epidemiol 2002;155:997-1006.
37. Suh-Yuh Wu YJY, et al.and Cristina Leske the Barbados Eye Studies Group. Nine-Year Refractive Changes in the Barbados Eye Studies. Investigative Ophthalmology and Visual Science 2005;46:4032-4039.

APPENDIX

แบบสอบถาม

การศึกษาปัจจัยที่มีความสัมพันธ์กับการเกิดโรคต้อกระจกในคนวัยทำงาน

ส่วนที่ 1 ข้อมูลทั่วไป

1. อายุ.....ปี

2. เพศ ( ) ชาย ( ) หญิง

3. ดัชนีมวลกาย.....กิโลกรัม/เมตร^2

น้ำหนัก.....กิโลกรัม

ส่วนสูง.....เซนติเมตร

4. การศึกษา ( ) ไม่ได้ศึกษา / ต่ำกว่าประถมศึกษา

( ) ประถมศึกษา

( ) มัธยมศึกษาตอนต้น

( ) มัธยมศึกษาตอนปลาย

( ) อนุปริญญา

( ) ปริญญาตรี

( ) สูงกว่าปริญญาตรี

( ) อื่นๆโปรดระบุ.....

5.อาชีพ

( ) เกษตรกรรม ระบุ.....

( ) รับราชการ/รัฐวิสาหกิจ ระบุ.....

( ) รับจ้าง (ใช้แรงงาน) ระบุ.....

( ) รับจ้าง (งานสำนักงาน) ระบุ.....

( ) งานบ้าน

( ) ค้าขาย/ธุรกิจส่วนตัว ระบุ.....

( ) อื่นๆโปรดระบุ.....

6. ระยะเวลาทำงาน.....ชั่วโมง/วัน

.....วัน/สัปดาห์

7. ท่านทำงานนี้มานาน.....ปี.....เดือน

8. ท่านสูบบุหรี่หรือไม่

( ) สูบ

( ) ไม่สูบ

9. ท่านดื่มเหล้าหรือไม่

( ) ดื่ม

( ) ไม่ดื่ม

10. ท่านมีปัญหาทางสายตาหรือไม่

( ) ไม่มี

( ) มี

10.1 สายตาสั้น

( ) ไม่มี

( ) มี ไม่ได้ใช้แว่นสายตา

( ) มี ใส่แว่นสายตามานาน .....ปี

10.2 สายตายาว

( ) ไม่มี

( ) มี ไม่ได้ใช้แว่นสายตา

( ) มีใส่แว่นสายตามานาน .....ปี

11. ท่านมี พ่อ แม่ พี่น้อง ร่วมสายเลือดเดียวกัน (ยกเว้นท่าน)เป็นโรคต้อกระจกหรือไม่

( ) ไม่มี ( ) มี เกี่ยวข้องเป็น.....ของท่าน

12. ท่านมีประวัติการเจ็บป่วยหรือกำลังป่วยด้วยโรคเหล่านี้หรือไม่

12.1 เบาหวาน

( ) เป็น

( ) ไม่เป็น

12.2 ความดันโลหิตสูง

( ) เป็น กำลังรับการรักษา

( ) เป็น รักษาหายแล้ว

( ) เป็น ไม่ได้รับการรักษา

( ) ไม่เป็น

12.3 โรคไขข้ออักเสบ

( ) เป็น

( ) ไม่เป็น

12.4 โรคหัวใจและหลอดเลือด

( ) เป็น

( ) ไม่เป็น

12.5 โรคอื่นๆ โปรดระบุ

1. .....

2.....

3.....

ส่วนที่ 2 ปัจจัยทางกายภาพ

1. ลักษณะงานที่ทำต้องสัมผัสกับสิ่งใดต่อไปนี้ (เลือกได้มากกว่า 1 ข้อ)

( ) อุณหภูมิ (ความร้อน/ความเย็น)

( ) แสงสว่างจ้า/แสงแดด

( ) ความสั่นสะเทือน

( ) การเคลื่อนไหวที่ซ้ำซาก

2. ถ้าอยู่ในที่ร้อนจัด อุณหภูมิประมาณ.....องศาเซลเซียส

เป็นเวลานานวันละ.....ชั่วโมง

สัปดาห์ละ.....วัน/สัปดาห์

3. ถ้าอยู่ในที่เย็นจัด อุณหภูมิประมาณ.....องศาเซลเซียส

เป็นเวลานานวันละ.....ชั่วโมง

สัปดาห์ละ.....วัน/สัปดาห์

4. ถ้าทำงานอยู่กลางแจ้งท่ามกลางแสงแดด

เป็นเวลานานวันละ.....ชั่วโมง

สัปดาห์ละ.....วัน/สัปดาห์

5. ถ้าทำงานสัมผัสกับแสงสว่างจ้า

เป็นเวลานานวันละ.....ชั่วโมง

สัปดาห์ละ.....วัน/สัปดาห์

6. ถ้าทำงานสัมผัสกับรังสีต่างๆ

โปรดระบุชนิดรังสีที่ท่านทราบ.....

เป็นเวลานานวันละ.....ชั่วโมง

สัปดาห์ละ.....วัน/สัปดาห์

7. ถ้าท่านทำงานสัมผัสกับความสั่นสะเทือน

เป็นเวลานานวันละ.....ชั่วโมง

สัปดาห์ละ.....วัน/สัปดาห์

8. ถ้าท่านทำงานสัมผัสกับการเคลื่อนไหวที่ซ้ำซาก

เป็นเวลานานวันละ.....ชั่วโมง

สัปดาห์ละ.....วัน/สัปดาห์

9. ดวงตาของท่านเคยได้รับบาดเจ็บจากอุบัติเหตุต่างๆจากการทำงานหรือไม่

( ) ไม่เคย (ข้ามไปทำ ข้อ2)

( ) เคย

9.1 ของมีคมทิ่มแทงตาอย่างรุนแรง

( ) ไม่เคย

( ) เคย เมื่อประมาณ .....ปีมาแล้ว

9.2 ของไม่มีคมกระแทกตาอย่างรุนแรง

( ) ไม่เคย

( ) เคย เมื่อประมาณ .....ปีมาแล้ว

10. ท่านใช้คอมพิวเตอร์หรือไม่

( ) ไม่ใช้

( ) ใช้ วันละ .....ชั่วโมง

จำนวน .....วัน/สัปดาห์

11.ท่านใช้เตาอุ่นอาหารไมโครเวฟหรือไม่

( ) ไม่ใช้

( ) ใช้ วันละ .....ครั้ง

จำนวน.....วัน/สัปดาห์

ส่วนที่ 3 ปัจจัยทางเคมี

1. ท่านทำงานสัมผัสที่อยู่ในรูปต่างๆชนิดใดบ้าง

( ) ฝุ่น

( ) ฟูม

( ) ควัน

( ) ละออง

( ) ก๊าซ

( ) ไอระเหย

( ) ตัวทำละลาย

2. โปรดระบุชื่อสารเคมีที่ท่านสัมผัส

1. .....

2. .....

3. .....

4. .....

3. ระยะเวลาที่ท่านสัมผัสสารเคมี

เป็นเวลานานวันละ.....ชั่วโมง

สัปดาห์ละ.....วัน/สัปดาห์

4. สารเคมีกระเด็นเข้าตา (เช่น กรด, ด่าง)

( ) ไม่เคย

( ) เคย เมื่อประมาณ .....ปีมาแล้ว ระบุชื่อสารเคมี.....

ส่วนที่ 4 ปัจจัยทางชีวภาพ

1. ท่านเคยเป็นโรคติดเชื้อทางตาจากการทำงานหรือไม่

( ) ไม่เคย

( ) เคย เมื่อประมาณ .....ปีมาแล้ว

2. ถ้าเคย ท่านติดเชื้อชนิดใด

( ) เชื้อแบคทีเรีย

( ) เชื้อปรสิต

( ) เชื้อไวรัส

BIOGRAPHY

NAME	Mrs. Suleeporn Khongsee
DATE OF BIRTH	06 November, 1964
PLACE OF BIRTH	Nakhornsawan Province, Thailand
INSTIUE ATTENDED	Mahidol University, 1990 - 1992 Bachelor of Nursing Science Mahidol University, 2004 - 2009 Master of Science (Public Health)
HOME ADDRESS	78/123, Prayasurane 19, Prasurane Rd., Klongsamwa, Bangkok, 10510, Thailand Tel 02-919-1821 E-mail: suleesee@yahoo.com
EMPLOYMENT ADDRESS	679 Nopparat Rajatranee Hospital, Ramindra Rd. Kunnayao, Bangkok, 10230, Thailand Tel. 02-517-4270 to 9